

Stormwater Management Report

For the Proposed:

Commercial Development

Located at:

**100 Industrial Park Road
Hingham, Massachusetts**

Prepared for Submission to:

**Town of Hingham Conservation Commission
Town of Hingham Planning Board**

March 6, 2020

Prepared for:

JEB Group LLC
PO Box E-62
Boston, MA 02127

Prepared by:



BL Companies
355 Research Parkway
Meriden, Connecticut 06450
Phone: (203) 630-1406
Fax: (203) 630-2615

BL Project Number: 1901517

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Executive Summary

This report has been prepared in support of a Permit Application submission to the Town of Hingham by JEB Group, LLC for a proposed redevelopment at 100 Industrial Park Road. The subject property is approximately 17.05 acres with two existing easements at the western portion of the property, one consisting of approximately 1.17 acres, the other of approximately 0.25 acres. The parcel is currently developed with two existing buildings, driveways, parking, and some wooded areas that have remained undeveloped. There are existing wetlands to the southeast and southwest of the site in which is currently undeveloped. The proposed redevelopment includes a renovation of a +/- 149,000 square foot (SF) building on the western portion of the site with associated modifications to the parking, drainage, and utilities necessary to support modifications for a new tenant. The project also proposes to demolish a existing ±41,203 square foot building to the southeast for additional parking that is required by the new tenant. The overall existing drainage onsite will be improved through the use of Best Management Practices (BMPs) for water quality and runoff management. Reduced runoff rate will be achieved through the use of outlet control structures, and water quality and quantity control through sub-catchment and water treatment measures.

To the north of the property is an existing school and Pilgrims Highway (State Route 3) which borders the north and east of the property. Industrial Park Road runs to the northwest and Commerce Road to southwest, both roads border the property. A school abuts the property to the northwest and shares an emergency access route off of Industrial Park Road. An existing manufacturing center is located west of Commerce Road. Additional retail/commercial development is located west of Industrial Park Road. To the southeast of the property lies an undeveloped wooded area containing existing wetlands.

Generally, the topography slopes from the northwest at an elevation of approximately 153 feet to the existing wooded area and wetlands southeast of the site at an elevation of 137 feet. Under the existing conditions, site's stormwater network primarily captures water in the site and along Commerce Road and discharges to the south/southeastern portion of the site towards the existing wooded area and wetlands.

A HydroCAD model, utilizing TR-55 methodology, was developed to evaluate the existing and proposed drainage conditions of the property. To mitigate the increase in impervious coverage on the site subsurface plastic storage chamber systems installed with outlet control structures will be utilized to provide stormwater runoff rate control. The results of the analysis demonstrate that there will not be an increase in peak stormwater runoff rates for, at a minimum, the 2-, 10- and 100-year storm events. Water Quality Best Management Practices (BMPs) have been incorporated into the project design to provide a minimum required 80% TSS removal. The majority of impervious area

runoff will be captured by hooded catch basins with deep sumps, with the building runoff discharging to roof leaders. The stormwater runoff will then be conveyed through hydrodynamic separators and into underground infiltration chambers, or over vegetated strips into bioretention systems.

The proposed stormwater management system is designed to be in compliance with the Town of Hingham regulations and the 2008 Massachusetts Stormwater Handbook.

Existing Conditions

General Existing Site Information

The existing site consists of impervious areas including the two existing buildings and bituminous concrete pavement. The property also consists of some wooded areas around and at the center of the site with large wetlands throughout the southeastern area. A highpoint is located in the northwestern portion of the parcel where the majority of stormwater runoff falls easterly into the wooded area and wetlands. Some of the runoff from the highpoint travels south towards Commerce Road. This water is collected via a catch basin storm network and connects with the Commerce Road storm network before being discharged into the wooded area towards the southeast. See Appendix E for existing and proposed drainage area mapping.

The site soils identified by the United States Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS) are Canton – Urban land – Rock outcrop, 3 to 15 percent slopes. A USDA the NRCS Hydrologic Soil Group rating is not assigned to this group. The Wetlands are identified on the NCRS mapping as aquepts, 0 to 3 percent slopes, rated D and southeast/upgradient of the wetlands is Swansea muck, 0 to 1 percent slopes, rated B/D. A portion of the site along Commerce Road is identified as Canton – Urban Land Complex, 0 to 8 percent slopes, rated A. A copy of the USDA NRCS Hydrologic Soil Group Map is included in Appendix A for reference.

Per the FEMA Flood Insurance Rate Map Number 25023C0091J for Town of Hingham, Massachusetts map effective revision date: July 17, 2012, the eastern portion of the site resides in FEMA Flood Hazard Zone A (shaded) without base flood elevation. There is no development on this portion of the site. The rest of the site is located in the Flood Hazard Zone X (unshaded), area of minimal flood hazard. A copy of the FEMA Flood insurance rate map is included in Appendix A for reference.

Existing Hydrologic Conditions

The existing site drainage area that was analyzed totals approximately 15.49 acres and has approximately 61.65% impervious ground cover. The existing stormwater management system onsite includes roof leaders and a network of catch basins and manholes with no treatment. Runoff from the site also enters the system in Industrial Park Road and Commerce Road. Stormwater from the subject property and portions of the roadway flows to two design points on site: the southeastern wetlands (Design Point 1, DP-1) and the adjacent southwestern wetlands (Design Point 2, DP-2).

The following is a brief analysis of the existing design points as shown on the enclosed Existing Drainage Plan (ED-1), in Appendix E.

Existing Drainage Area 1A (EDA-1A): This drainage area consists of native wooded vegetation in the southeastern portion of the subject property and bituminous pavement in between the two existing buildings. In the EDA-1A drainage area, the stormwater runoff flows directly to the eastern wetlands on site, Design Point 1 (DP-1).

Existing Drainage Area 1B (EDA-1B): This drainage area consists of native wooded vegetation, grass, and bituminous pavement in the northeastern portion of the site. In the EDA-1B drainage area, the stormwater runoff flows east and southeast to an existing catch basin and to a swale that runs north to south to the east of the building 1 into the southeasterly wetlands (DP-1).

Existing Drainage Area 1C (EDA-1C): This drainage area consists of the western building's roof. In the EDA-1C drainage area, based on mapping on record with the town and field survey data, it is assumed the stormwater runoff flows through a roof leader into the site drainage network and discharges through a headwall at the southeasterly wetlands at DP-1.

Existing Drainage Area 1D (EDA-1D): This drainage area consists of the roof of the attached storage building adjacent to the western building. In the EDA-1D drainage area, based on mapping on record with the town and field survey data, it is assumed the stormwater runoff flows through a roof leader into the sanitary sewer system and discharges into the leach field that upgradient of the southeasterly wetlands (DP-1).

Existing Drainage Area 2A (EDA-2A): This drainage area consists of native wooded vegetation and bituminous pavement in the western portion of the site. In the EDA-2A drainage area, the stormwater runoff flows directly to the southeastern portion of the site towards Commerce Road

and is captured by an existing storm system that discharges through a headwall at the southwesterly wetlands, Design Point 2 (DP-2).

Existing Drainage Area 2B (EDA-2B): This drainage area consists the roof of the eastern building. In the EDA-2B drainage area, based on mapping on record with the town and field survey data, it is assumed the stormwater runoff flows through a roof leader into the site drainage network and discharges through a headwall at the southwesterly wetlands at DP-2.

Table 1 below displays the overall size and hydraulic characteristics used to analyze the existing drainage areas.

Table 1 – Pre-Development (Existing Conditions) Drainage Characteristics

Drainage Area	Total Area SF	Composite Curve Number	Imperviousness Cover %	Time of Concentration Minutes
EDA-1A	101,071	88	36.1%	29.70
EDA-1B	105,544	88	35.9%	31.90
EDA-1C	143,469	98	100.0%	6.00
EDA-1D	3,147	98	100.0%	34.50
EDA-2A	280,385	89	54.9%	20.10
EDA-2B	41,203	98	100.0%	6.00

Proposed Conditions

General Proposed Site Information

The proposed development includes a renovation of the +/- 149,000 square foot (SF) building on the western portion of the site with associated modifications to the parking, drainage, and utilities necessary to support modifications for a new tenant. The project also proposes to demolish the ±41,203 square foot existing building to the southeast for additional parking that is required by the new tenant.

No permanent impacts are proposed to the existing wetlands located on the subject property. A headwall to the southwest of the site adjacent to the wetlands along Commerce Road will be repaired. No work is proposed within the FEMA Floodplain Zone A. Proposed impacts to the wetland buffer are due to expansion of existing parking areas, stormwater management and minor

grading. These proposed wetland buffer impacts are estimated to total ±37,580 square feet. Some existing impervious surface is proposed to be removed and planted within the wetland buffer. Where new impacts are proposed within the wetland buffer, new native plantings are proposed to enhance the buffer.

The overall existing drainage onsite will be improved through the use of Best Management Practices (BMPs) for water quality and runoff management through detention and outlet control.

Proposed Hydrologic Conditions

For the purposes of the drainage analysis and discussion, as well as to maintain existing drainage patterns to the maximum extent practical, the design points for the proposed conditions analysis are the same as the existing conditions analysis. The proposed development has been analyzed as six sub-drainage areas as illustrated on the enclosed Proposed Drainage Plan (PD-1) located in Appendix E. The proposed analysis includes a total of 15.49 acres and is approximately 70.14% impervious. The site stormwater management system will provide stormwater quantity and quality improvements through the installation of subsurface detention systems with outlet control, utilizing infiltration with adequate pretreatment, and bioretention BMPs in accordance with the Massachusetts Stormwater Handbook.

The following is a brief analysis of the proposed sub-drainage areas as shown on the enclosed Proposed Drainage Plan (PD-1), in Appendix E.

Proposed Drainage Area 1A (PDA-1A): This drainage area consists mostly of wooded areas to the north and northeast that will remain undeveloped or are impacted by grading only where stormwater will runoff directly into the eastern wetlands, Design Point 1 (DP-1).

Proposed Drainage Area 1B (PDA-1B): This drainage area consists mostly of parking areas, some internal landscape islands, a site access drive and upgradient undisturbed woodland area in the northeastern portion of the property. In the PDA-1B drainage area, the stormwater runoff flows to the center of the drainage area, collected by a series of catch basins and is routed to a detention system, Detention Basin 1B, under the parking area. The runoff is pretreated with a hydrodynamic separator prior to entering the structure to keep trash and suspended solids out of the system (proprietary system claims to also meet 80% TSS removal requirement, but is not used for primary treatment in this BMP). The stormwater quality structure consists of polyethylene storage chambers encased in crushed stone. This system allows for maximum infiltration and groundwater recharge potential, the stone below the system has been sized to fully capture the water quality volume and the required groundwater recharge volume for this drainage area (see Appendix D for

calculations). This system will infiltrate and draw down within 72 hours due to the presence of well draining soils (see Appendix G for the Geotechnical Report, Boring Logs and Infiltration Test results for more details details). The detention below the outlet promotes the infiltration of the first inch of runoff and recharge the groundwater as close to the point of capture as practical, before being directed to the outlet control structure or downstream network. The discharge from this system is routed through an outlet control structure and is connected to a manhole and a proposed series of pipes that discharges at DP-1.

Proposed Drainage Area 1C (PDA-1C): This drainage area consists of the western building's roof. In the PDA-1C drainage area, based on mapping on record with the town and field survey data, it is assumed the stormwater runoff flows through a roof leader into the site drainage network and discharges through a headwall at the southeasterly wetlands at DP-1.

Proposed Drainage Area 1D (PDA-1D): This drainage area consists mostly of parking areas, some internal landscape islands in the southeastern portion of the property. In the PDA-1D drainage area, the stormwater runoff flows southerly and easterly, collected by a series of catch basins and is routed to a detention system, Detention Basin 1D, under the parking area. The runoff is pretreated with a hydrodynamic separator prior to entering the structure to keep trash and suspended solids out of the system (proprietary system claims to also meet 80% TSS removal requirement, but is not used for primary treatment in this BMP). The stormwater quality structure consists of polyethylene storage chambers encased in crushed stone. This system allows for maximum infiltration and groundwater recharge potential, the stone below the system has been sized to fully capture the water quality volume and the required groundwater recharge volume for this drainage area (see Appendix D for calculations). This system will infiltrate and draw down within 72 hours due to the presence of well draining soils (see Appendix G for the Geotechnical Report, Boring Logs and Infiltration Test results for more details). The detention below the outlet promotes the infiltration of the first inch of runoff and recharge the groundwater as close to the point of capture as practical, before being directed to the outlet control structure or downstream network. The discharge from this system is routed through an outlet control structure and is connected to a manhole and a proposed series of pipes that discharges at DP-1.

Proposed Drainage Area 2A (PDA-2A): This drainage area consists mostly of parking areas, some internal landscape islands in the northwestern portion of the property. In the PDA-2A drainage area, the stormwater runoff flows northerly and westerly, collected by a series of catch basins and is routed to a detention system, Detention Basin 2A, under the parking area. The runoff is pretreated with a hydrodynamic separator prior to entering the structure to keep trash and suspended solids out of the system (proprietary system claims to also meet 80% TSS removal requirement, but is not used for primary treatment in this BMP). The stormwater quality structure

consists of polyethylene storage chambers encased in crushed stone. This system contains a 30 mil. PVC impervious liner due to the presence of shallow bedrock (see Appendix G for the Geotechnical Report, Boring Logs and Infiltration Test results for more details). The stone below the outlet is sized for the first inch of runoff however recharge in this area is impractical due to the presence of shallow bedrock. A perforated 6" PVC pipe network imbedded in the stone below the system will ensure the system will drain within 72 hours. The discharge from this system is routed through an outlet pipe that has been sized to provide adequate attenuation and is connected to a catch basin and a proposed series of pipes that discharges at Design Point 2 (DP-2).

Proposed Drainage Area 2B (PDA-2B): This drainage area consists mostly of parking areas, some internal landscape islands in the southwestern portion of the property. In the PDA-2B drainage area, there are two more subareas that treat the stormwater runoff in a similar fashion, calculations for both BMPs are found in Appendix D, it is described in this section once. The stormwater runoff flows and westerly and runs off the pavement and over a vegetated filter strip (which includes a pea diaphragm level spreader). The runoff is spread and pretreated by the strip before entering a bioretention filter box. The stormwater quality structure consists of a concrete chamber due to concerns of groundwater, since this drainage area is in close proximity, and close to the same elevation as the existing wetlands at Design Point 2. Additionally, the limits of the pervious area in this drainage area have been maintained, therefore there is very little change from pre-existing recharge to post development recharge in this area. This system has been sized to fully capture the water quality volume for this drainage area. This system is fitted with a perforated underdrain and does not provide groundwater recharge. Recharge is impractical at this location due to the proximity of the wetlands and the potential for Type D soils. The discharge from this system is routed through an outlet pipe that is connected to a catch basin and a proposed series of pipes that discharges at Design Point 2 (DP-2).

Table 2 below displays the overall size and hydraulic characteristics used to analyze the proposed drainage areas.

Table 2 – Post Development Drainage Characteristics

Drainage Area	Total Area SF	Composite Curve Number	Imperviousness Cover %	Time of Concentration Minutes
PDA-1A	71,741	82	0.7%	11.80
PDA-1B	94,703	91	55.4%	25.30
PDA-1C	143,469	98	100.0%	6.00
PDA-1D	56,959	97	93.5%	6.00
PDA-2A	157,176	96	87.3%	6.00
PDA-2B	150,771	91	58.6%	8.40

Stormwater Standards

Standard 1

“No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.”

Through proper grading and drainage design and BMPs designed in accordance with the Massachusetts Stormwater Handbook all the stormwater runoff generated by the proposed development is captured and treated before entering the wetlands on site.

Standard 2

“Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.”

A hydrologic analysis to determine peak stormwater discharge rates was performed using the HydroCAD stormwater modeling system computer program, version 10.00 developed by HydroCAD Software Solutions, LLC. Hydrographs for each watershed were developed using the SCS Synthetic Unit Hydrograph Method. Rainfall depths and distribution taken from the NOAA Atlas 14 for Hingham, MA were used for the calculation of peak flow rates and are listed in Table 3. The drainage areas, or sub-drainage areas as labeled by the program, are depicted by hexagons on the attached drainage diagrams. Pre- and post-development HydroCAD output and details can be found in Appendix B.

**Table 3 – Rainfall Depths per NOAA Atlas 14
Appendix B - 24-hour Rainfall Data**

Return Period	24-hour Rainfall Depth
2-year	3.36”
5-year	4.32”
10-year	5.12”
25-year	6.22”
50-year	7.04”
100-year	7.92”

The results of the analysis can be found in Table 4 below of the 2-, 10- and 100-year storm events. With the use of detention structures the site proposed stormwater management system meets the intent of Standard 2 at both discharge point locations by not increasing peak runoff rates from the proposed developments at the site.

Table 4 – Existing vs Proposed Peak Rates of Runoff

Peak Flow (cfs)			
	Design Storms		
Analysis Point	2-YEAR	10-YEAR	100-YEAR
DP-1			
Existing	20.96	33.59	53.74
Proposed	20.11	33.44	53.73
DP-2			
Existing	16.81	28.62	47.29
Proposed	16.79	26.48	43.98

Standard 3

“Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type.”

The site is in an Activity and Use Limitation do to soil contamination, groundwater recharge has been designed to the maximum extent practical with some geotechnical assumptions. Through the use of infiltration chambers the site groundwater recharge requirement is met to the maximum extend practical. The recharge requirement calculations have been performed based on assumed A rated soils, in order to be as conservative as possible with limited geotechnical information. A field study is scheduled to be performed to verify existing soil conditions. Calculations can be found in Appendix D.

Standard 4

“Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).”

Through the use of point source control (street sweeping) and pretreatment devices such as deep sump catch basins, hydrodynamic separators and filter strips as well as primary treatment BMPs of infiltration chambers and a bioretention filter box the site stormwater management system is designed to remove 80% of the average annual post-construction load of TSS. Calculations for water quality volume, treatment train efficiency can be found in Appendix D. A long-term Stormwater System Operation and Maintenance Manual can be found in Appendix F for this site.

Standard 5

“For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.”

The treatment BMPs utilized on this site all conform the requirements established in the “Best Management Practices for Land Uses with Higher Potential Pollutant Loads” (LUHPPL) as identified by the Massachusetts Stormwater Handbook including point source control, over 44% pretreatment for the infiltration chambers and a sealed bottom in the bioretention areas.

Standard 6

“Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.”

The site is not located within the Zone II or Interim Wellhead Protection Area, see the MA DEP mapping in Appendix A for more information.

Standard 7

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

The site is not a redevelopment project since there is an overall increase in pervious area post-development.

Standard 8

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

A soil erosion and sediment control plan has been developed to protect the adjacent roadways, storm drainage systems, properties and wetland areas and any adjacent water course from sediment laden surface runoff and erosion.

Sediment control will be accomplished through rapid stabilization and by the installation of mechanical devices, including a temporary gravel construction entrance, silt fence, haybales, and storm drain inlet protection and temporary sediment traps. The proposed construction activities will be in accordance with policies and requirements of the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas. Permanent stabilization will occur as quickly as possible with site-specific seeding mixtures and as required by local officials.

Structural practices utilized as part of this development will include:

1. Temporary Construction Entrance

A temporary construction entrance shall be installed at the stone construction entrance of the development. Mud and debris shall be washed from all construction vehicles and equipment before leaving the site. The sediment laden water will be diverted to a proposed sediment basin/trap. Water tanks will be used if public water is unavailable.

2. Silt Fence

Silt fence shall be installed downstream of disturbed areas to filter the sediment laden sheet flow. Haybale backing will be used upstream of wetlands.

3. Inlet Protection

All storm inlets existing and constructed, that could potentially receive sediment laden runoff will have silt sack and/or haybale protection installed until site stabilization is complete.

4. Temporary Diversion Swales

Temporary diversion swales will be installed along the perimeter slopes to direct flow towards temporary sediment basins. The diversion shall be stabilized immediately following installation with temporary vegetation or a structural device to prevent erosion.

5. Stone Check Dams

Stone check dams will be installed along diversion swales to filter sediment laden runoff being directed into temporary sediment traps.

6. Temporary Sediment Traps

Temporary sediment traps and basins will be installed to capture and filter sediment laden water throughout the site the extent practical.

Standard 9

“A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.”

A long-term Stormwater System Operation and Maintenance Manual can be found in Appendix F for this site.

Standard 10

“All illicit discharges to the stormwater management system are prohibited.”

It is acknowledged that illicit discharges to the stormwater management system are prohibited.

Stormwater Conveyance

The hydraulic study of the on-site drainage system has been designed to comply with the requirements set forth in the Hingham MA, Zoning By-Law. The on-site collection and conveyance system is modeled with StormCAD V8i, to ensure hydraulic conveyance is achieved for the 10-year storm event. Refer to Catch Basin Drainage Area Map Sheet No. CB-1 in Appendix B and hydraulic tables and profiles in Appendix C for more details.

Conclusion

The stormwater design for the project development meets regulatory requirements and stormwater quality goals. The stormwater quality basins aid in keeping pollutants out of the adjacent wetlands and increasing groundwater recharge as well as attenuate peak flows and detain stormwater for the most frequent storm events as practical. Stormwater quality is being addressed by water quality structures and BMPs providing the minimum required 80% TSS removal as required in the Massachusetts Stormwater Handbook. The proposed stormwater management system will meet the stormwater quality requirements of the Commonwealth of Massachusetts and the Town of Hingham while improving overall site drainage characteristics.

APPENDIX A

DATA AND MAPPING

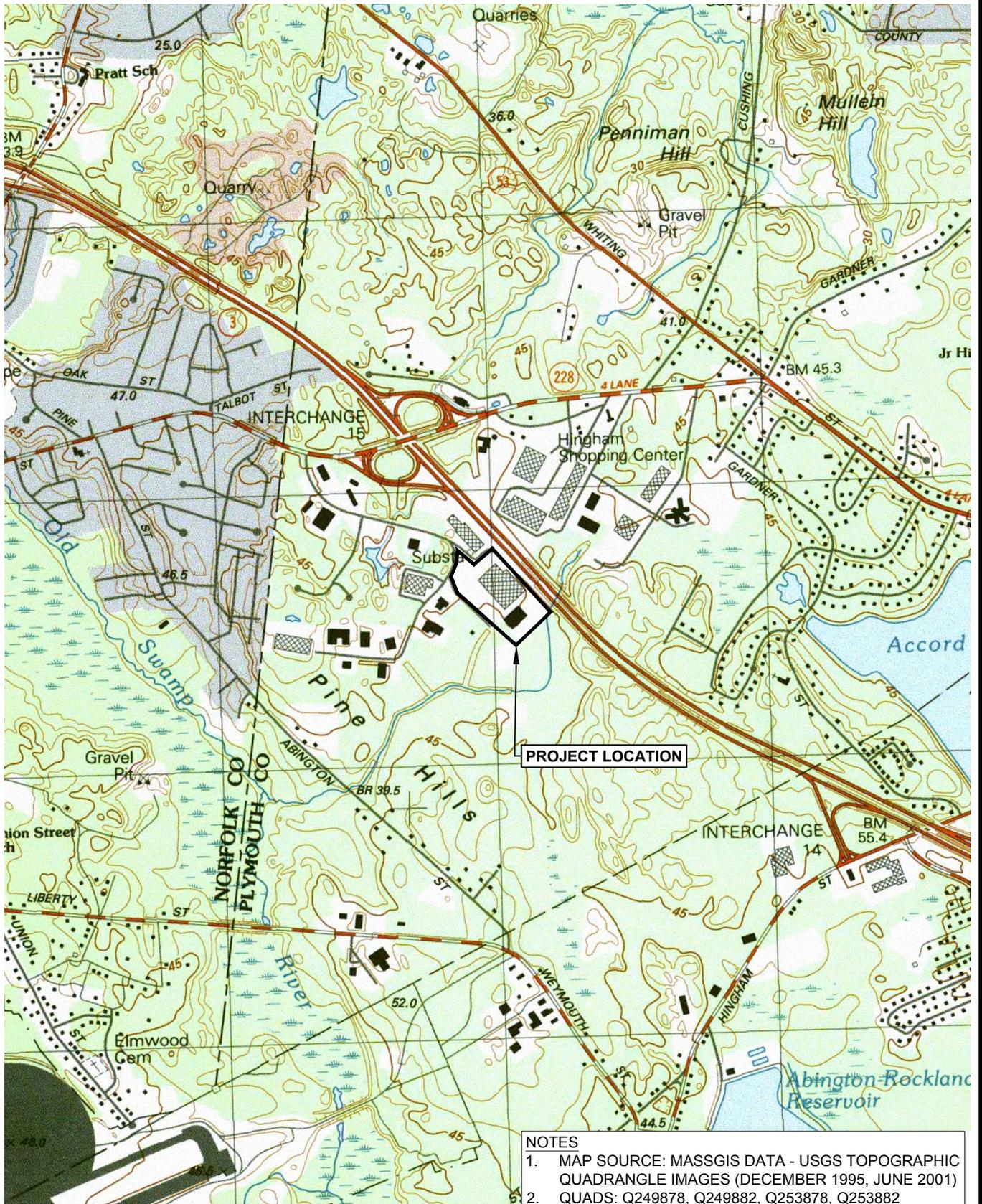
Figure 1: USGS Location Map

Figure 2: MA DEP Mapping

Figure 3: NRCS Soil Survey Map with Hydrologic Soil Group Data

Figure 4: FEMA Federal Insurance Rate Map

Figure 5: NOAA Atlas 14 Storm Data



- NOTES**
1. MAP SOURCE: MASSGIS DATA - USGS TOPOGRAPHIC QUADRANGLE IMAGES (DECEMBER 1995, JUNE 2001)
 2. QUADS: Q249878, Q249882, Q253878, Q253882



ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

PROJECT LOCATION
100 INDUSTRIAL PARK ROAD
HINGHAM, MASSACHUSETTS

Designed	W.E.V.
Drawn	W.E.V.
Reviewed	
Scale	1"=500'
Project No.	1901517
Date	10/18/2019
CAD File	USGS FIGURE

FIG-1

Map Tools

MassDEP Online Map Viewer

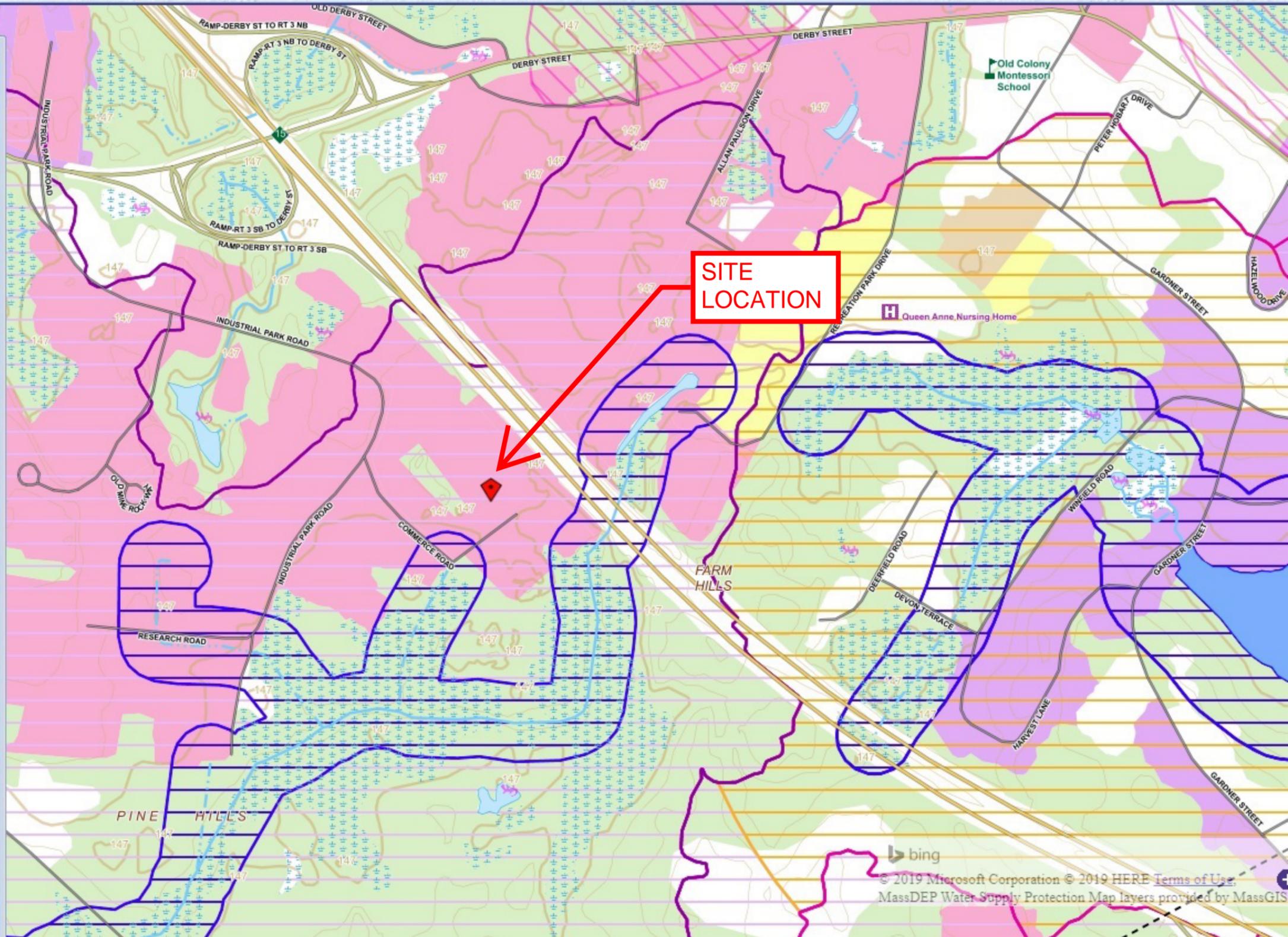


Massachusetts Department of Environmental Protection

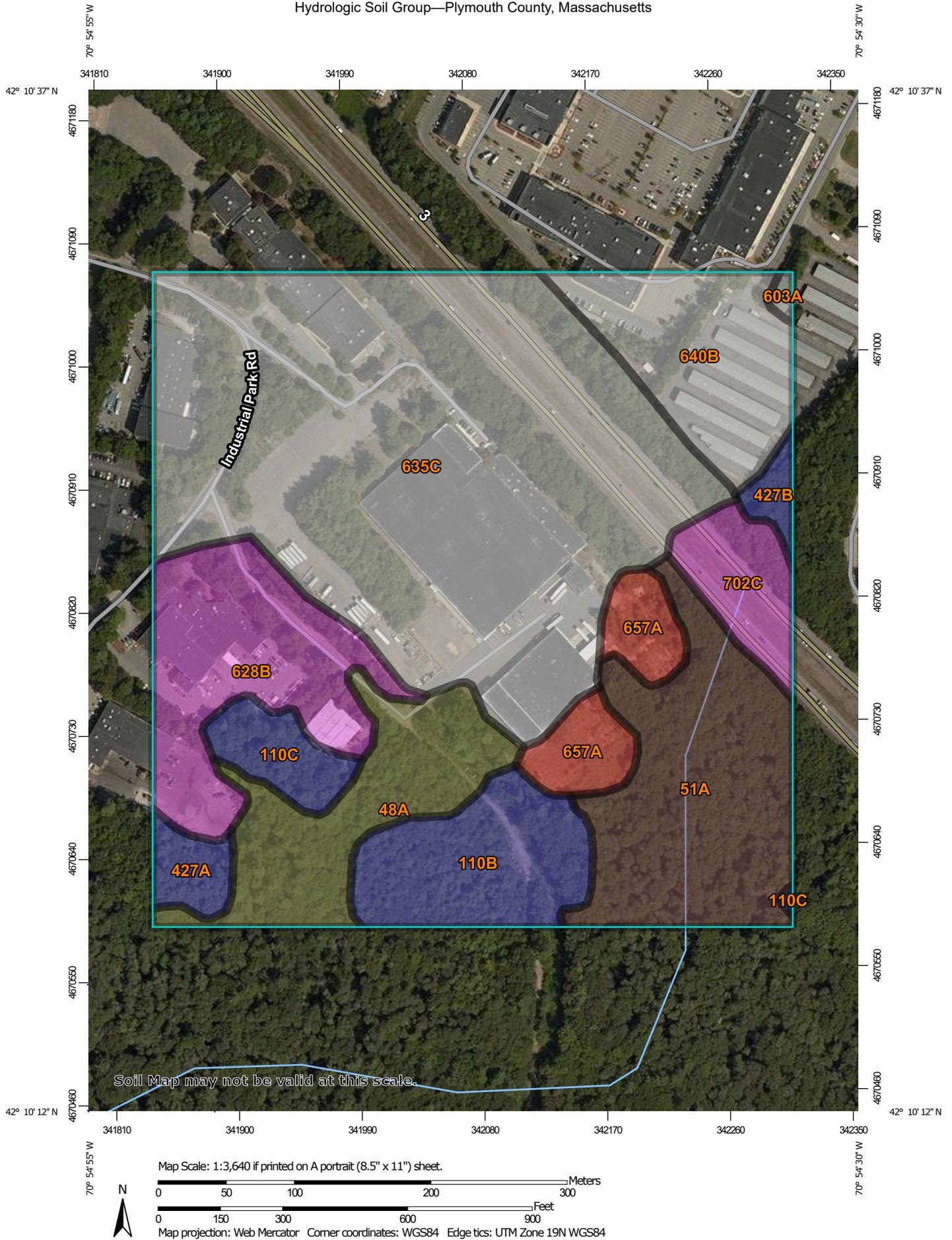
Map Legend

	--- Town and State Boundary	
	— DEP Region Boundary	
	— Perennial Stream or Shoreline	
	--- Intermittent Stream	
	--- Intermittent Shoreline	— 15 Meter Contour Interval
	— Manmade Shoreline	— 3 Meter Contour Interval
	— Ditch or Canal	
	— Aqueduct	
	— Dam	
	--- Channel in Water	

Overview | Map Layers | Legend | Map Help | Contact | Query Results



Hydrologic Soil Group—Plymouth County, Massachusetts



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

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 1:12,000.

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

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

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

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

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

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

Soil Survey Area: Plymouth County, Massachusetts
 Survey Area Data: Version 12, Sep 12, 2019

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

Date(s) aerial images were photographed: Aug 26, 2014—Sep 4, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
48A	Brockton sandy loam, 0 to 3 percent slopes, extremely stony	C/D	4.6	8.2%
51A	Swansea muck, 0 to 1 percent slopes	B/D	7.1	12.7%
110B	Canton-Chatfield-Rock outcrop complex, 0 to 8 percent slopes, very stony	B	3.8	6.8%
110C	Canton-Chatfield-Rock outcrop complex, 8 to 15 percent slopes, very stony	B	1.3	2.4%
427A	Newfields fine sandy loam, 0 to 3 percent slopes, extremely stony	B	0.8	1.5%
427B	Newfields fine sandy loam, 3 to 8 percent slopes, extremely stony	B	0.5	0.8%
603A	Urban land, wet substratum, 0 to 3 percent slopes		0.1	0.2%
628B	Canton - Urban land complex, 0 to 8 percent slopes	A	5.5	9.9%
635C	Canton - Urban land - Rock outcrop complex, 3 to 15 percent slopes		23.9	42.9%
640B	Urban land, till substratum, 0 to 8 percent slopes		4.2	7.6%
657A	Aquepts, 0 to 3 percent slopes	D	2.0	3.7%
702C	Udipsamments, 8 to 15 percent slopes	A	1.8	3.3%
Totals for Area of Interest			55.7	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

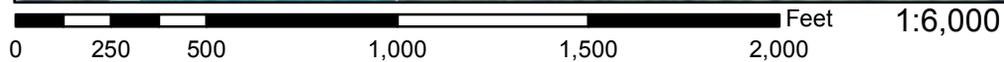
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette



42°10'39.24"N



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- | | | |
|------------------------------------|--|---|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE)
Zone A, V, A99 |
| | | With BFE or Depth Zone AE, AO, AH, VE, AR |
| | | Regulatory Floodway |
| OTHER AREAS OF FLOOD HAZARD | | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X |
| | | Future Conditions 1% Annual Chance Flood Hazard Zone X |
| | | Area with Reduced Flood Risk due to Levee. See Notes. Zone X |
| | | Area with Flood Risk due to Levee Zone D |
| OTHER AREAS | | NO SCREEN Area of Minimal Flood Hazard Zone X |
| | | Effective LOMRs |
| | | Area of Undetermined Flood Hazard Zone D |
| GENERAL STRUCTURES | | Channel, Culvert, or Storm Sewer |
| | | Levee, Dike, or Floodwall |
| OTHER FEATURES | | 20.2 Cross Sections with 1% Annual Chance Water Surface Elevation |
| | | 17.5 |
| | | Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| MAP PANELS | | Coastal Transect Baseline |
| | | Profile Baseline |
| | | Hydrographic Feature |
| | | Digital Data Available |
| | | No Digital Data Available |
| | | Unmapped |



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **10/15/2019 at 12:47:04 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



70°54'24.03"W



NOAA Atlas 14, Volume 10, Version 3
Location name: Hingham, Massachusetts, USA*
Latitude: 42.1739°, Longitude: -70.9119°
Elevation: 150.08 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.302 (0.234-0.384)	0.375 (0.291-0.478)	0.494 (0.382-0.631)	0.593 (0.456-0.762)	0.730 (0.545-0.986)	0.832 (0.609-1.15)	0.941 (0.673-1.36)	1.07 (0.720-1.57)	1.27 (0.821-1.92)	1.44 (0.909-2.21)
10-min	0.428 (0.332-0.544)	0.531 (0.412-0.677)	0.700 (0.540-0.894)	0.841 (0.646-1.08)	1.03 (0.772-1.40)	1.18 (0.864-1.63)	1.33 (0.954-1.92)	1.52 (1.02-2.22)	1.80 (1.16-2.72)	2.04 (1.29-3.14)
15-min	0.503 (0.390-0.640)	0.625 (0.484-0.796)	0.824 (0.637-1.05)	0.990 (0.760-1.27)	1.22 (0.909-1.64)	1.39 (1.02-1.92)	1.57 (1.12-2.26)	1.79 (1.20-2.61)	2.12 (1.37-3.20)	2.40 (1.52-3.69)
30-min	0.698 (0.542-0.888)	0.868 (0.672-1.11)	1.15 (0.884-1.46)	1.38 (1.06-1.77)	1.69 (1.26-2.28)	1.93 (1.41-2.66)	2.18 (1.56-3.14)	2.48 (1.67-3.62)	2.95 (1.91-4.45)	3.34 (2.11-5.15)
60-min	0.893 (0.693-1.14)	1.11 (0.860-1.41)	1.47 (1.13-1.87)	1.76 (1.35-2.26)	2.16 (1.62-2.92)	2.46 (1.81-3.41)	2.79 (2.00-4.03)	3.18 (2.14-4.64)	3.78 (2.44-5.71)	4.28 (2.71-6.60)
2-hr	1.13 (0.885-1.43)	1.43 (1.12-1.81)	1.91 (1.49-2.43)	2.32 (1.79-2.96)	2.87 (2.15-3.85)	3.28 (2.42-4.51)	3.72 (2.69-5.34)	4.27 (2.88-6.17)	5.10 (3.31-7.63)	5.83 (3.70-8.88)
3-hr	1.32 (1.03-1.66)	1.66 (1.30-2.09)	2.22 (1.73-2.81)	2.69 (2.09-3.42)	3.34 (2.51-4.46)	3.81 (2.82-5.21)	4.33 (3.13-6.18)	4.96 (3.35-7.13)	5.94 (3.87-8.83)	6.79 (4.32-10.3)
6-hr	1.73 (1.36-2.16)	2.15 (1.69-2.69)	2.84 (2.23-3.57)	3.41 (2.66-4.31)	4.20 (3.18-5.56)	4.78 (3.55-6.48)	5.41 (3.93-7.64)	6.18 (4.20-8.79)	7.36 (4.81-10.8)	8.36 (5.34-12.5)
12-hr	2.27 (1.80-2.82)	2.76 (2.18-3.43)	3.56 (2.81-4.44)	4.23 (3.31-5.30)	5.14 (3.91-6.74)	5.82 (4.34-7.80)	6.55 (4.76-9.12)	7.43 (5.06-10.4)	8.73 (5.73-12.7)	9.84 (6.31-14.6)
24-hr	2.77 (2.20-3.41)	3.36 (2.67-4.15)	4.32 (3.43-5.35)	5.12 (4.04-6.38)	6.22 (4.76-8.09)	7.04 (5.28-9.35)	7.92 (5.78-10.9)	8.97 (6.14-12.5)	10.5 (6.94-15.1)	11.9 (7.63-17.4)
2-day	3.14 (2.51-3.85)	3.87 (3.10-4.75)	5.07 (4.04-6.23)	6.06 (4.80-7.49)	7.42 (5.71-9.59)	8.43 (6.36-11.1)	9.53 (7.01-13.1)	10.9 (7.46-15.0)	12.9 (8.51-18.3)	14.6 (9.44-21.1)
3-day	3.43 (2.76-4.19)	4.22 (3.39-5.15)	5.50 (4.40-6.74)	6.57 (5.22-8.09)	8.04 (6.20-10.3)	9.13 (6.90-12.0)	10.3 (7.60-14.1)	11.7 (8.09-16.1)	13.9 (9.23-19.7)	15.8 (10.2-22.7)
4-day	3.71 (2.99-4.51)	4.52 (3.64-5.51)	5.85 (4.69-7.15)	6.95 (5.54-8.53)	8.47 (6.54-10.8)	9.59 (7.27-12.5)	10.8 (7.98-14.7)	12.3 (8.48-16.7)	14.5 (9.64-20.4)	16.5 (10.7-23.5)
7-day	4.48 (3.63-5.43)	5.33 (4.31-6.45)	6.71 (5.40-8.15)	7.85 (6.29-9.58)	9.43 (7.32-12.0)	10.6 (8.06-13.7)	11.9 (8.77-15.9)	13.4 (9.27-18.1)	15.6 (10.4-21.8)	17.6 (11.4-24.8)
10-day	5.20 (4.22-6.27)	6.07 (4.92-7.32)	7.49 (6.05-9.06)	8.67 (6.96-10.5)	10.3 (8.00-13.0)	11.5 (8.75-14.8)	12.8 (9.45-17.0)	14.3 (9.94-19.2)	16.5 (11.0-22.8)	18.4 (12.0-25.8)
20-day	7.27 (5.94-8.71)	8.22 (6.71-9.86)	9.78 (7.94-11.7)	11.1 (8.94-13.4)	12.8 (10.0-16.0)	14.2 (10.8-17.9)	15.6 (11.5-20.2)	17.1 (11.9-22.6)	19.1 (12.8-26.1)	20.7 (13.5-28.8)
30-day	8.99 (7.36-10.7)	10.0 (8.19-11.9)	11.7 (9.51-14.0)	13.0 (10.6-15.7)	14.9 (11.7-18.4)	16.4 (12.5-20.5)	17.9 (13.1-22.9)	19.3 (13.6-25.5)	21.2 (14.3-28.8)	22.7 (14.9-31.3)
45-day	11.1 (9.16-13.2)	12.2 (10.0-14.5)	14.0 (11.5-16.7)	15.5 (12.6-18.5)	17.5 (13.7-21.5)	19.1 (14.6-23.7)	20.7 (15.1-26.2)	22.1 (15.6-28.9)	23.9 (16.1-32.1)	25.2 (16.5-34.4)
60-day	13.0 (10.7-15.3)	14.1 (11.6-16.7)	16.0 (13.1-19.0)	17.5 (14.3-20.9)	19.7 (15.4-24.0)	21.3 (16.3-26.4)	22.9 (16.8-28.9)	24.4 (17.2-31.8)	26.1 (17.7-34.9)	27.3 (17.9-37.1)

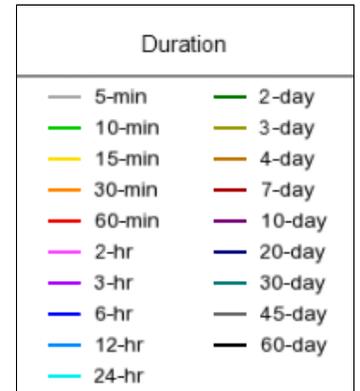
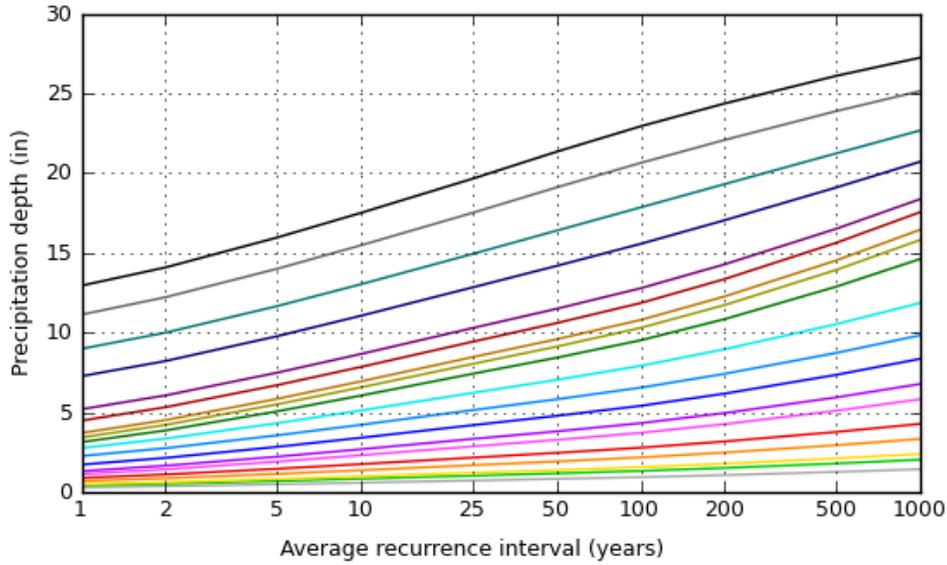
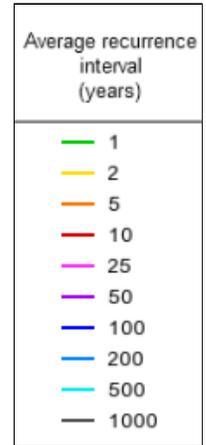
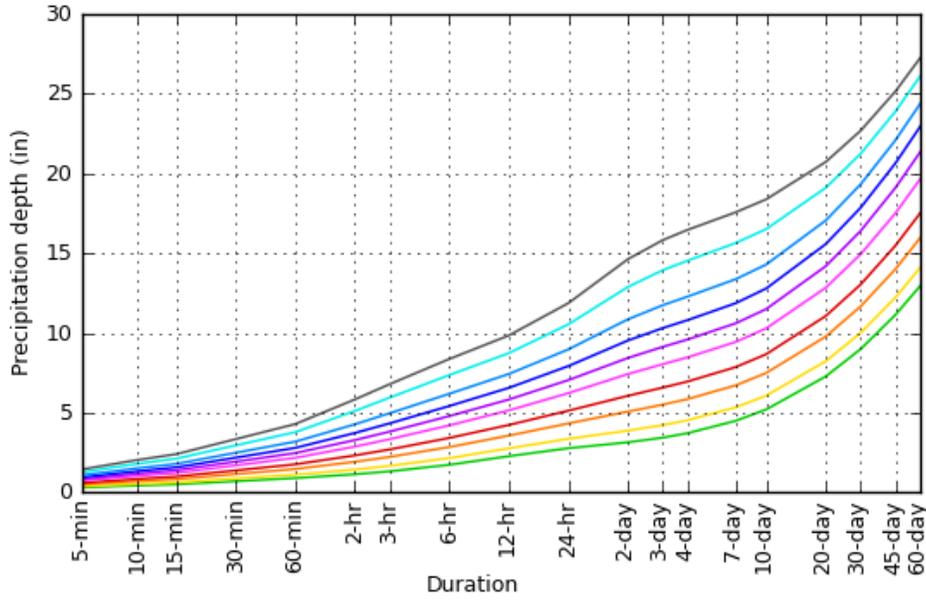
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves

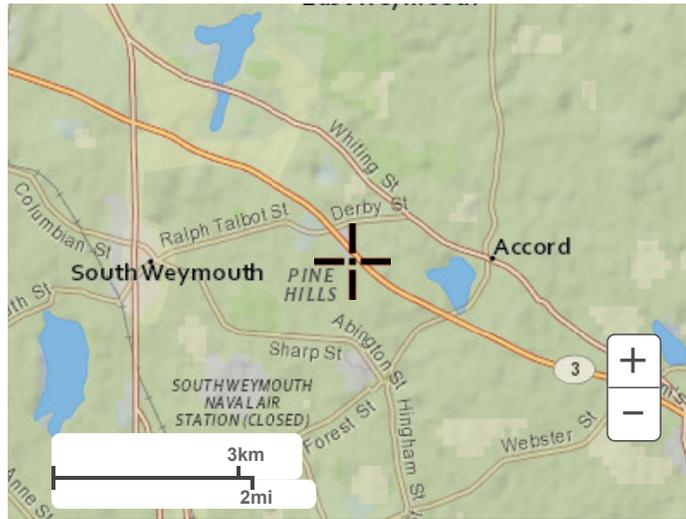
Latitude: 42.1739°, Longitude: -70.9119°



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Maps & aerials

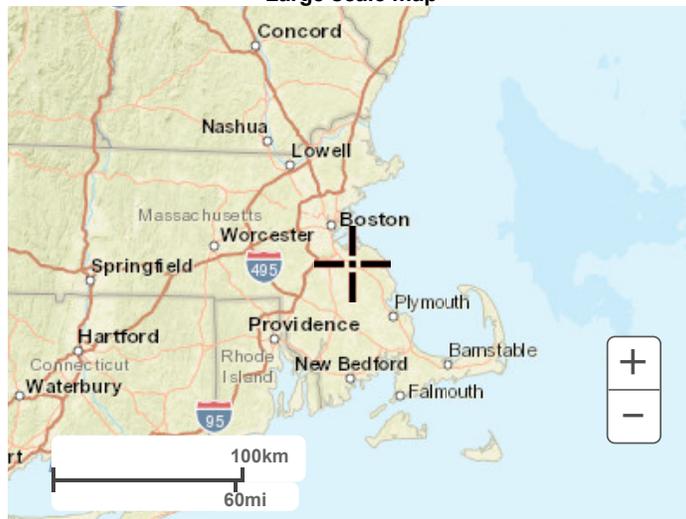
Small scale terrain



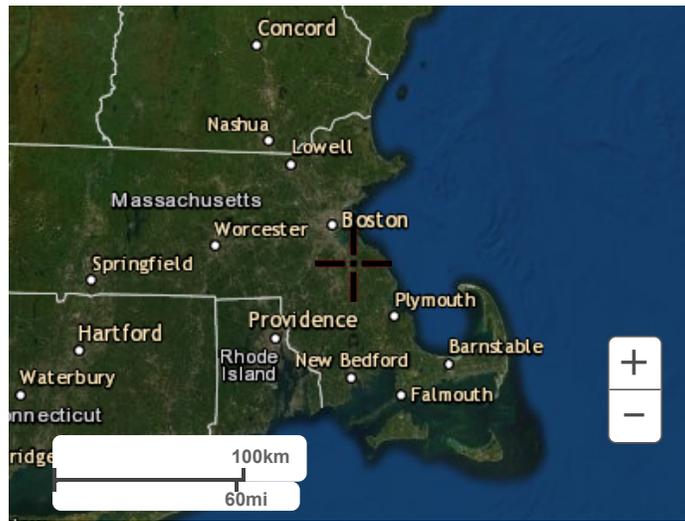
Large scale terrain



Large scale map



Large scale aerial



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[US Department of Commerce](#)
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[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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NOAA Atlas 14, Volume 10, Version 3
Location name: Hingham, Massachusetts, USA*
Latitude: 42.1739°, Longitude: -70.9119°
Elevation: 150.08 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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NOAA, National Weather Service, Silver Spring, Maryland

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PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	3.62 (2.81-4.61)	4.50 (3.49-5.74)	5.93 (4.58-7.57)	7.12 (5.47-9.14)	8.76 (6.54-11.8)	9.98 (7.31-13.8)	11.3 (8.08-16.3)	12.9 (8.64-18.8)	15.2 (9.85-23.0)	17.2 (10.9-26.6)
10-min	2.57 (1.99-3.26)	3.19 (2.47-4.06)	4.20 (3.24-5.36)	5.05 (3.88-6.49)	6.21 (4.63-8.38)	7.07 (5.18-9.77)	8.00 (5.72-11.5)	9.11 (6.12-13.3)	10.8 (6.98-16.3)	12.2 (7.73-18.8)
15-min	2.01 (1.56-2.56)	2.50 (1.94-3.18)	3.30 (2.55-4.21)	3.96 (3.04-5.08)	4.87 (3.64-6.58)	5.54 (4.06-7.66)	6.27 (4.49-9.04)	7.14 (4.80-10.4)	8.46 (5.48-12.8)	9.58 (6.06-14.8)
30-min	1.40 (1.08-1.78)	1.74 (1.34-2.21)	2.29 (1.77-2.93)	2.75 (2.11-3.53)	3.38 (2.52-4.57)	3.85 (2.82-5.32)	4.36 (3.12-6.28)	4.97 (3.34-7.25)	5.89 (3.81-8.90)	6.68 (4.23-10.3)
60-min	0.893 (0.693-1.14)	1.11 (0.860-1.41)	1.47 (1.13-1.87)	1.76 (1.35-2.26)	2.16 (1.62-2.92)	2.46 (1.81-3.41)	2.79 (2.00-4.03)	3.18 (2.14-4.64)	3.78 (2.44-5.71)	4.28 (2.71-6.60)
2-hr	0.567 (0.442-0.716)	0.715 (0.558-0.904)	0.957 (0.743-1.21)	1.16 (0.894-1.48)	1.43 (1.08-1.93)	1.64 (1.21-2.25)	1.86 (1.34-2.67)	2.13 (1.44-3.08)	2.55 (1.66-3.82)	2.91 (1.85-4.44)
3-hr	0.438 (0.343-0.551)	0.553 (0.432-0.697)	0.740 (0.577-0.936)	0.896 (0.694-1.14)	1.11 (0.837-1.49)	1.27 (0.939-1.74)	1.44 (1.04-2.06)	1.65 (1.12-2.38)	1.98 (1.29-2.94)	2.26 (1.44-3.42)
6-hr	0.289 (0.227-0.361)	0.359 (0.282-0.449)	0.474 (0.372-0.596)	0.570 (0.444-0.719)	0.701 (0.531-0.929)	0.799 (0.594-1.08)	0.904 (0.656-1.28)	1.03 (0.701-1.47)	1.23 (0.802-1.81)	1.40 (0.892-2.09)
12-hr	0.188 (0.149-0.234)	0.229 (0.181-0.285)	0.295 (0.233-0.369)	0.351 (0.275-0.440)	0.427 (0.324-0.559)	0.483 (0.360-0.647)	0.544 (0.395-0.757)	0.616 (0.420-0.867)	0.725 (0.475-1.05)	0.817 (0.524-1.21)
24-hr	0.115 (0.092-0.142)	0.140 (0.111-0.173)	0.180 (0.143-0.223)	0.213 (0.168-0.266)	0.259 (0.198-0.337)	0.293 (0.220-0.389)	0.330 (0.241-0.455)	0.374 (0.256-0.520)	0.439 (0.289-0.631)	0.494 (0.318-0.723)
2-day	0.065 (0.052-0.080)	0.081 (0.064-0.099)	0.106 (0.084-0.130)	0.126 (0.100-0.156)	0.155 (0.119-0.200)	0.176 (0.132-0.232)	0.198 (0.146-0.272)	0.226 (0.155-0.312)	0.268 (0.177-0.381)	0.305 (0.197-0.440)
3-day	0.048 (0.038-0.058)	0.059 (0.047-0.072)	0.076 (0.061-0.094)	0.091 (0.073-0.112)	0.112 (0.086-0.144)	0.127 (0.096-0.166)	0.143 (0.106-0.195)	0.163 (0.112-0.223)	0.194 (0.128-0.273)	0.220 (0.142-0.315)
4-day	0.039 (0.031-0.047)	0.047 (0.038-0.057)	0.061 (0.049-0.074)	0.072 (0.058-0.089)	0.088 (0.068-0.113)	0.100 (0.076-0.131)	0.113 (0.083-0.153)	0.128 (0.088-0.174)	0.151 (0.100-0.213)	0.171 (0.111-0.245)
7-day	0.027 (0.022-0.032)	0.032 (0.026-0.038)	0.040 (0.032-0.048)	0.047 (0.037-0.057)	0.056 (0.044-0.071)	0.063 (0.048-0.082)	0.071 (0.052-0.095)	0.080 (0.055-0.108)	0.093 (0.062-0.129)	0.105 (0.068-0.148)
10-day	0.022 (0.018-0.026)	0.025 (0.021-0.031)	0.031 (0.025-0.038)	0.036 (0.029-0.044)	0.043 (0.033-0.054)	0.048 (0.036-0.062)	0.053 (0.039-0.071)	0.060 (0.041-0.080)	0.069 (0.046-0.095)	0.077 (0.050-0.108)
20-day	0.015 (0.012-0.018)	0.017 (0.014-0.021)	0.020 (0.017-0.024)	0.023 (0.019-0.028)	0.027 (0.021-0.033)	0.030 (0.023-0.037)	0.032 (0.024-0.042)	0.036 (0.025-0.047)	0.040 (0.027-0.054)	0.043 (0.028-0.060)
30-day	0.012 (0.010-0.015)	0.014 (0.011-0.017)	0.016 (0.013-0.019)	0.018 (0.015-0.022)	0.021 (0.016-0.026)	0.023 (0.017-0.029)	0.025 (0.018-0.032)	0.027 (0.019-0.035)	0.029 (0.020-0.040)	0.031 (0.021-0.043)
45-day	0.010 (0.008-0.012)	0.011 (0.009-0.013)	0.013 (0.011-0.015)	0.014 (0.012-0.017)	0.016 (0.013-0.020)	0.018 (0.014-0.022)	0.019 (0.014-0.024)	0.020 (0.014-0.027)	0.022 (0.015-0.030)	0.023 (0.015-0.032)
60-day	0.009 (0.007-0.011)	0.010 (0.008-0.012)	0.011 (0.009-0.013)	0.012 (0.010-0.015)	0.014 (0.011-0.017)	0.015 (0.011-0.018)	0.016 (0.012-0.020)	0.017 (0.012-0.022)	0.018 (0.012-0.024)	0.019 (0.012-0.026)

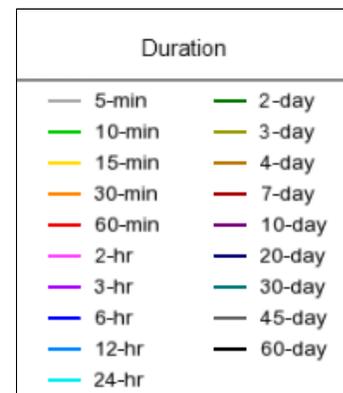
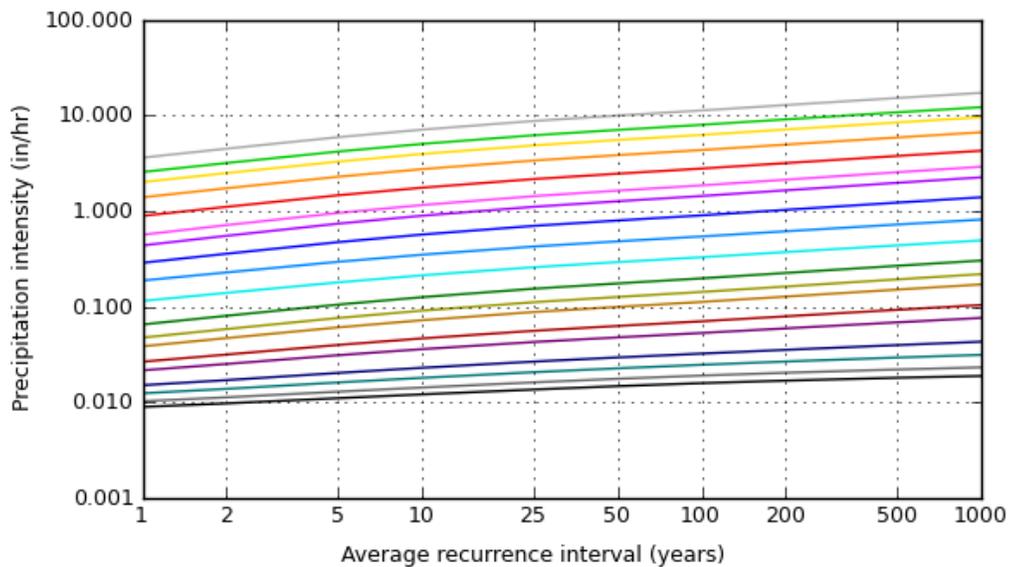
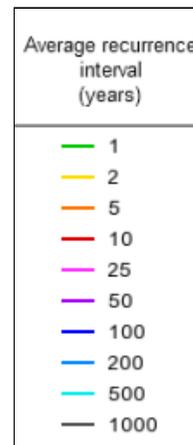
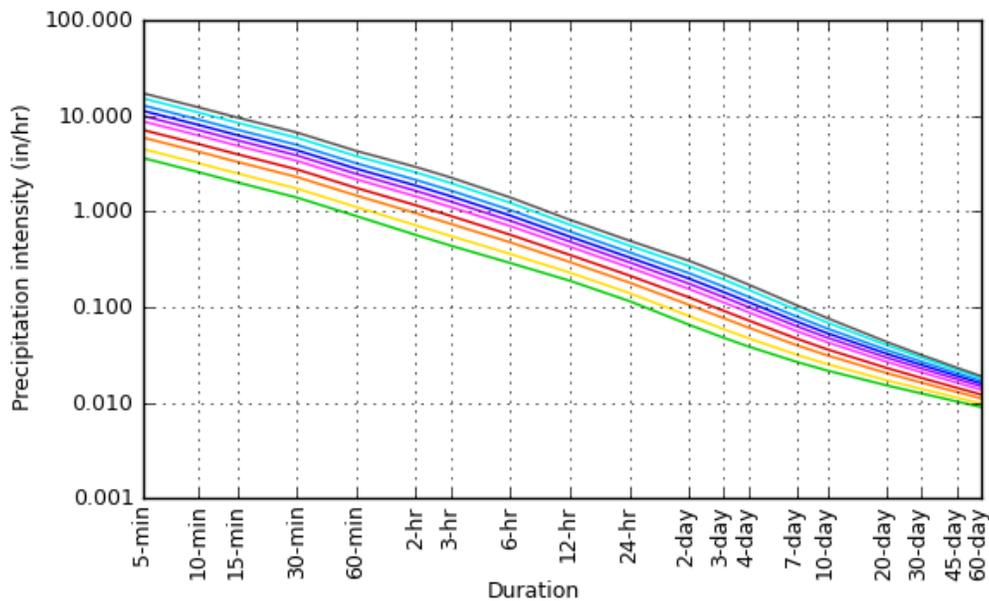
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based intensity-duration-frequency (IDF) curves

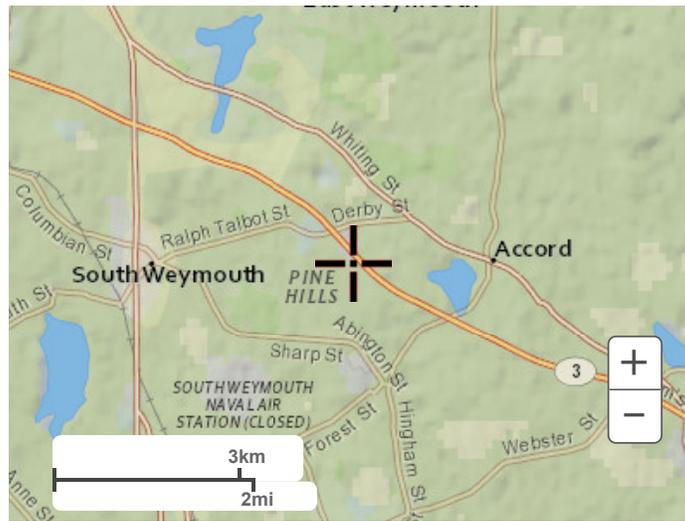
Latitude: 42.1739°, Longitude: -70.9119°



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Maps & arials

Small scale terrain



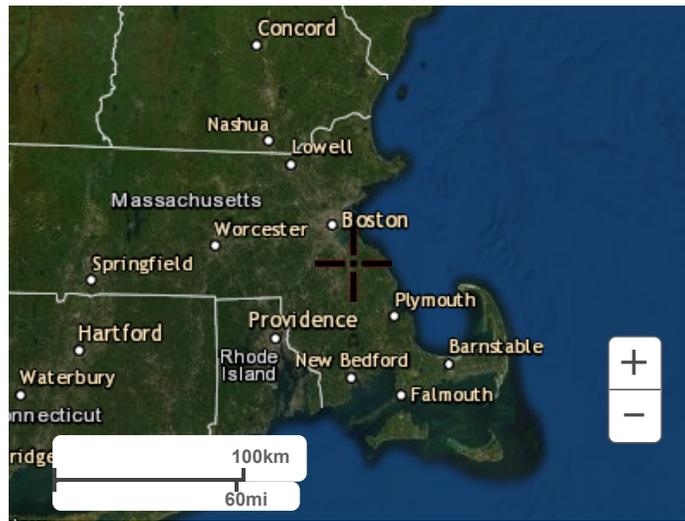
Large scale terrain



Large scale map



Large scale aerial



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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

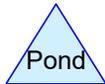
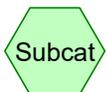
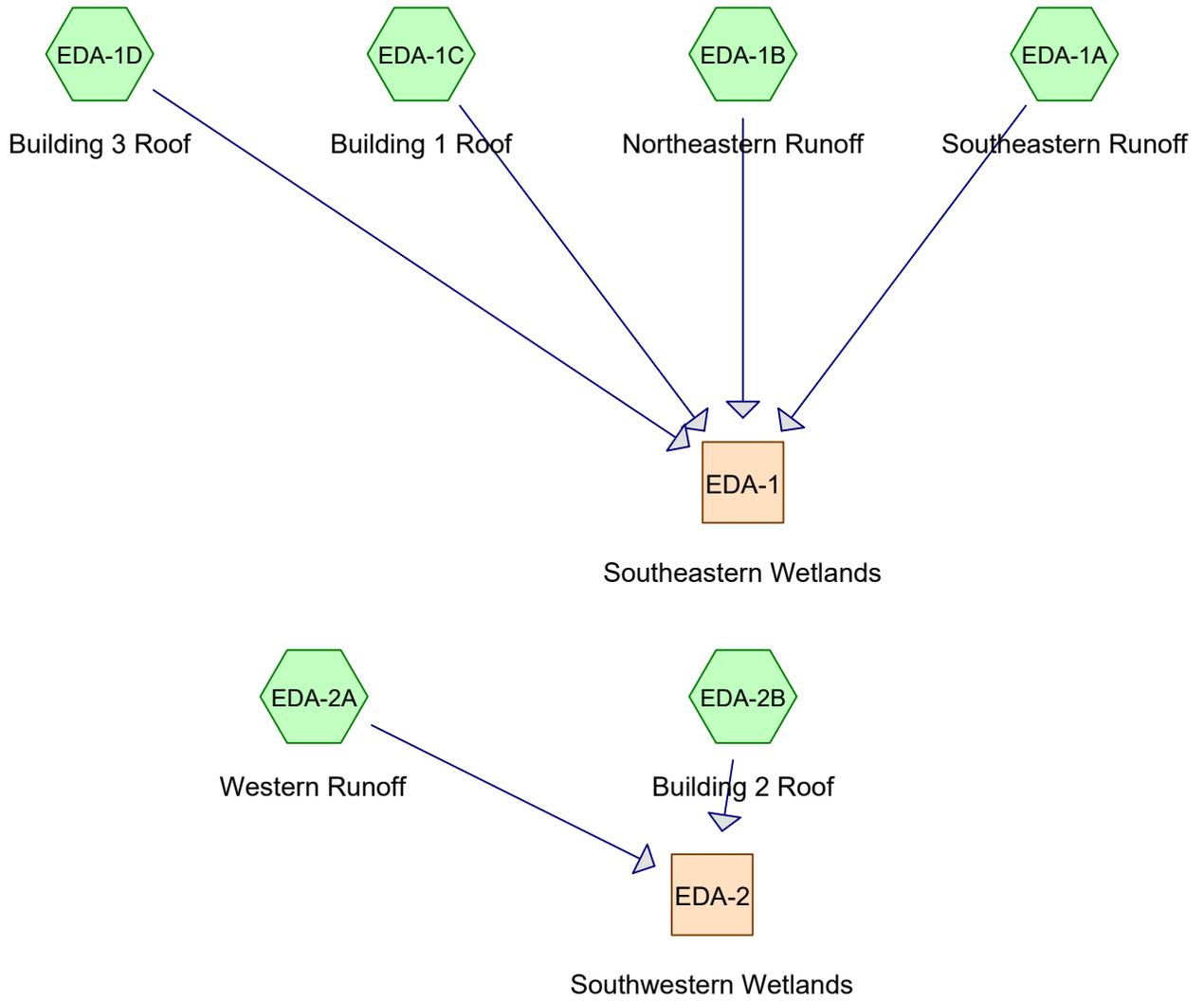
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APPENDIX B

HYDROLOGIC ANALYSIS

Pre-Development Hydrological Analysis (2-, 10- and 100-year storms)

Post-Development Hydrological Analyses (2-, 10- and 100-year storms)



Routing Diagram for 1901517-HYDRO
 Prepared by {enter your company name here}, Printed 3/8/2020
 HydroCAD® 10.00-22 s/n 01334 © 2018 HydroCAD Software Solutions LLC

Summary for Subcatchment EDA-1A: Southeastern Runoff

Runoff = 5.55 cfs @ 12.12 hrs, Volume= 18,036 cf, Depth= 2.14"

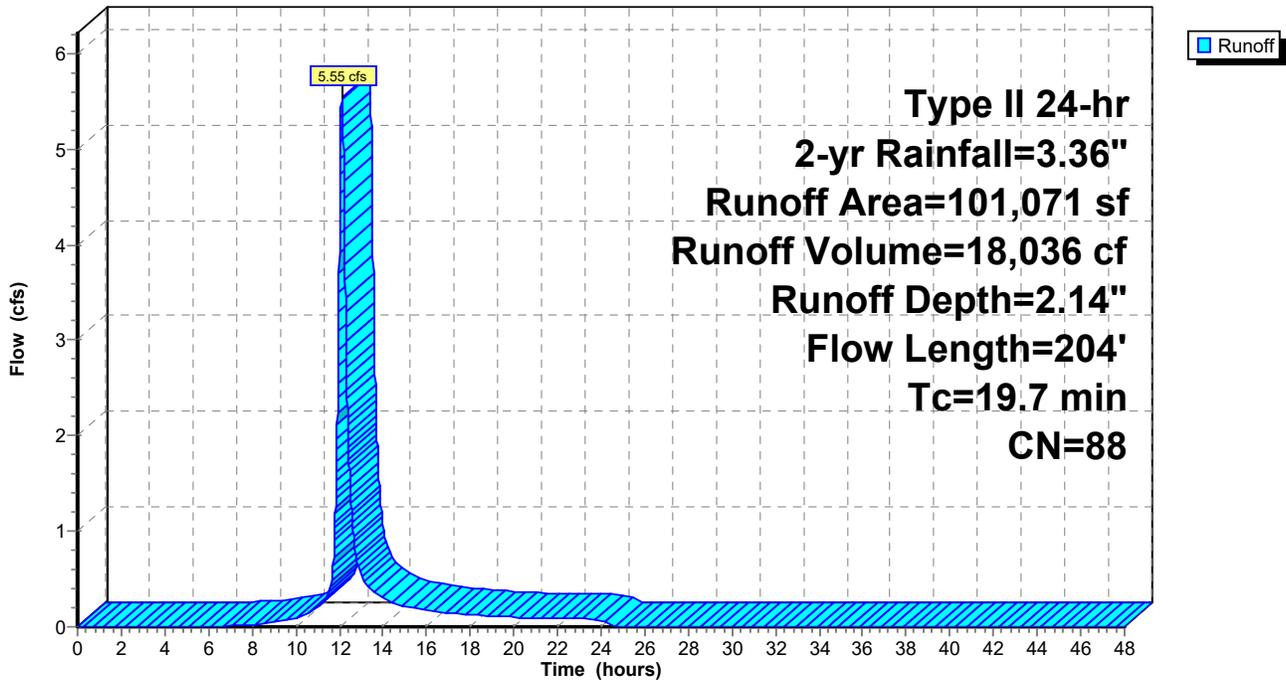
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
36,485	98	Paved parking, HSG D
64,586	82	Woods/grass comb., Fair, HSG D
101,071	88	Weighted Average
64,586		63.90% Pervious Area
36,485		36.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	100	0.0350	0.10		Sheet Flow, Grass/Woods
					Woods: Light underbrush n= 0.400 P2= 3.36"
2.9	104	0.0140	0.59		Shallow Concentrated Flow, Woods
					Woodland Kv= 5.0 fps
19.7	204	Total			

Subcatchment EDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1B: Northeastern Runoff

Runoff = 4.32 cfs @ 12.26 hrs, Volume= 18,834 cf, Depth= 2.14"

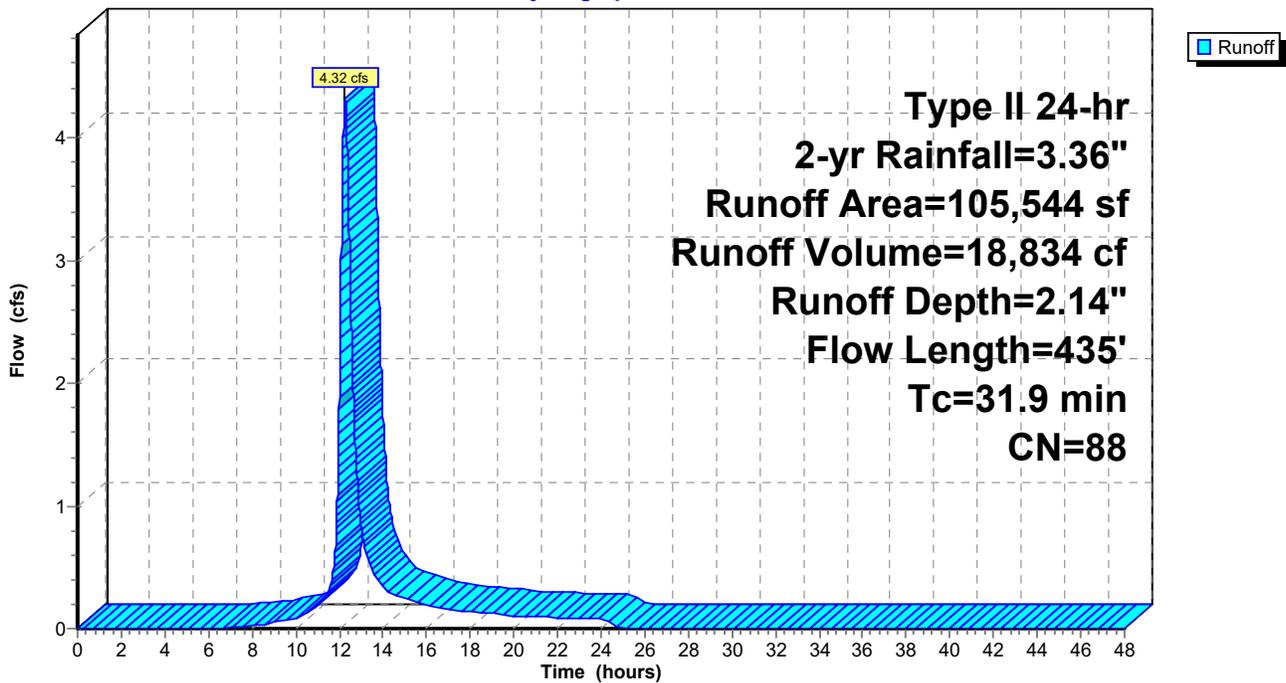
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
37,851	98	Paved parking, HSG D
63,191	82	Woods/grass comb., Fair, HSG D
4,502	84	50-75% Grass cover, Fair, HSG D
105,544	88	Weighted Average
67,693		64.14% Pervious Area
37,851		35.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.1	138	0.0220	0.09		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
2.8	17	0.0880	0.10		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
3.0	280	0.0060	1.57		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
31.9	435	Total			

Subcatchment EDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1C: Building 1 Roof

Runoff = 15.66 cfs @ 11.97 hrs, Volume= 37,385 cf, Depth= 3.13"

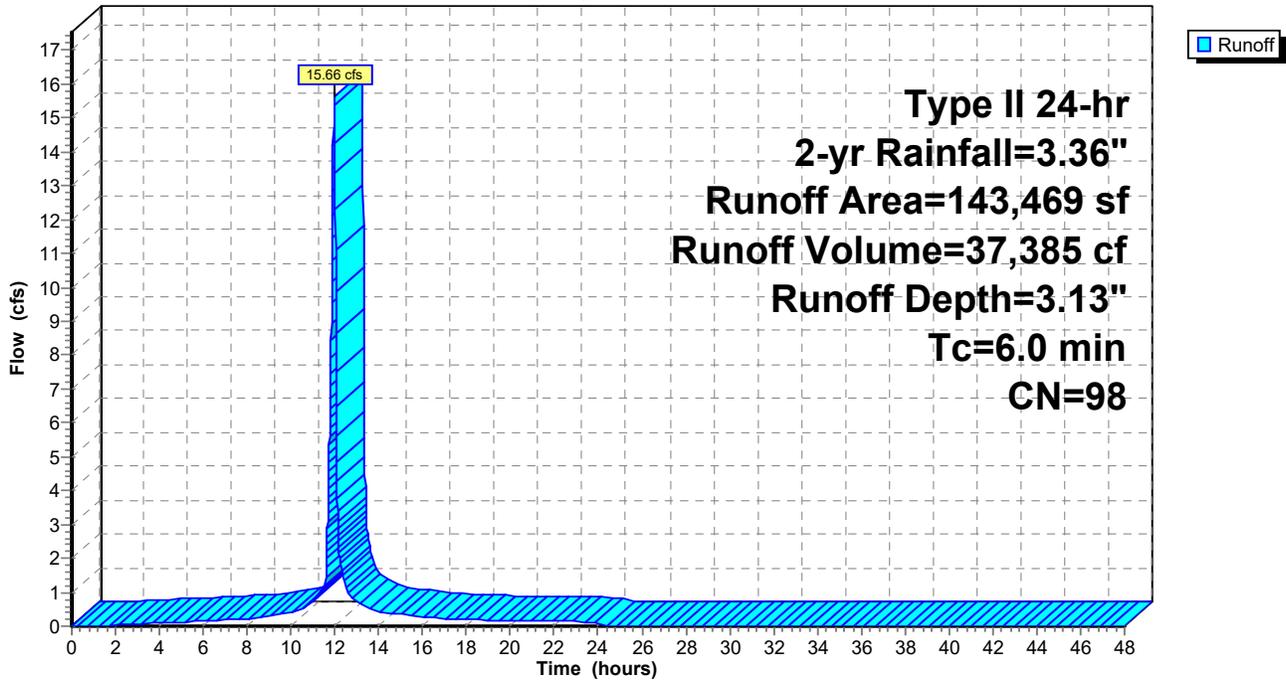
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
143,469	98	Unconnected roofs, HSG D
143,469		100.00% Impervious Area
143,469		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment EDA-1C: Building 1 Roof

Hydrograph



Summary for Subcatchment EDA-1D: Building 3 Roof

Runoff = 0.34 cfs @ 11.97 hrs, Volume= 820 cf, Depth= 3.13"

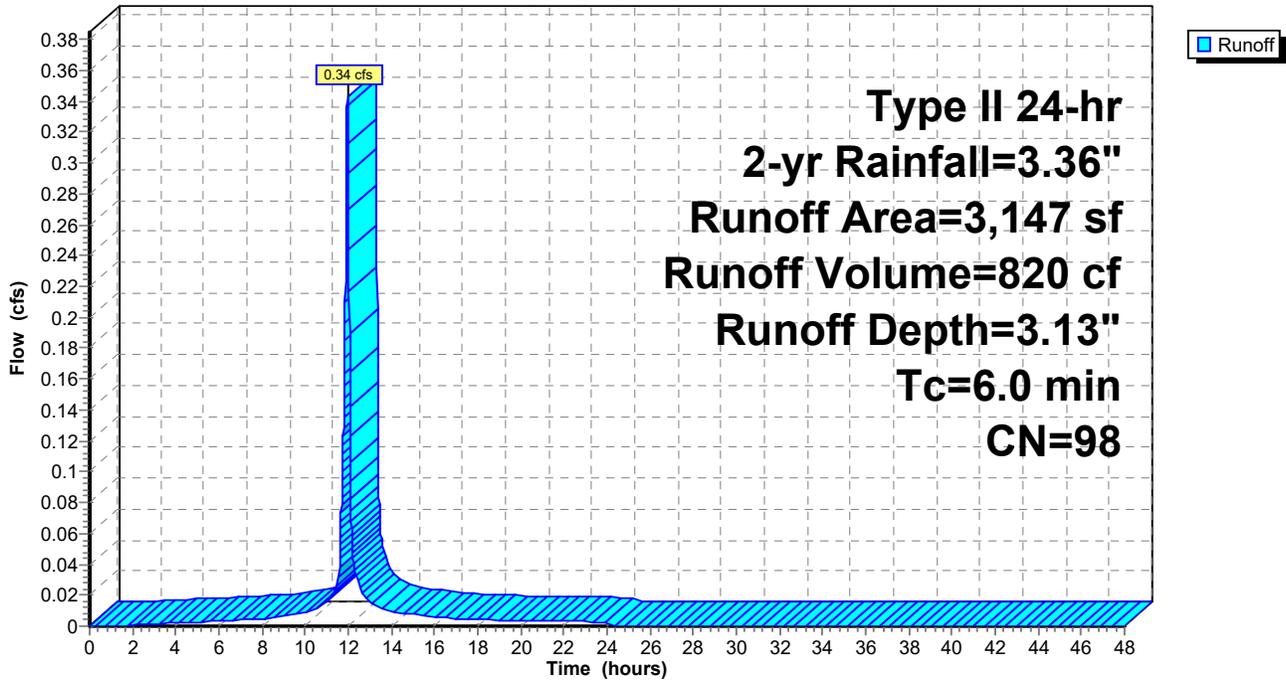
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
3,147	98	Unconnected roofs, HSG D
3,147		100.00% Impervious Area
3,147		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment EDA-1D: Building 3 Roof

Hydrograph



Summary for Subcatchment EDA-2A: Western Runoff

Runoff = 15.82 cfs @ 12.13 hrs, Volume= 52,061 cf, Depth= 2.23"

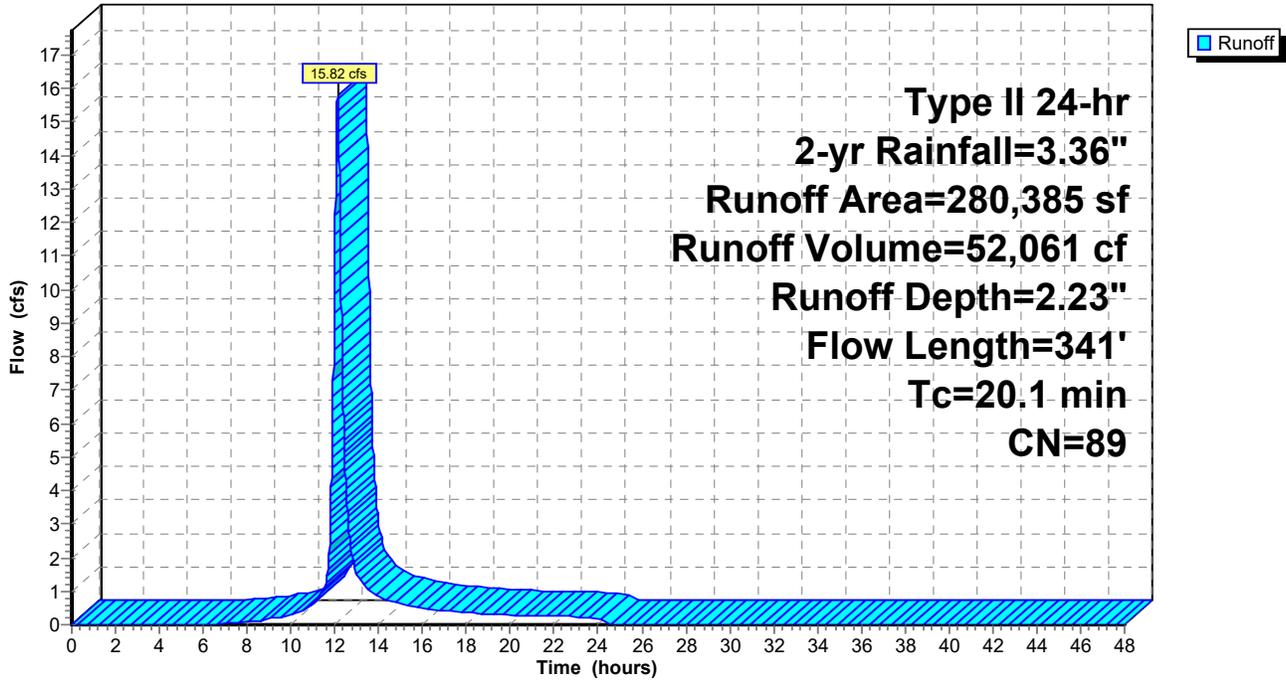
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
132,915	98	Paved parking, HSG D
122,348	79	Woods, Fair, HSG D
20,947	96	Gravel surface, HSG D
4,175	84	50-75% Grass cover, Fair, HSG D
280,385	89	Weighted Average
147,470		52.60% Pervious Area
132,915		47.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	88	0.0400	0.10		Sheet Flow, Woods Woods: Light underbrush n= 0.400 P2= 3.36"
2.7	92	0.0125	0.56		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
0.6	86	0.0140	2.40		Shallow Concentrated Flow, Paved Paved Kv= 20.3 fps
2.5	75	0.0100	0.50		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
20.1	341	Total			

Subcatchment EDA-2A: Western Runoff

Hydrograph



Summary for Subcatchment EDA-2B: Building 2 Roof

Runoff = 4.50 cfs @ 11.97 hrs, Volume= 10,737 cf, Depth= 3.13"

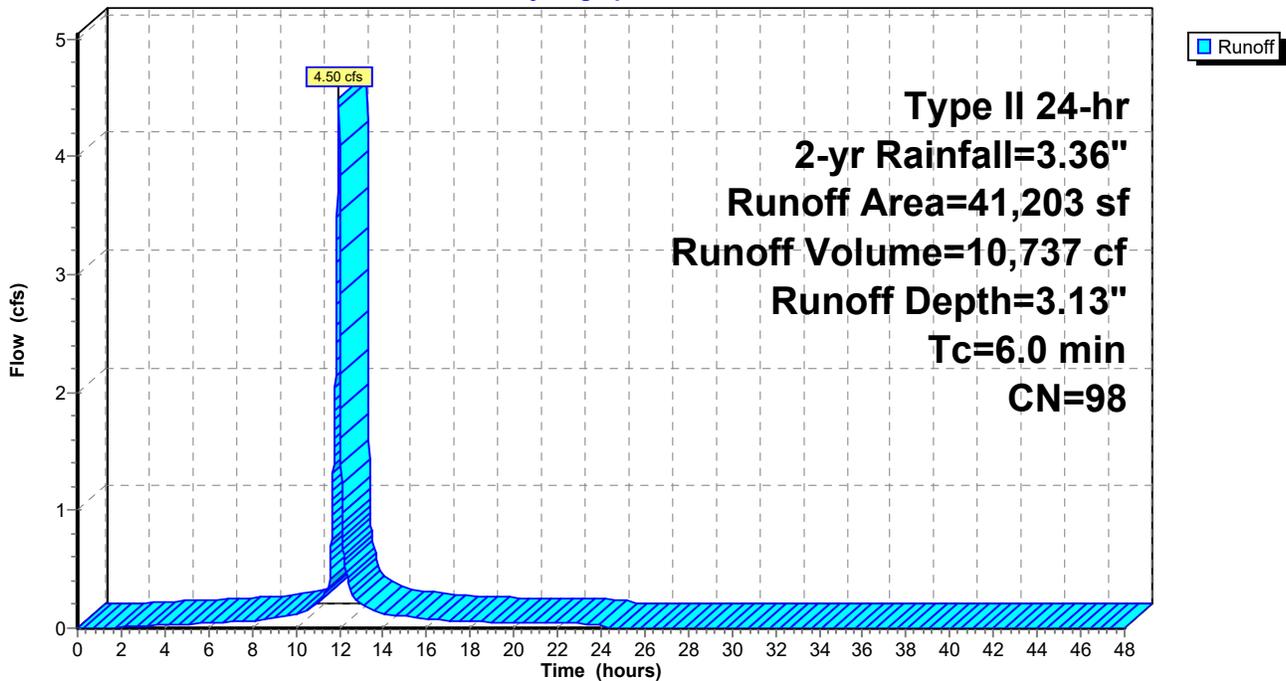
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
41,203	98	Unconnected roofs, HSG D
41,203		100.00% Impervious Area
41,203		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment EDA-2B: Building 2 Roof

Hydrograph



Summary for Reach EDA-1: Southeastern Wetlands

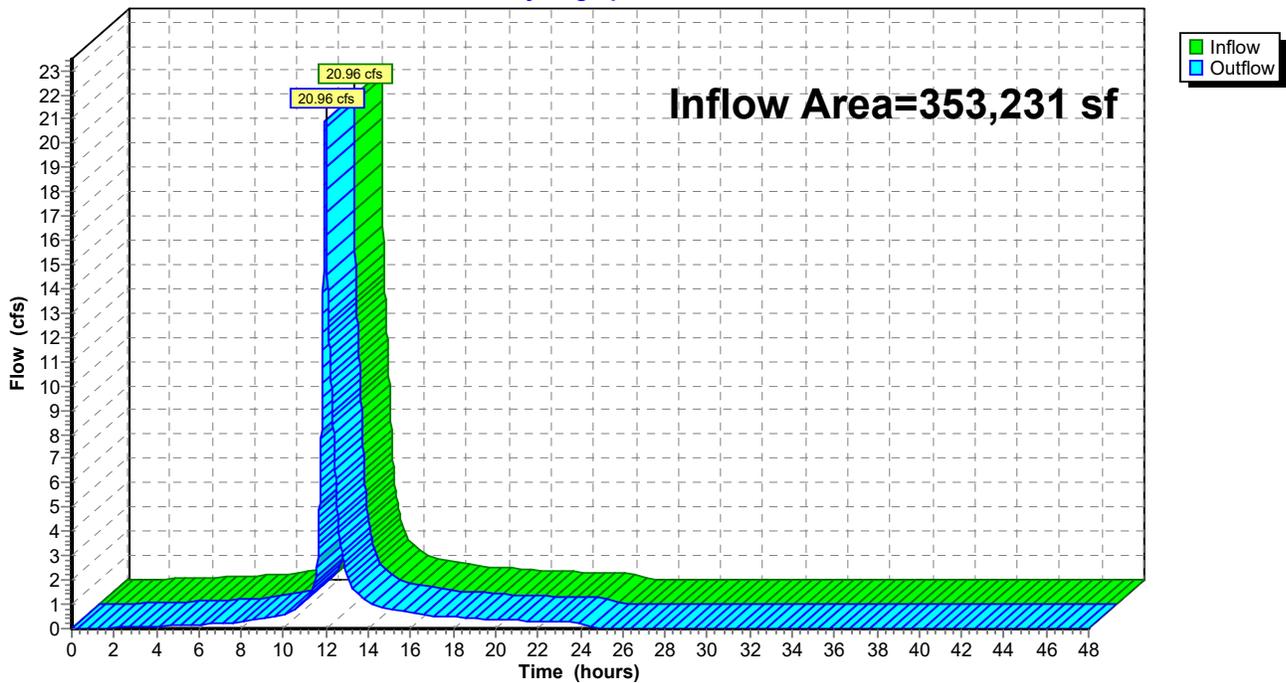
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 353,231 sf, 62.55% Impervious, Inflow Depth = 2.55" for 2-yr event
Inflow = 20.96 cfs @ 11.98 hrs, Volume= 75,075 cf
Outflow = 20.96 cfs @ 11.98 hrs, Volume= 75,075 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach EDA-1: Southeastern Wetlands

Hydrograph



Summary for Reach EDA-2: Southwestern Wetlands

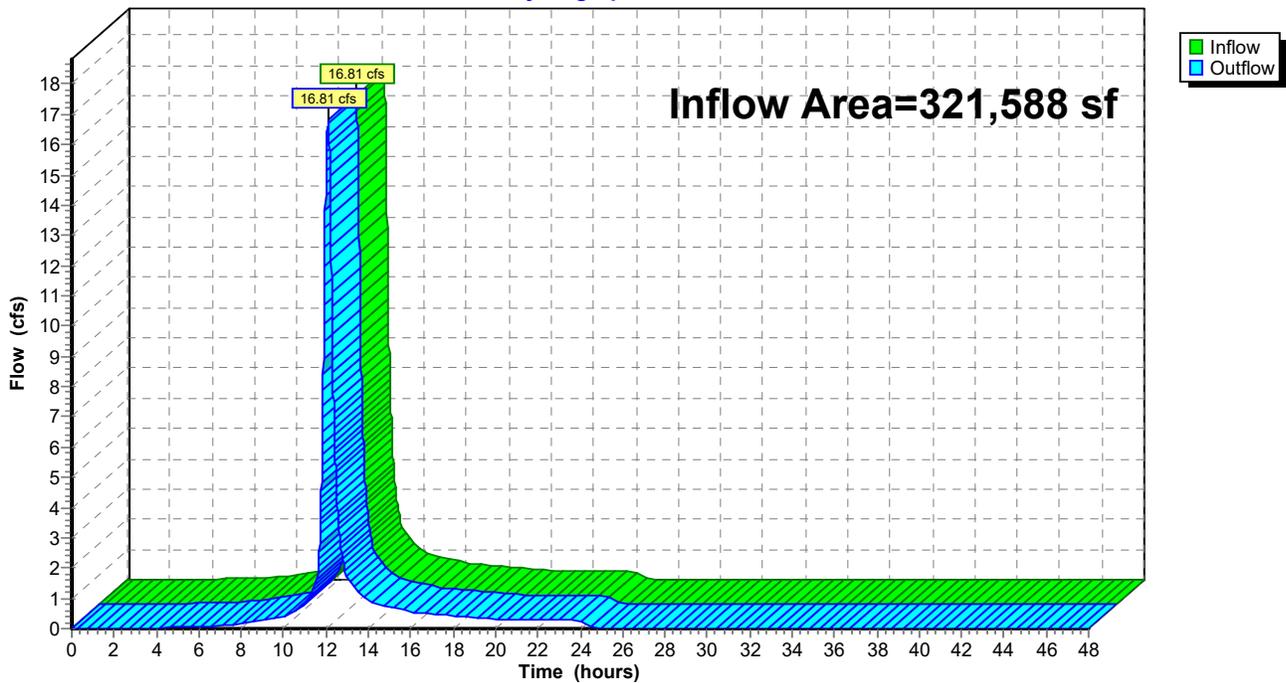
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 321,588 sf, 54.14% Impervious, Inflow Depth = 2.34" for 2-yr event
Inflow = 16.81 cfs @ 12.11 hrs, Volume= 62,798 cf
Outflow = 16.81 cfs @ 12.11 hrs, Volume= 62,798 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach EDA-2: Southwestern Wetlands

Hydrograph



Summary for Subcatchment EDA-1A: Southeastern Runoff

Runoff = 9.64 cfs @ 12.11 hrs, Volume= 31,863 cf, Depth= 3.78"

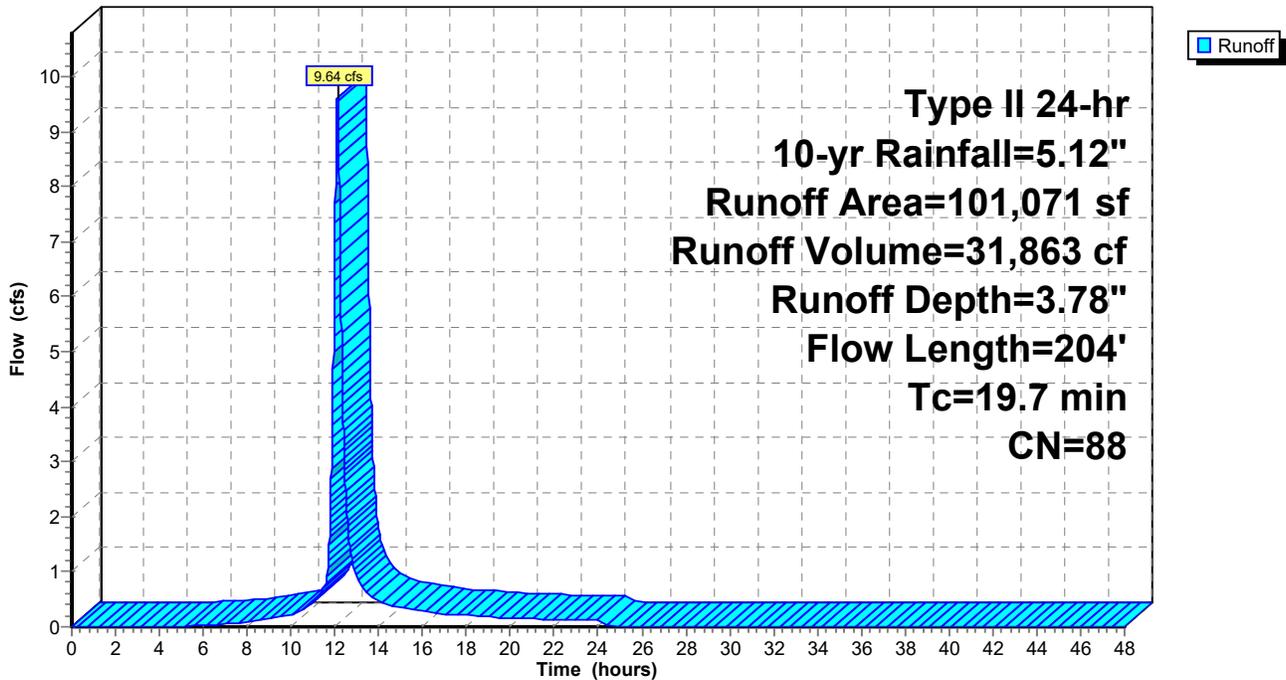
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
36,485	98	Paved parking, HSG D
64,586	82	Woods/grass comb., Fair, HSG D
101,071	88	Weighted Average
64,586		63.90% Pervious Area
36,485		36.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	100	0.0350	0.10		Sheet Flow, Grass/Woods
					Woods: Light underbrush n= 0.400 P2= 3.36"
2.9	104	0.0140	0.59		Shallow Concentrated Flow, Woods
					Woodland Kv= 5.0 fps
19.7	204	Total			

Subcatchment EDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1B: Northeastern Runoff

Runoff = 7.54 cfs @ 12.26 hrs, Volume= 33,273 cf, Depth= 3.78"

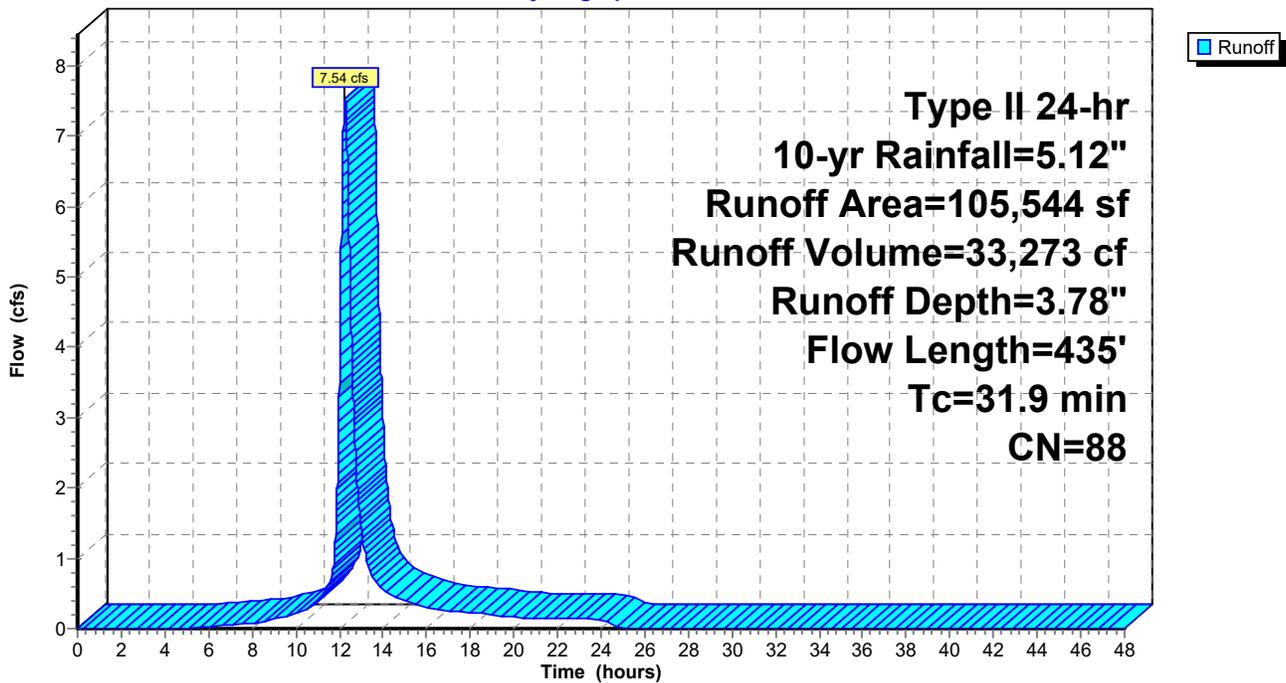
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
37,851	98	Paved parking, HSG D
63,191	82	Woods/grass comb., Fair, HSG D
4,502	84	50-75% Grass cover, Fair, HSG D
105,544	88	Weighted Average
67,693		64.14% Pervious Area
37,851		35.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.1	138	0.0220	0.09		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
2.8	17	0.0880	0.10		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
3.0	280	0.0060	1.57		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
31.9	435	Total			

Subcatchment EDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1C: Building 1 Roof

Runoff = 24.01 cfs @ 11.97 hrs, Volume= 58,380 cf, Depth= 4.88"

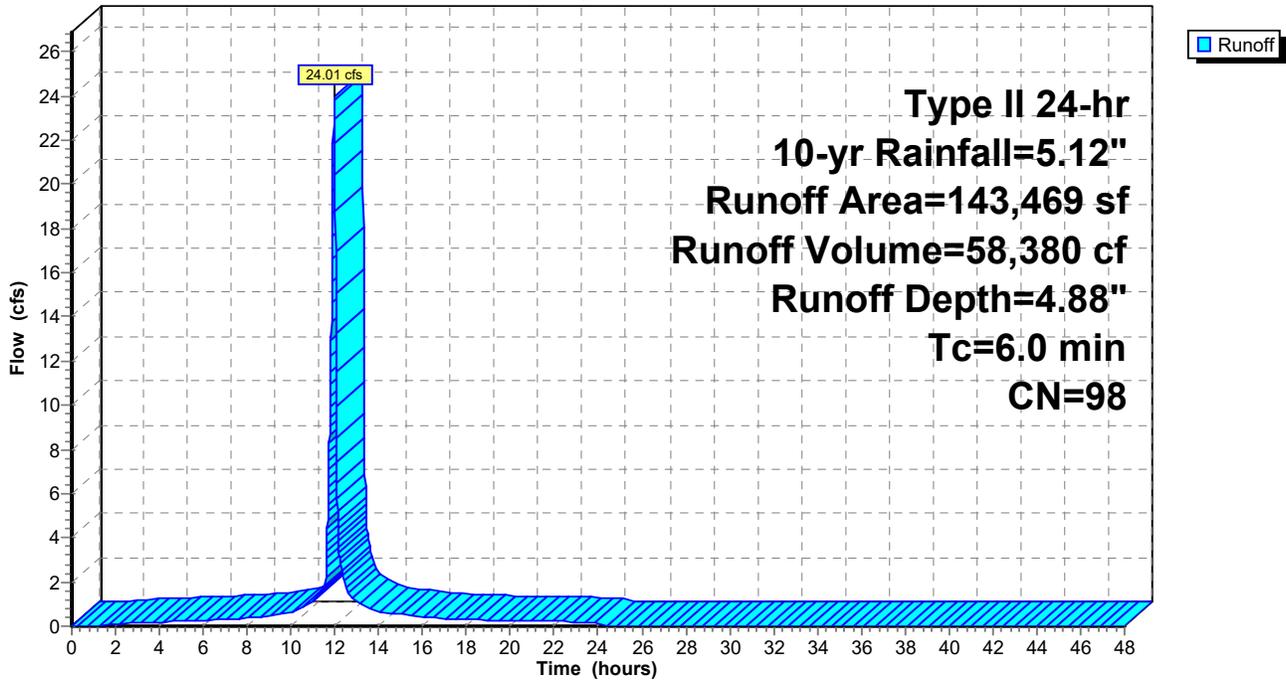
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
143,469	98	Unconnected roofs, HSG D
143,469		100.00% Impervious Area
143,469		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment EDA-1C: Building 1 Roof

Hydrograph



Summary for Subcatchment EDA-1D: Building 3 Roof

Runoff = 0.53 cfs @ 11.97 hrs, Volume= 1,281 cf, Depth= 4.88"

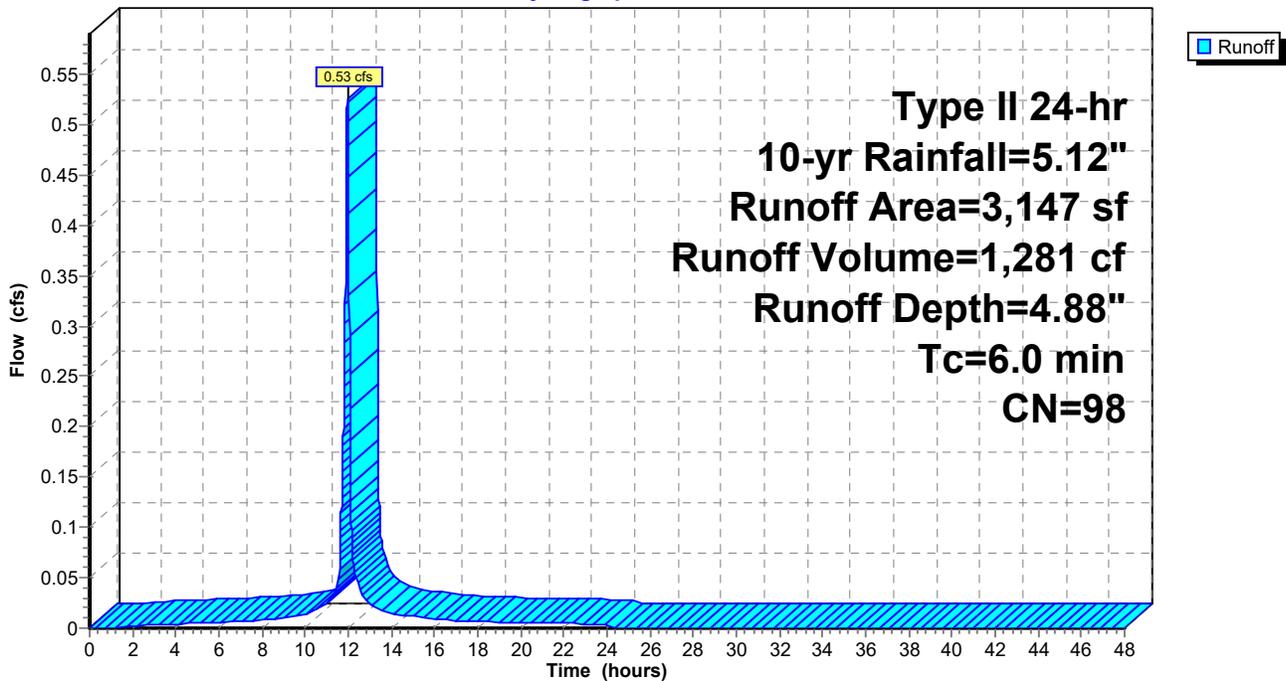
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
3,147	98	Unconnected roofs, HSG D
3,147		100.00% Impervious Area
3,147		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment EDA-1D: Building 3 Roof

Hydrograph



Summary for Subcatchment EDA-2A: Western Runoff

Runoff = 27.03 cfs @ 12.12 hrs, Volume= 90,819 cf, Depth= 3.89"

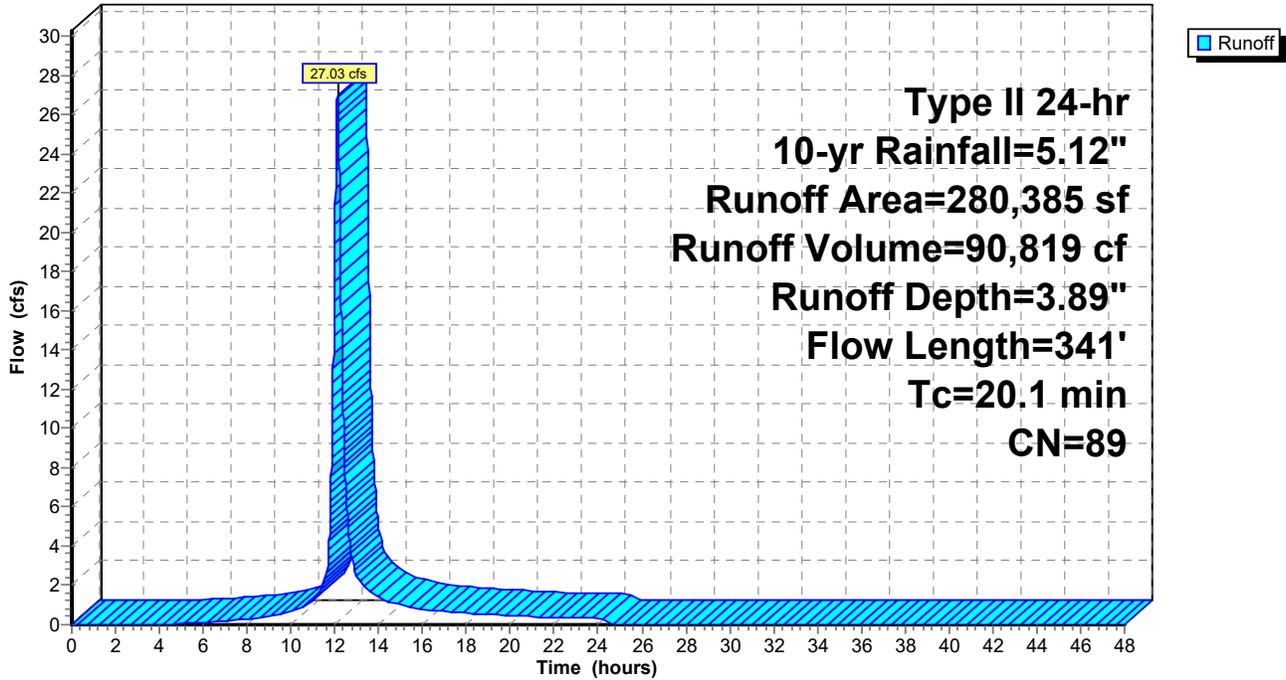
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
132,915	98	Paved parking, HSG D
122,348	79	Woods, Fair, HSG D
20,947	96	Gravel surface, HSG D
4,175	84	50-75% Grass cover, Fair, HSG D
280,385	89	Weighted Average
147,470		52.60% Pervious Area
132,915		47.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	88	0.0400	0.10		Sheet Flow, Woods Woods: Light underbrush n= 0.400 P2= 3.36"
2.7	92	0.0125	0.56		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
0.6	86	0.0140	2.40		Shallow Concentrated Flow, Paved Paved Kv= 20.3 fps
2.5	75	0.0100	0.50		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
20.1	341	Total			

Subcatchment EDA-2A: Western Runoff

Hydrograph



Summary for Subcatchment EDA-2B: Building 2 Roof

Runoff = 6.89 cfs @ 11.97 hrs, Volume= 16,766 cf, Depth= 4.88"

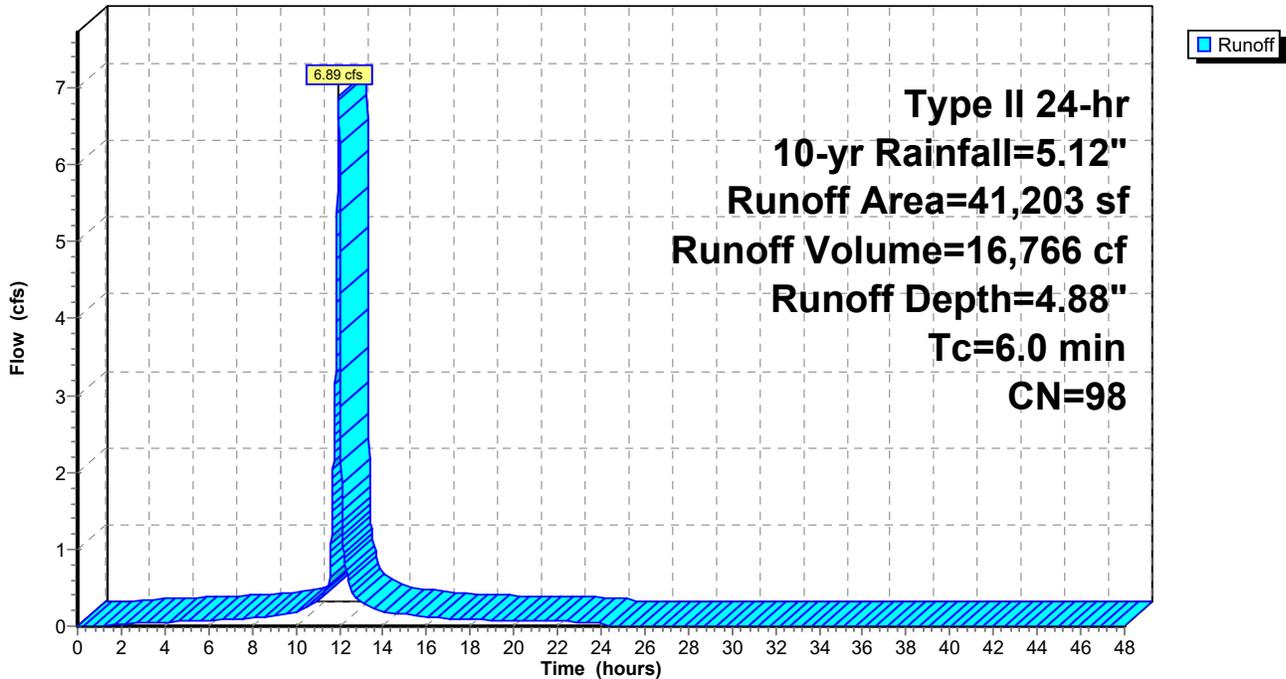
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
41,203	98	Unconnected roofs, HSG D
41,203		100.00% Impervious Area
41,203		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment EDA-2B: Building 2 Roof

Hydrograph



Summary for Reach EDA-1: Southeastern Wetlands

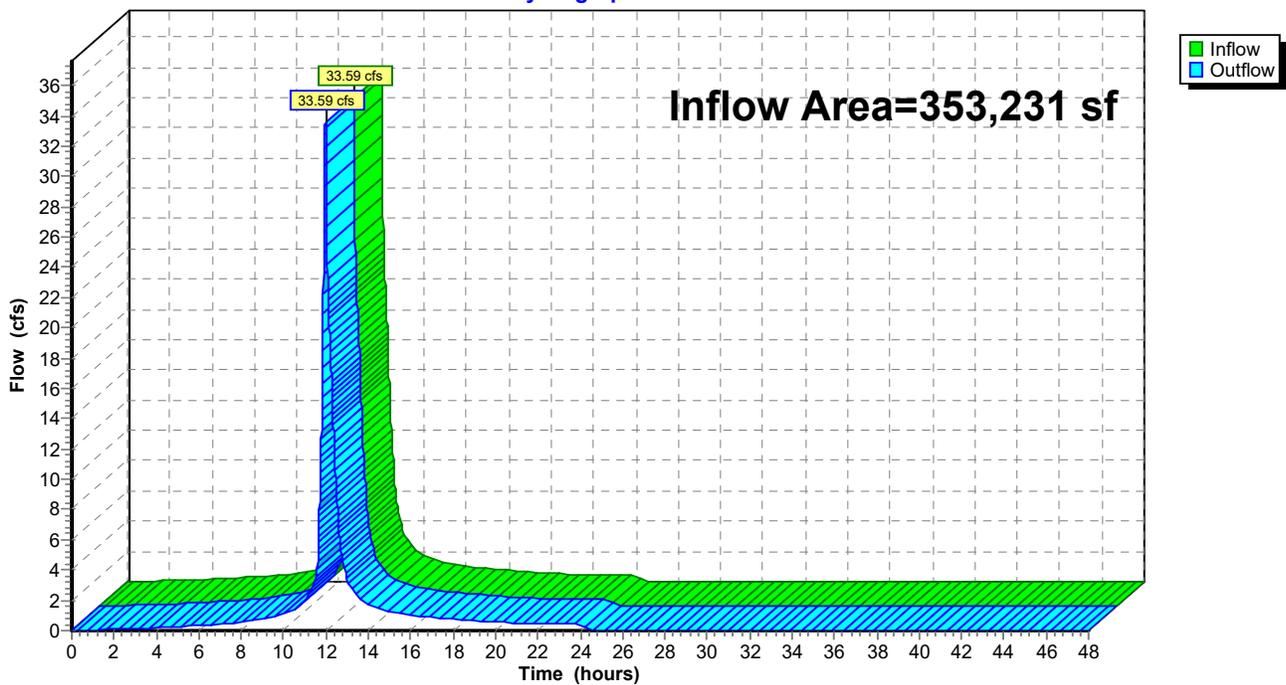
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 353,231 sf, 62.55% Impervious, Inflow Depth = 4.24" for 10-yr event
Inflow = 33.59 cfs @ 11.98 hrs, Volume= 124,796 cf
Outflow = 33.59 cfs @ 11.98 hrs, Volume= 124,796 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach EDA-1: Southeastern Wetlands

Hydrograph



Summary for Reach EDA-2: Southwestern Wetlands

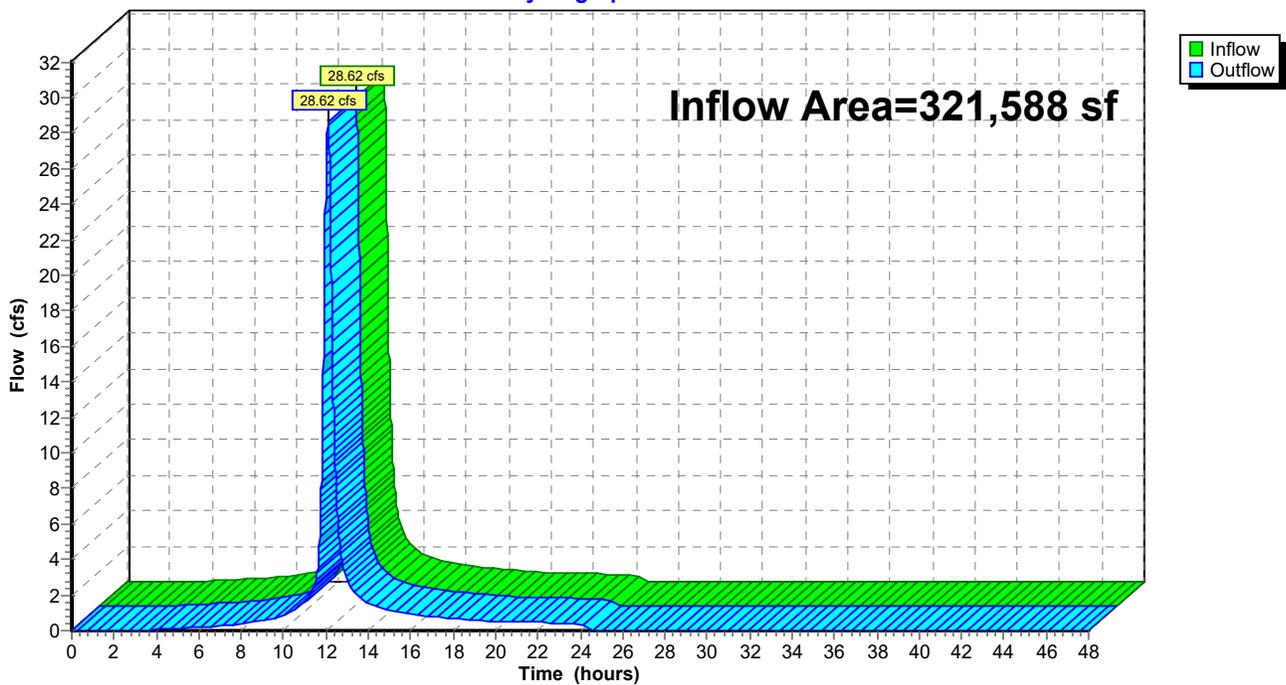
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 321,588 sf, 54.14% Impervious, Inflow Depth = 4.01" for 10-yr event
Inflow = 28.62 cfs @ 12.10 hrs, Volume= 107,586 cf
Outflow = 28.62 cfs @ 12.10 hrs, Volume= 107,586 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach EDA-2: Southwestern Wetlands

Hydrograph



1901517-HYDRO

Type II 24-hr 100-yr Rainfall=7.92"

Prepared by {enter your company name here}

Printed 3/8/2020

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Summary for Subcatchment EDA-1A: Southeastern Runoff

Runoff = 16.11 cfs @ 12.11 hrs, Volume= 54,663 cf, Depth= 6.49"

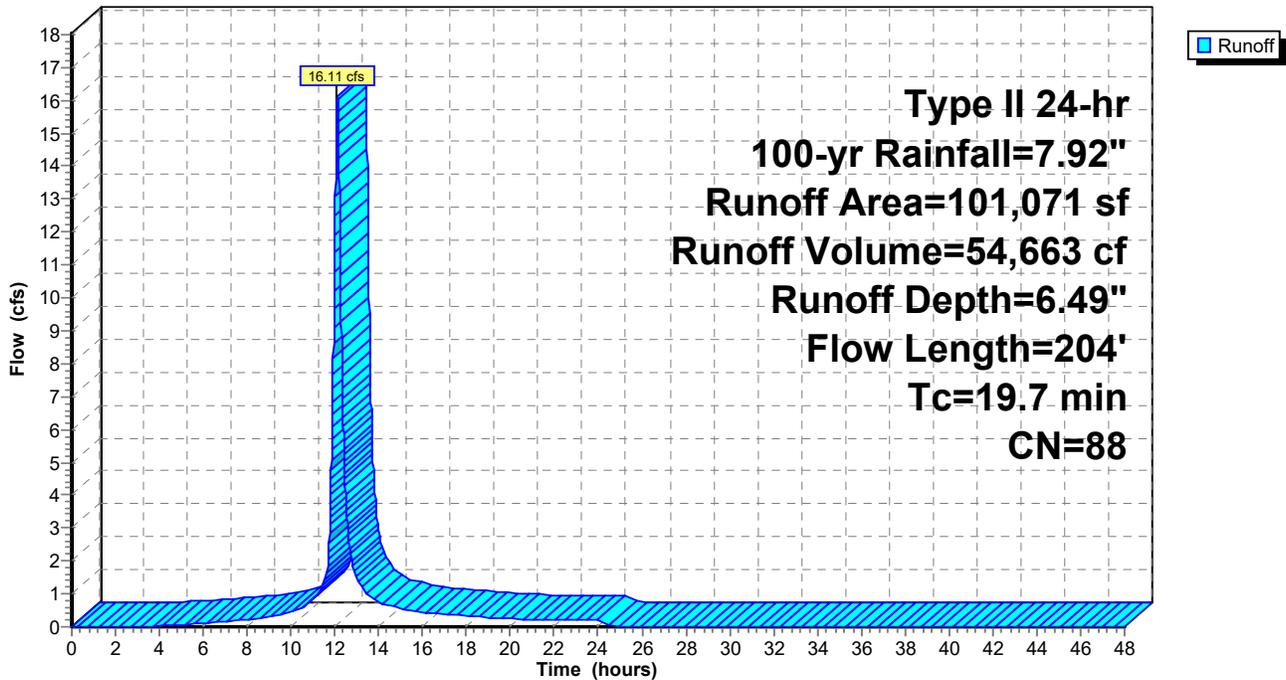
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
36,485	98	Paved parking, HSG D
64,586	82	Woods/grass comb., Fair, HSG D
101,071	88	Weighted Average
64,586		63.90% Pervious Area
36,485		36.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.8	100	0.0350	0.10		Sheet Flow, Grass/Woods
2.9	104	0.0140	0.59		Woods: Light underbrush n= 0.400 P2= 3.36" Shallow Concentrated Flow, Woods
19.7	204	Total			Woodland Kv= 5.0 fps

Subcatchment EDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1B: Northeastern Runoff

Runoff = 12.64 cfs @ 12.26 hrs, Volume= 57,082 cf, Depth= 6.49"

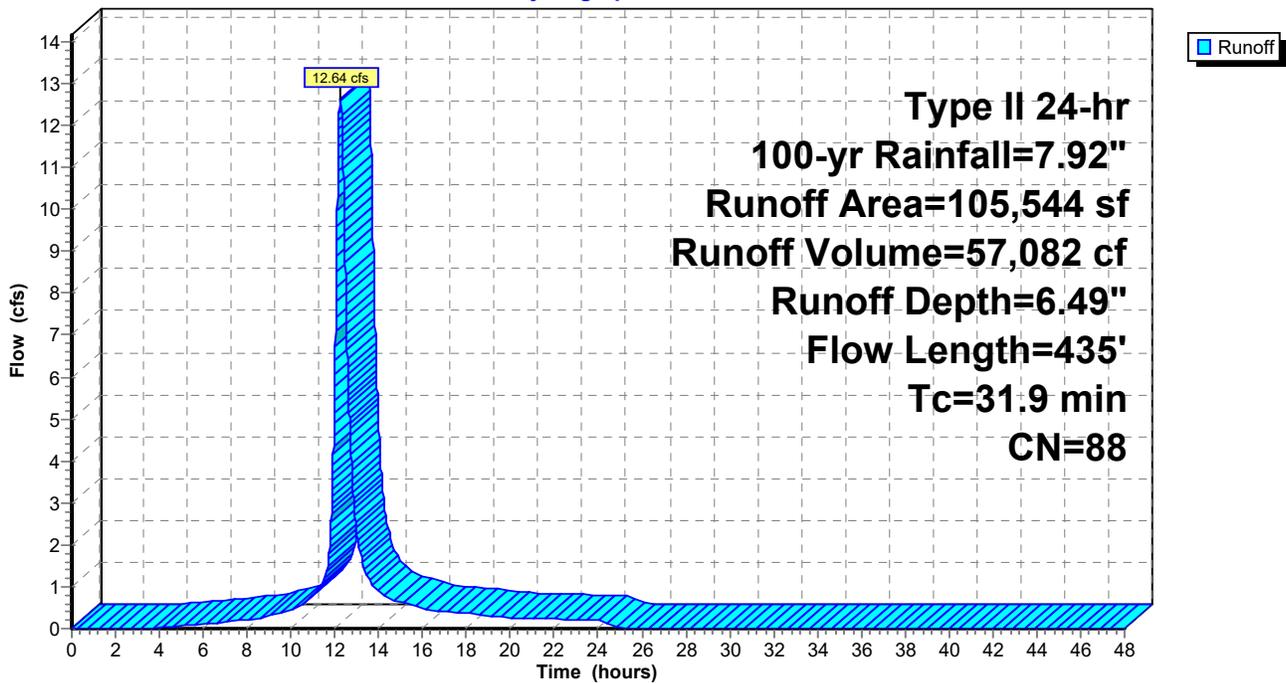
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
37,851	98	Paved parking, HSG D
63,191	82	Woods/grass comb., Fair, HSG D
4,502	84	50-75% Grass cover, Fair, HSG D
105,544	88	Weighted Average
67,693		64.14% Pervious Area
37,851		35.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.1	138	0.0220	0.09		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
2.8	17	0.0880	0.10		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
3.0	280	0.0060	1.57		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
31.9	435	Total			

Subcatchment EDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1C: Building 1 Roof

Runoff = 37.24 cfs @ 11.97 hrs, Volume= 91,823 cf, Depth= 7.68"

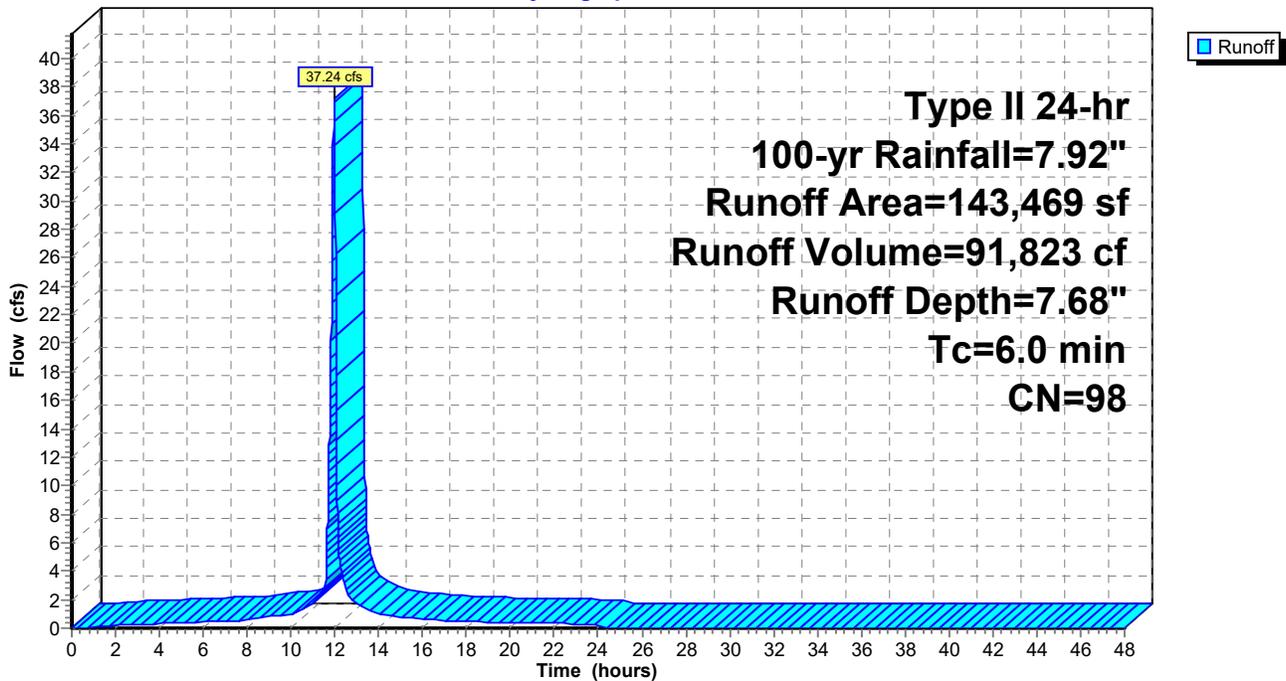
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
143,469	98	Unconnected roofs, HSG D
143,469		100.00% Impervious Area
143,469		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment EDA-1C: Building 1 Roof

Hydrograph



Summary for Subcatchment EDA-1D: Building 3 Roof

Runoff = 0.82 cfs @ 11.97 hrs, Volume= 2,014 cf, Depth= 7.68"

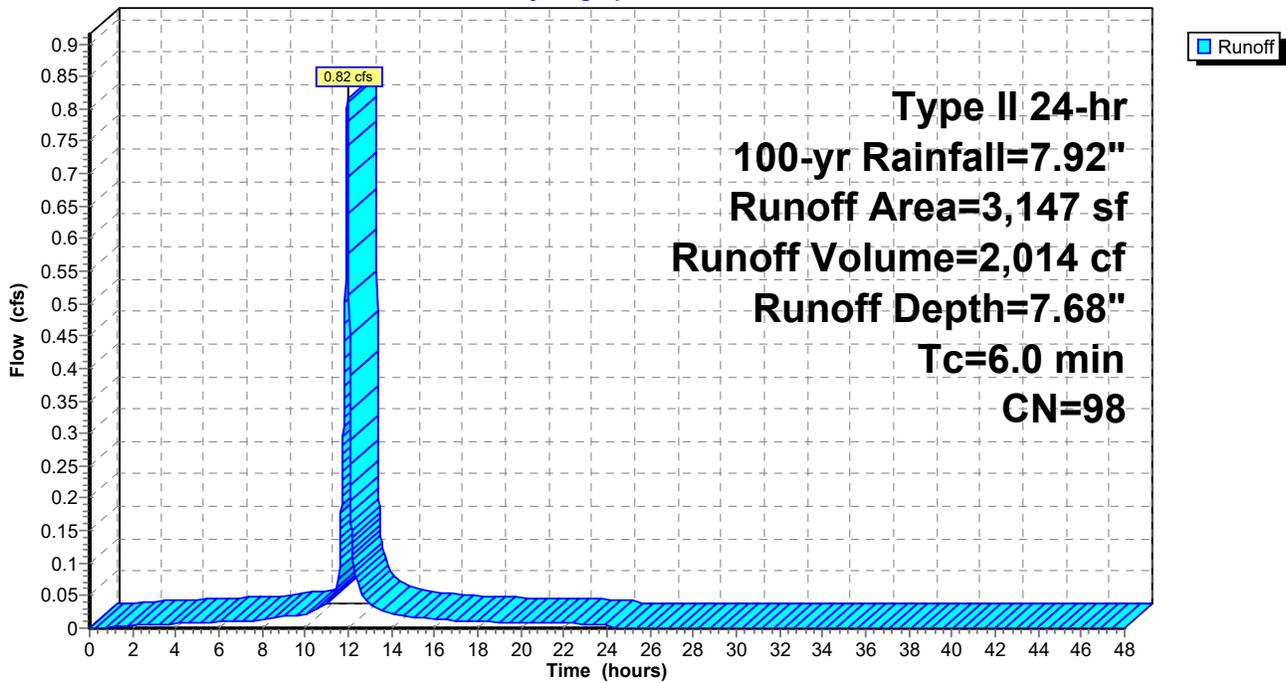
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
3,147	98	Unconnected roofs, HSG D
3,147		100.00% Impervious Area
3,147		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment EDA-1D: Building 3 Roof

Hydrograph



Summary for Subcatchment EDA-2A: Western Runoff

Runoff = 44.73 cfs @ 12.12 hrs, Volume= 154,406 cf, Depth= 6.61"

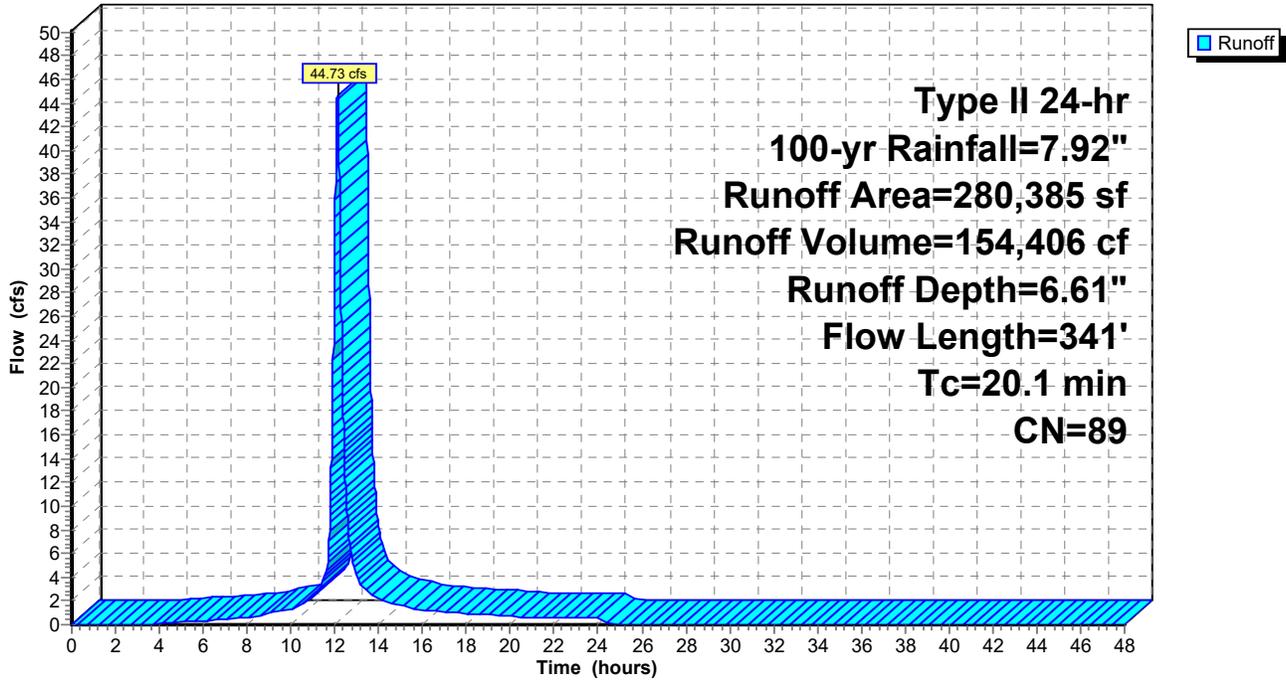
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
132,915	98	Paved parking, HSG D
122,348	79	Woods, Fair, HSG D
20,947	96	Gravel surface, HSG D
4,175	84	50-75% Grass cover, Fair, HSG D
280,385	89	Weighted Average
147,470		52.60% Pervious Area
132,915		47.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	88	0.0400	0.10		Sheet Flow, Woods Woods: Light underbrush n= 0.400 P2= 3.36"
2.7	92	0.0125	0.56		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
0.6	86	0.0140	2.40		Shallow Concentrated Flow, Paved Paved Kv= 20.3 fps
2.5	75	0.0100	0.50		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
20.1	341	Total			

Subcatchment EDA-2A: Western Runoff

Hydrograph



Summary for Subcatchment EDA-2B: Building 2 Roof

Runoff = 10.70 cfs @ 11.97 hrs, Volume= 26,371 cf, Depth= 7.68"

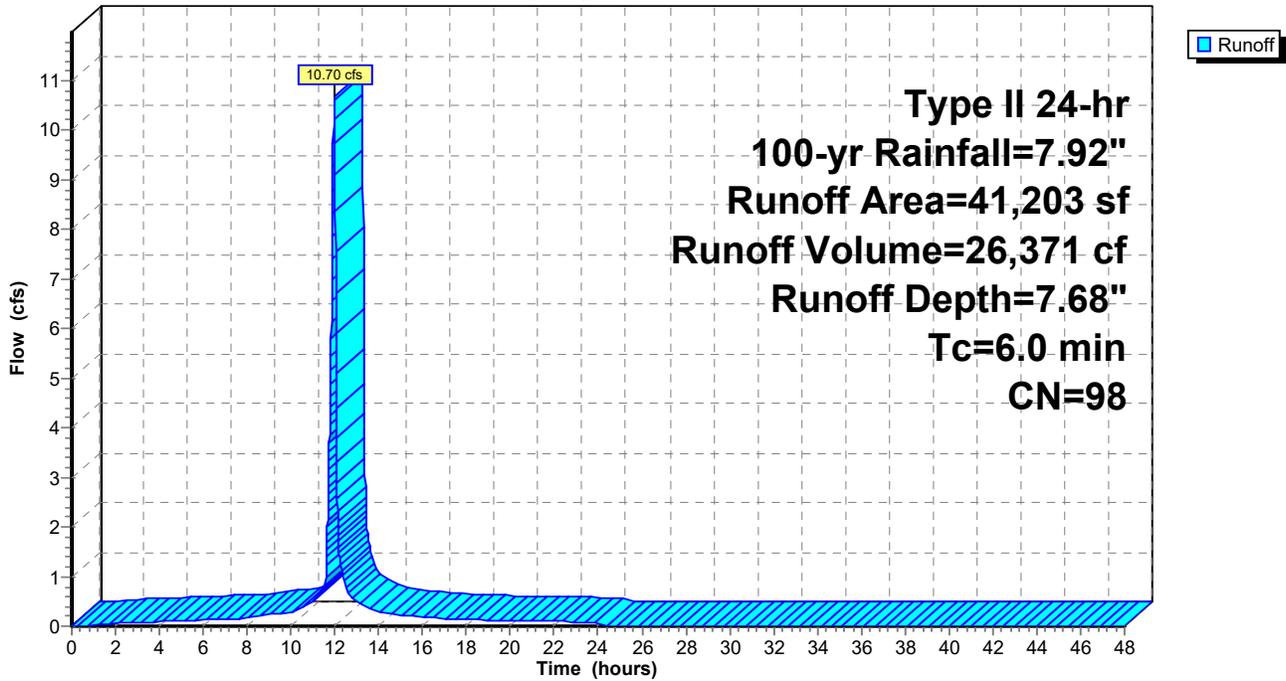
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
41,203	98	Unconnected roofs, HSG D
41,203		100.00% Impervious Area
41,203		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment EDA-2B: Building 2 Roof

Hydrograph



Summary for Reach EDA-1: Southeastern Wetlands

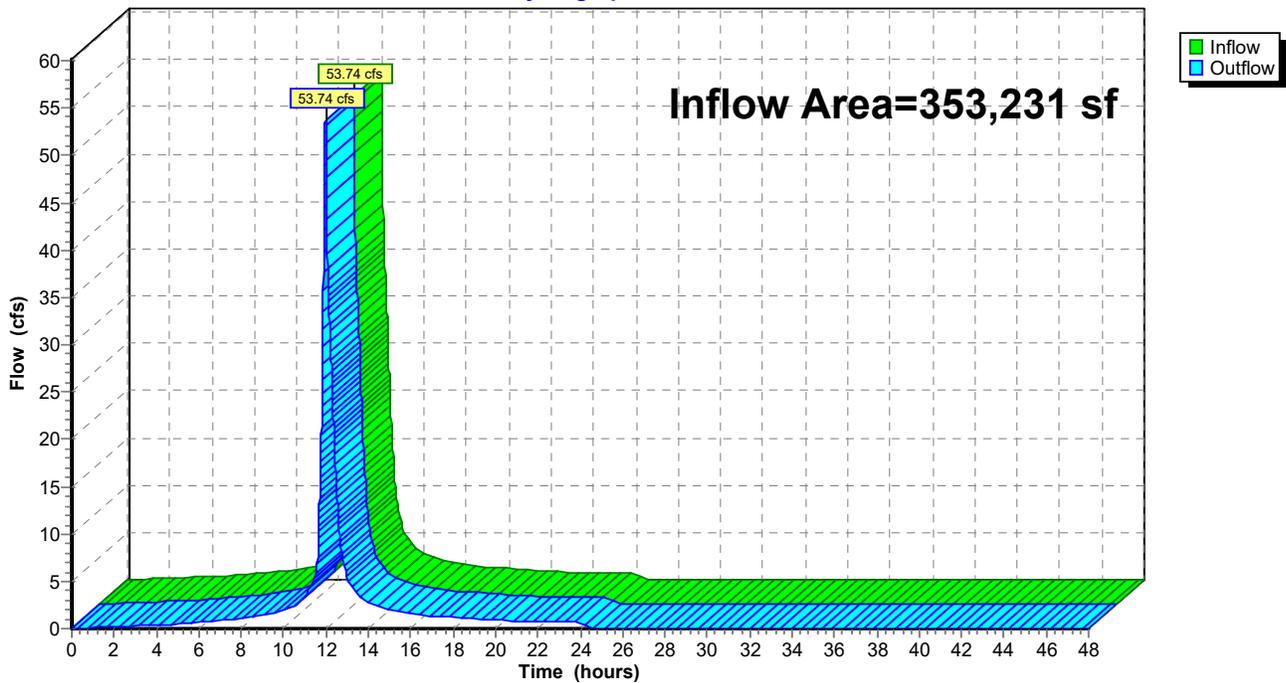
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 353,231 sf, 62.55% Impervious, Inflow Depth = 6.98" for 100-yr event
Inflow = 53.74 cfs @ 11.98 hrs, Volume= 205,582 cf
Outflow = 53.74 cfs @ 11.98 hrs, Volume= 205,582 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach EDA-1: Southeastern Wetlands

Hydrograph



Summary for Reach EDA-2: Southwestern Wetlands

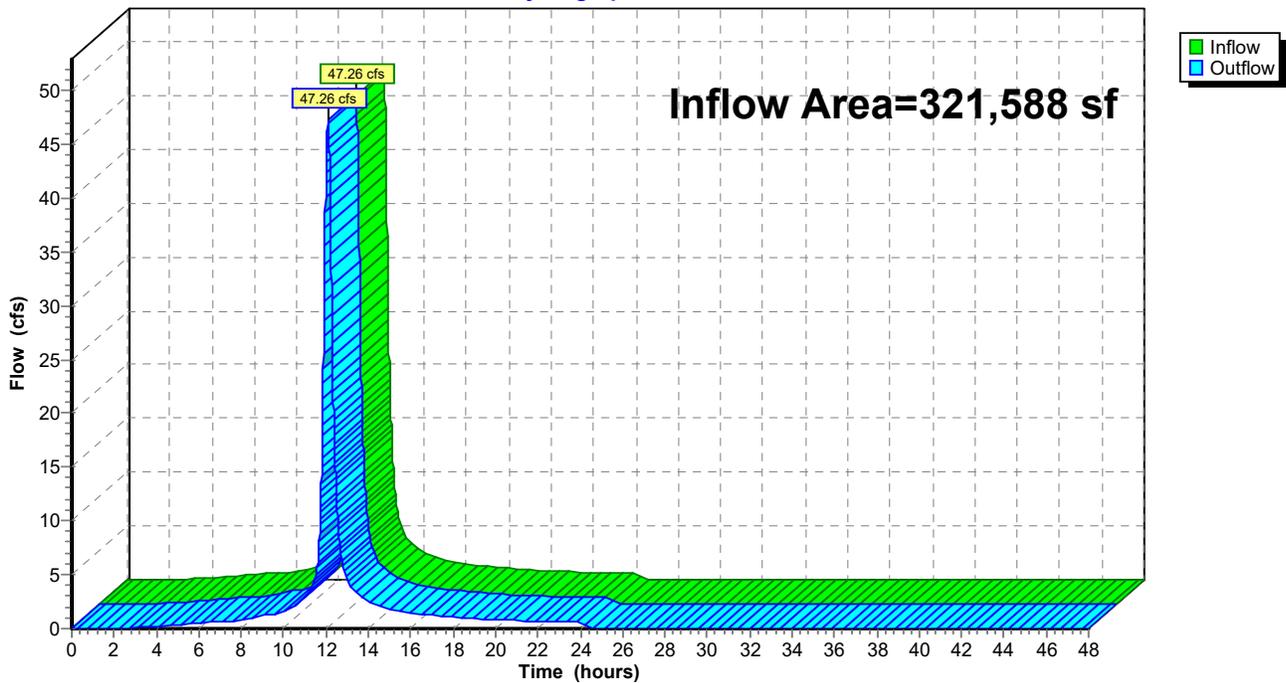
[40] Hint: Not Described (Outflow=Inflow)

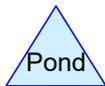
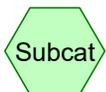
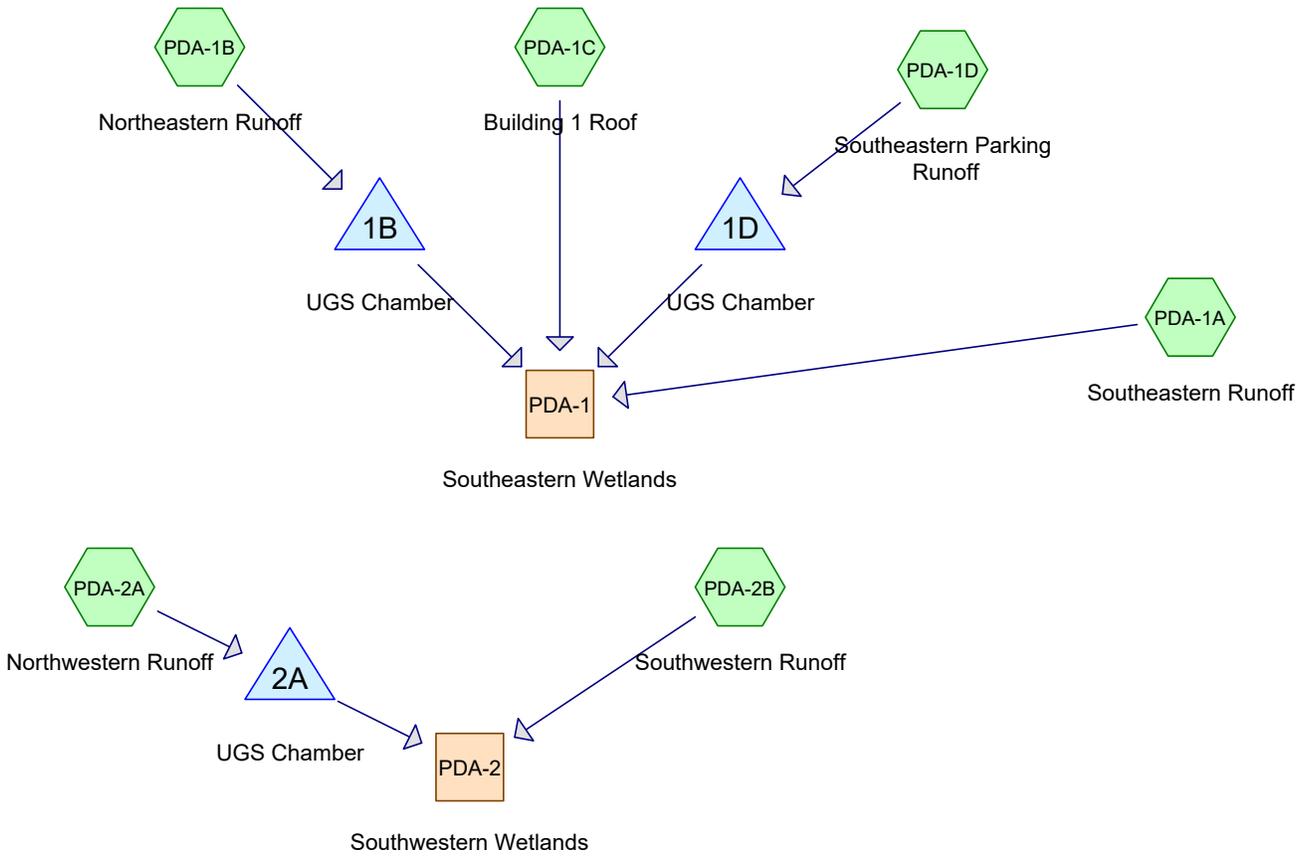
Inflow Area = 321,588 sf, 54.14% Impervious, Inflow Depth = 6.75" for 100-yr event
Inflow = 47.26 cfs @ 12.10 hrs, Volume= 180,777 cf
Outflow = 47.26 cfs @ 12.10 hrs, Volume= 180,777 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach EDA-2: Southwestern Wetlands

Hydrograph





Routing Diagram for 1901517-HYDRO
 Prepared by {enter your company name here}, Printed 3/9/2020
 HydroCAD® 10.00-22 s/n 01334 © 2018 HydroCAD Software Solutions LLC

Summary for Subcatchment PDA-1A: Southeastern Runoff

Runoff = 3.97 cfs @ 12.04 hrs, Volume= 9,970 cf, Depth= 1.67"

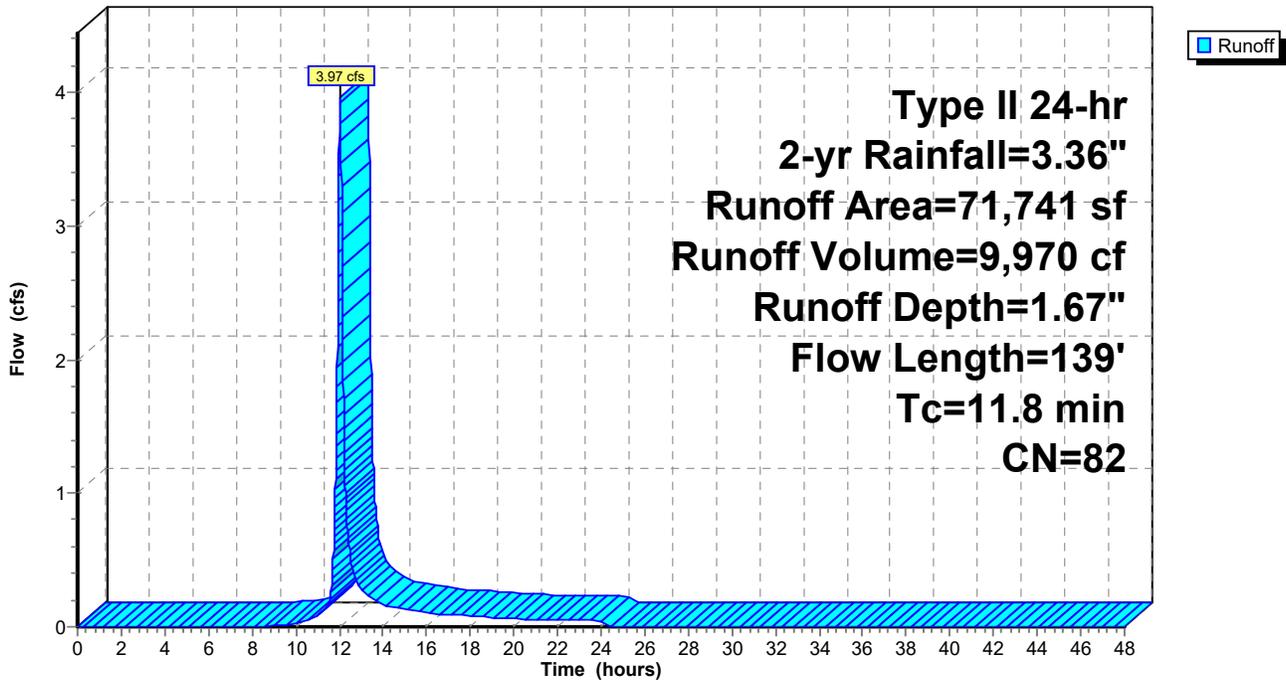
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
71,239	82	Woods/grass comb., Fair, HSG D
502	98	Paved parking, HSG D
71,741	82	Weighted Average
71,239		99.30% Pervious Area
502		0.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	103	0.0340	0.15		Sheet Flow, Grass
					Grass: Dense n= 0.240 P2= 3.36"
0.3	36	0.1100	2.32		Shallow Concentrated Flow, Grass
					Short Grass Pasture Kv= 7.0 fps
11.8	139	Total			

Subcatchment PDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1B: Northeastern Runoff

Runoff = 5.01 cfs @ 12.17 hrs, Volume= 19,010 cf, Depth= 2.41"

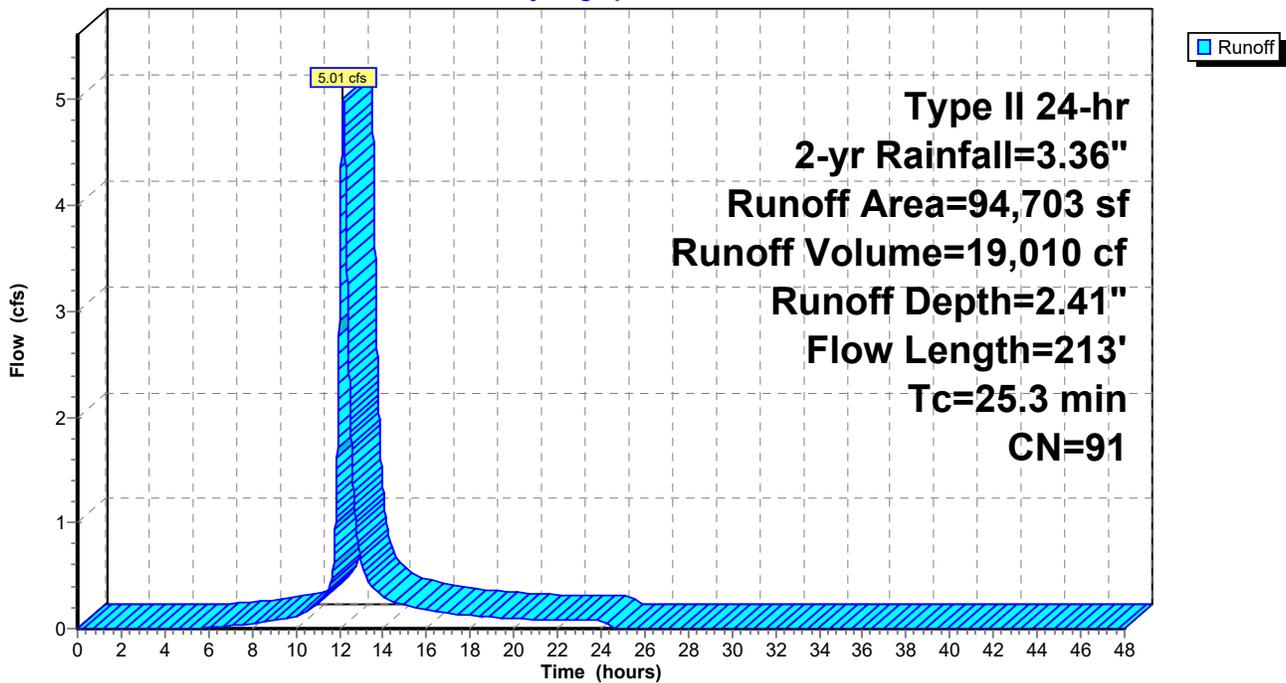
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
52,482	98	Paved parking, HSG D
12,144	84	50-75% Grass cover, Fair, HSG D
30,077	82	Woods/grass comb., Fair, HSG D
94,703	91	Weighted Average
42,221		44.58% Pervious Area
52,482		55.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.3	102	0.0143	0.07		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
0.5	35	0.0249	1.10		Shallow Concentrated Flow, Grass/Woods Short Grass Pasture Kv= 7.0 fps
0.5	76	0.0188	2.78		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
25.3	213	Total			

Subcatchment PDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1C: Building 1 Roof

Runoff = 15.66 cfs @ 11.97 hrs, Volume= 37,385 cf, Depth= 3.13"

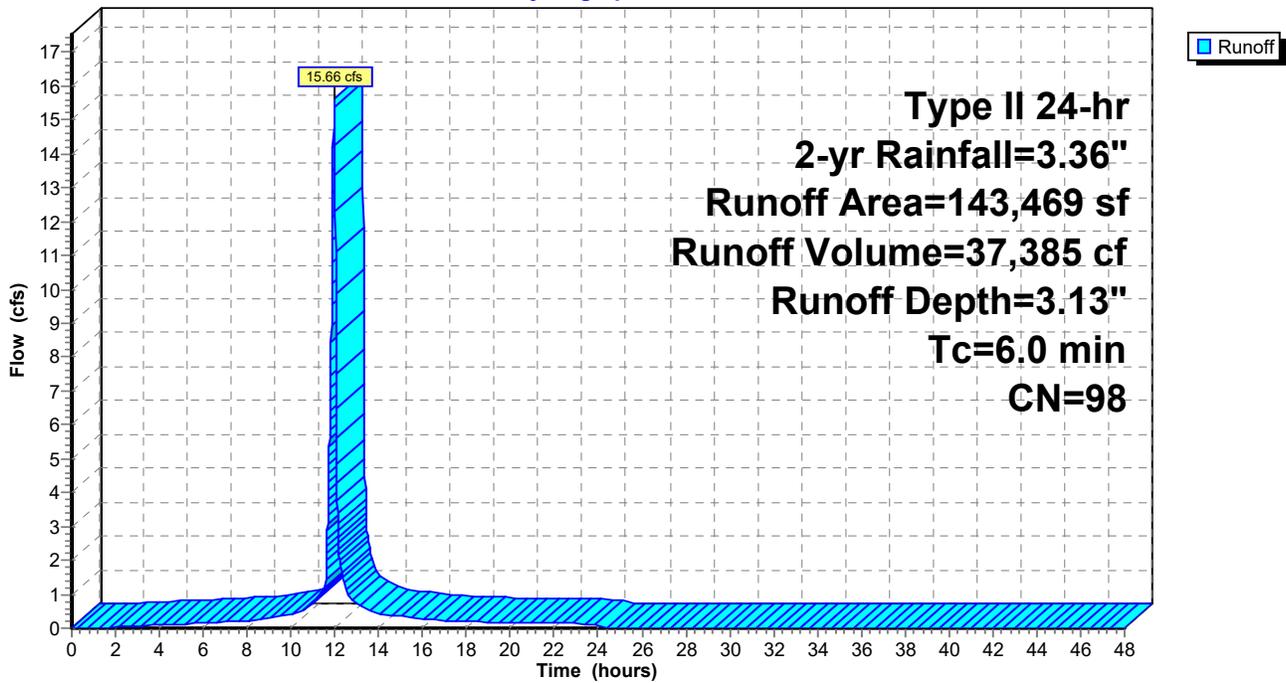
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
143,469	98	Unconnected roofs, HSG D
143,469		100.00% Impervious Area
143,469		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment PDA-1C: Building 1 Roof

Hydrograph



Summary for Subcatchment PDA-1D: Southeastern Parking Runoff

Runoff = 6.14 cfs @ 11.97 hrs, Volume= 14,313 cf, Depth= 3.02"

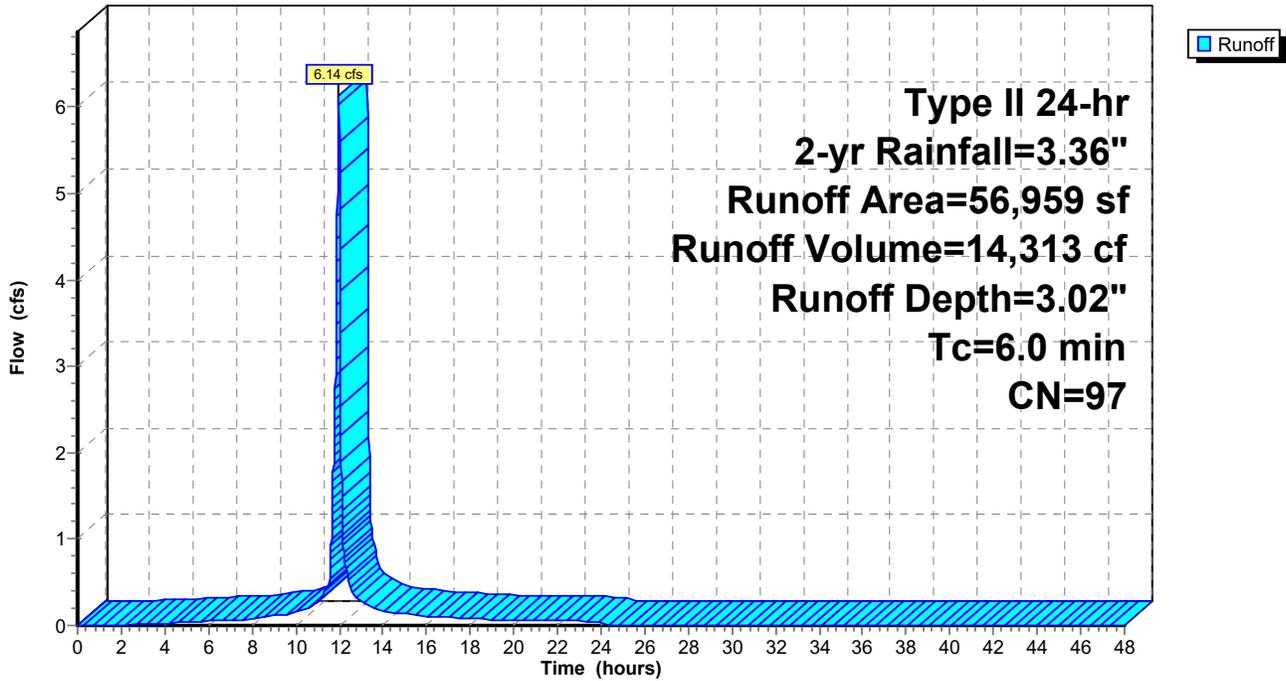
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
3,700	84	50-75% Grass cover, Fair, HSG D
53,259	98	Paved parking, HSG D
56,959	97	Weighted Average
3,700		6.50% Pervious Area
53,259		93.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment PDA-1D: Southeastern Parking Runoff

Hydrograph



Summary for Subcatchment PDA-2A: Northwestern Runoff

Runoff = 16.67 cfs @ 11.97 hrs, Volume= 38,076 cf, Depth= 2.91"

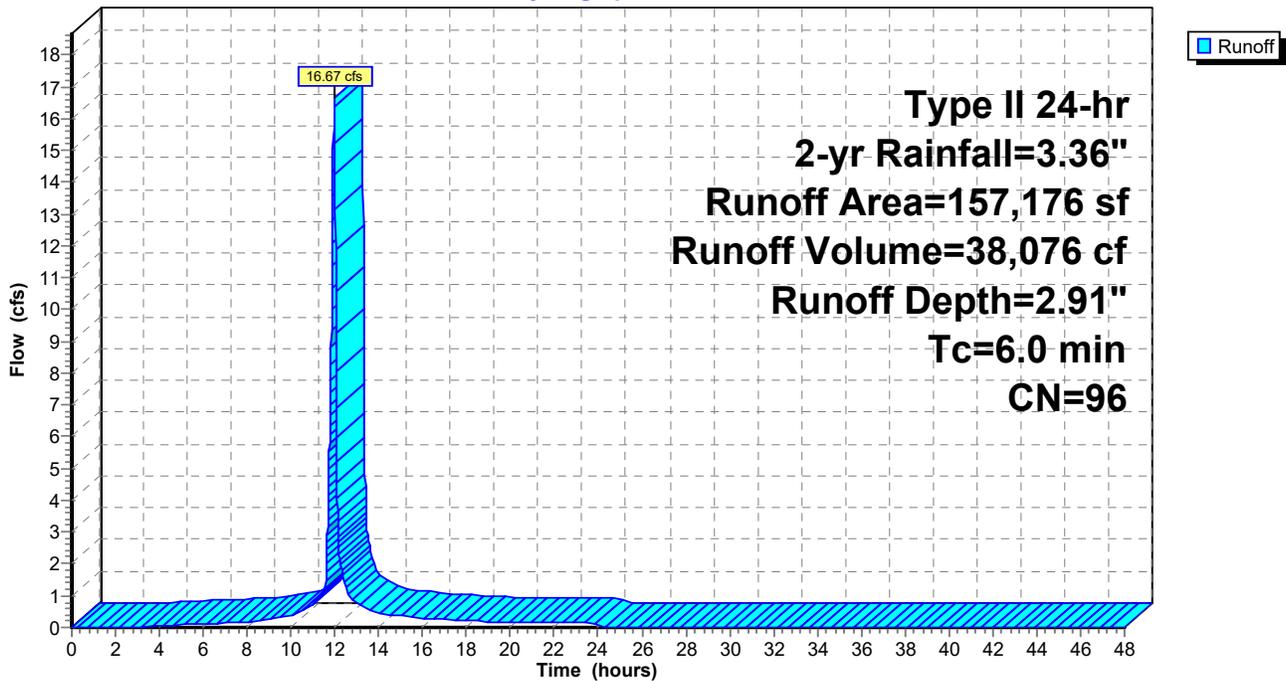
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
137,288	98	Paved parking, HSG D
19,888	80	>75% Grass cover, Good, HSG D
157,176	96	Weighted Average
19,888		12.65% Pervious Area
137,288		87.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment PDA-2A: Northwestern Runoff

Hydrograph



Summary for Subcatchment PDA-2B: Southwestern Runoff

Runoff = 13.09 cfs @ 12.00 hrs, Volume= 30,265 cf, Depth= 2.41"

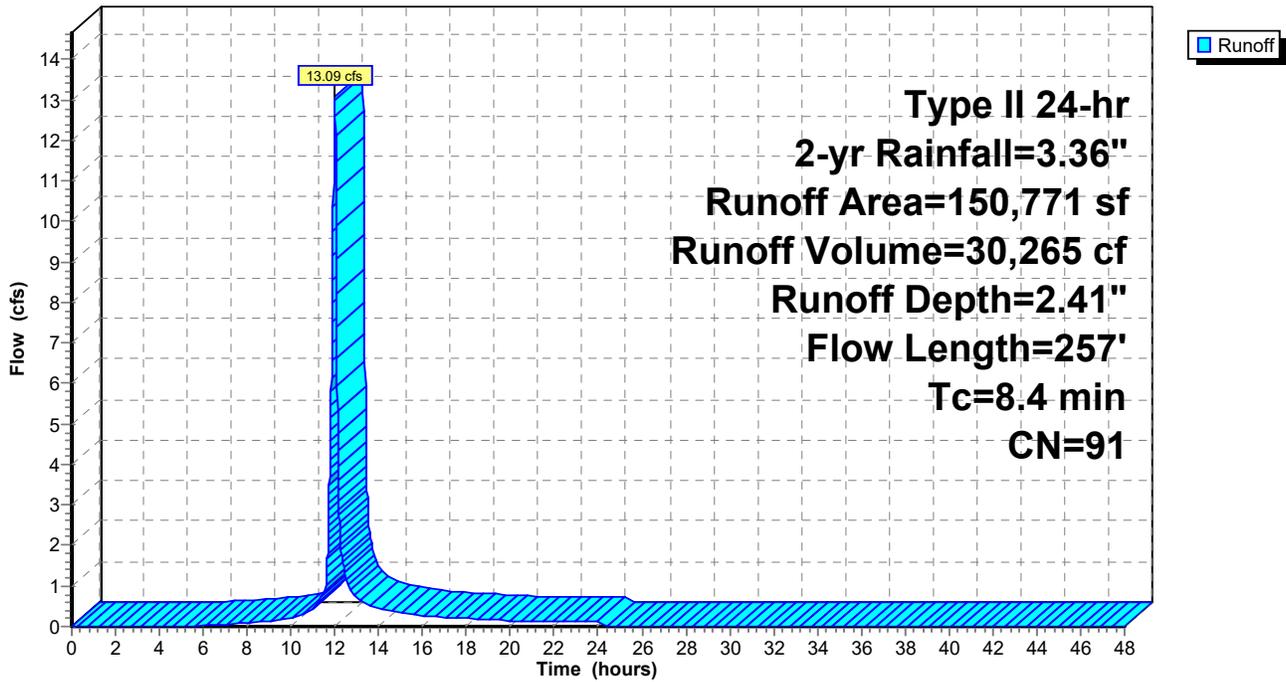
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
88,315	98	Paved parking, HSG D
62,456	80	>75% Grass cover, Good, HSG D
150,771	91	Weighted Average
62,456		41.42% Pervious Area
88,315		58.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	102	0.0392	0.23		Sheet Flow, Grass Grass: Short n= 0.150 P2= 3.36"
0.2	25	0.1400	2.62		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
0.8	130	0.0175	2.69		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
8.4	257	Total			

Subcatchment PDA-2B: Southwestern Runoff

Hydrograph



Summary for Reach PDA-1: Southeastern Wetlands

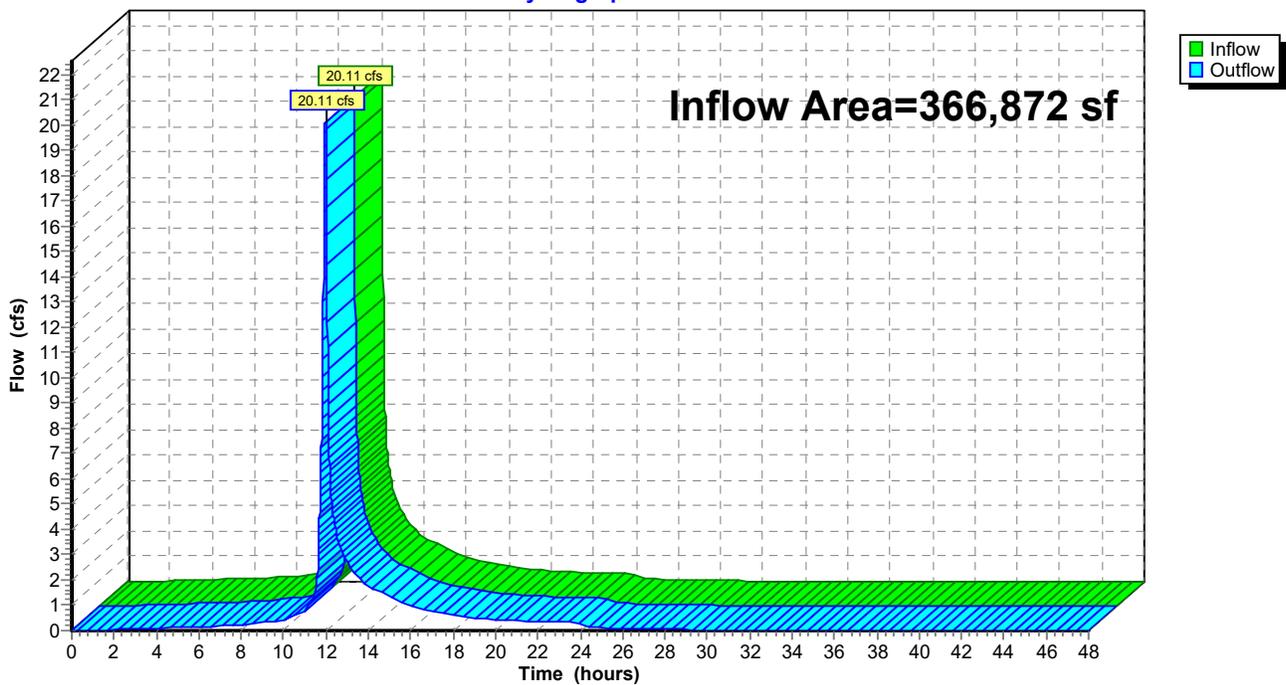
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 366,872 sf, 68.07% Impervious, Inflow Depth > 2.51" for 2-yr event
Inflow = 20.11 cfs @ 11.98 hrs, Volume= 76,599 cf
Outflow = 20.11 cfs @ 11.98 hrs, Volume= 76,599 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach PDA-1: Southeastern Wetlands

Hydrograph



Summary for Reach PDA-2: Southwestern Wetlands

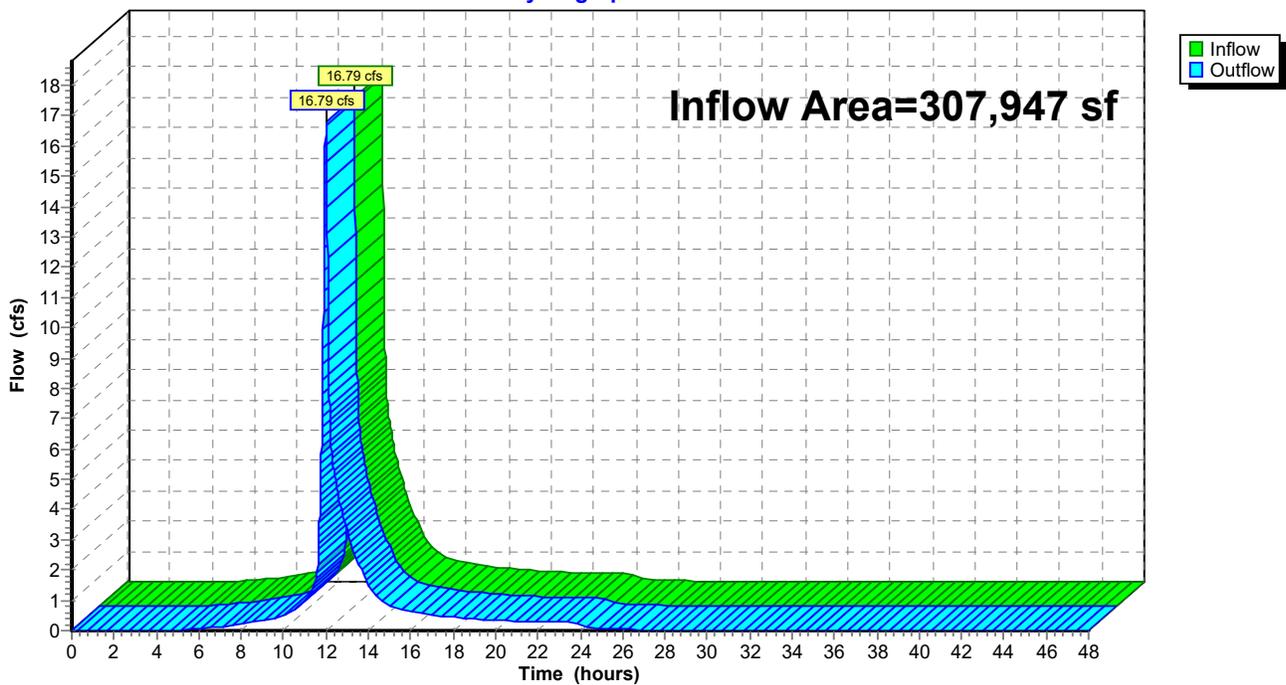
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 307,947 sf, 73.26% Impervious, Inflow Depth = 2.66" for 2-yr event
Inflow = 16.79 cfs @ 12.00 hrs, Volume= 68,301 cf
Outflow = 16.79 cfs @ 12.00 hrs, Volume= 68,301 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach PDA-2: Southwestern Wetlands

Hydrograph



Summary for Pond 1B: UGS Chamber

Inflow Area = 94,703 sf, 55.42% Impervious, Inflow Depth = 2.41" for 2-yr event
 Inflow = 5.01 cfs @ 12.17 hrs, Volume= 19,010 cf
 Outflow = 0.97 cfs @ 12.77 hrs, Volume= 17,084 cf, Atten= 81%, Lag= 35.8 min
 Primary = 0.97 cfs @ 12.77 hrs, Volume= 17,084 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 145.08' @ 12.77 hrs Surf.Area= 8,781 sf Storage= 9,817 cf

Plug-Flow detention time= 225.3 min calculated for 17,081 cf (90% of inflow)
 Center-of-Mass det. time= 174.1 min (989.5 - 815.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	143.50'	7,229 cf	64.33'W x 136.50'L x 3.54'H Field A 31,101 cf Overall - 13,028 cf Embedded = 18,073 cf x 40.0% Voids
#2A	144.00'	13,028 cf	Cultec R-330XLHD x 247 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		20,257 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	144.00'	24.0" Round Culvert L= 450.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 144.00' / 139.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.90'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	144.00'	6.4" Vert. Orifice/Grate C= 0.600
#4	Device 1	145.50'	36.0" W x 4.0" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.97 cfs @ 12.77 hrs HW=145.08' (Free Discharge)

- ↑ 1=Culvert (Passes 0.97 cfs of 4.81 cfs potential flow)
- ↑ 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- ↑ 3=Orifice/Grate (Orifice Controls 0.97 cfs @ 4.33 fps)
- ↑ 4=Orifice/Grate (Controls 0.00 cfs)

Pond 1B: UGS Chamber - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

19 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 134.50' Row Length +12.0" End Stone x 2 = 136.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

247 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 13,028.1 cf Chamber Storage

31,101.1 cf Field - 13,028.1 cf Chambers = 18,073.1 cf Stone x 40.0% Voids = 7,229.2 cf Stone Storage

Chamber Storage + Stone Storage = 20,257.3 cf = 0.465 af

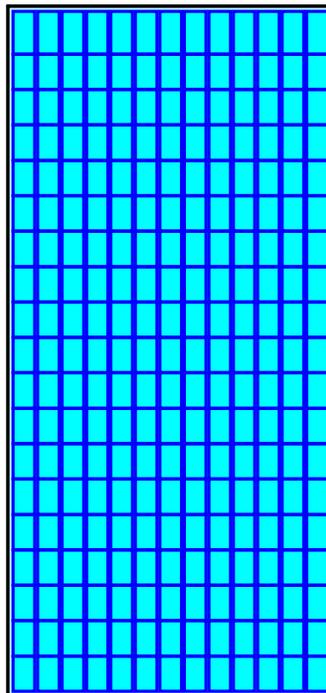
Overall Storage Efficiency = 65.1%

Overall System Size = 136.50' x 64.33' x 3.54'

247 Chambers

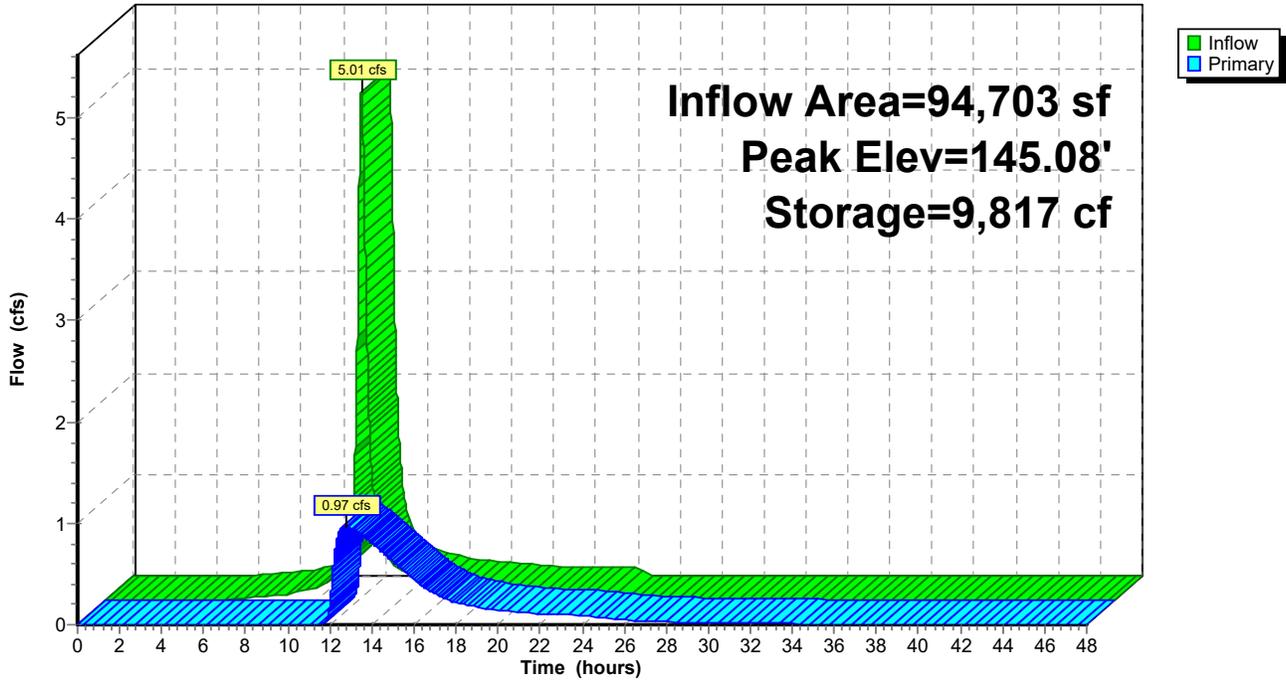
1,151.9 cy Field

669.4 cy Stone



Pond 1B: UGS Chamber

Hydrograph



Summary for Pond 1D: UGS Chamber

Inflow Area = 56,959 sf, 93.50% Impervious, Inflow Depth = 3.02" for 2-yr event
 Inflow = 6.14 cfs @ 11.97 hrs, Volume= 14,313 cf
 Outflow = 1.65 cfs @ 12.10 hrs, Volume= 12,160 cf, Atten= 73%, Lag= 8.1 min
 Primary = 1.65 cfs @ 12.10 hrs, Volume= 12,160 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 142.65' @ 12.10 hrs Surf.Area= 10,132 sf Storage= 7,704 cf

Plug-Flow detention time= 244.5 min calculated for 12,157 cf (85% of inflow)
 Center-of-Mass det. time= 176.6 min (937.7 - 761.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	141.50'	8,329 cf	64.33'W x 157.50'L x 3.54'H Field A 35,886 cf Overall - 15,062 cf Embedded = 20,824 cf x 40.0% Voids
#2A	142.00'	15,062 cf	Cultec R-330XLHD x 286 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		23,392 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	142.00'	24.0" Round Culvert L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 142.00' / 141.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	144.60'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	142.00'	14.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	143.40'	10.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=1.65 cfs @ 12.10 hrs HW=142.65' (Free Discharge)

- ↑ **1=Culvert** (Barrel Controls 1.65 cfs @ 2.79 fps)
- ↑ **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **3=Orifice/Grate** (Passes 1.65 cfs of 1.67 cfs potential flow)
- ↑ **4=Orifice/Grate** (Controls 0.00 cfs)

Pond 1D: UGS Chamber - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

22 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 155.50' Row Length +12.0" End Stone x 2 = 157.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

286 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 15,062.2 cf Chamber Storage

35,885.9 cf Field - 15,062.2 cf Chambers = 20,823.7 cf Stone x 40.0% Voids = 8,329.5 cf Stone Storage

Chamber Storage + Stone Storage = 23,391.7 cf = 0.537 af

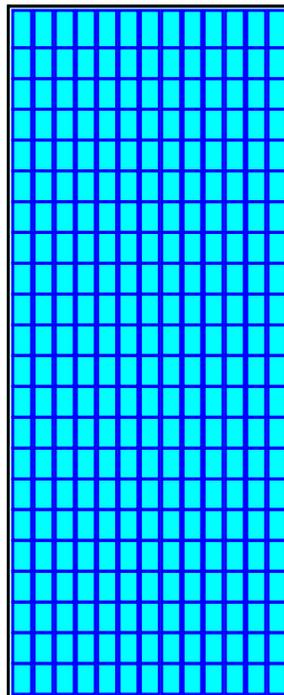
Overall Storage Efficiency = 65.2%

Overall System Size = 157.50' x 64.33' x 3.54'

286 Chambers

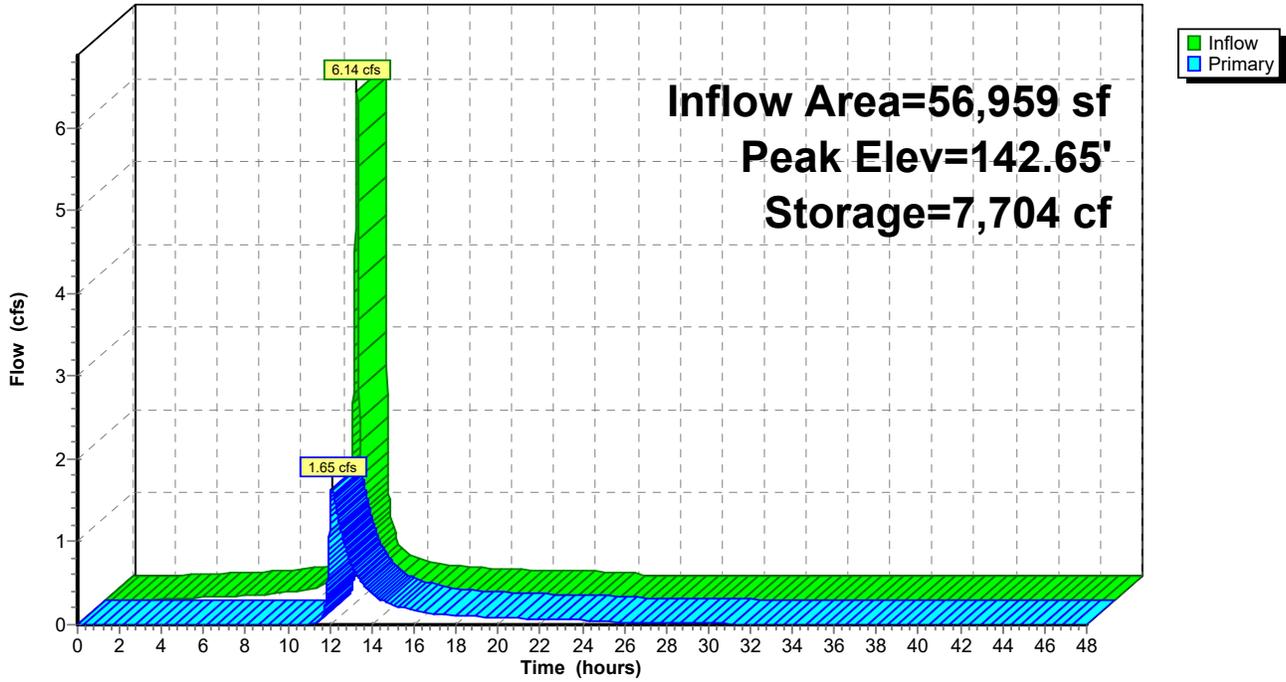
1,329.1 cy Field

771.2 cy Stone



Pond 1D: UGS Chamber

Hydrograph



Summary for Pond 2A: UGS Chamber

Inflow Area = 157,176 sf, 87.35% Impervious, Inflow Depth = 2.91" for 2-yr event
 Inflow = 16.67 cfs @ 11.97 hrs, Volume= 38,076 cf
 Outflow = 4.11 cfs @ 12.11 hrs, Volume= 38,036 cf, Atten= 75%, Lag= 8.5 min
 Primary = 4.11 cfs @ 12.11 hrs, Volume= 38,036 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 143.32' @ 12.11 hrs Surf.Area= 14,934 sf Storage= 14,022 cf

Plug-Flow detention time= 71.0 min calculated for 38,028 cf (100% of inflow)
 Center-of-Mass det. time= 70.6 min (839.7 - 769.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	141.92'	12,712 cf	83.67"W x 178.50"L x 3.62'H Field A 54,138 cf Overall - 22,357 cf Embedded = 31,781 cf x 40.0% Voids
#2A	142.50'	22,357 cf	Cultec R-330XLHD x 425 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 17 rows
		35,069 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	141.92'	24.0" Round Culvert L= 12.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 141.92' / 141.00' S= 0.0767 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#2	Device 1	145.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	141.92'	13.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	144.00'	18.0" W x 6.0" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=4.11 cfs @ 12.11 hrs HW=143.32' (Free Discharge)

- ↑ 1=Culvert (Passes 4.11 cfs of 7.48 cfs potential flow)
- ↑ 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- ↑ 3=Orifice/Grate (Orifice Controls 4.11 cfs @ 4.46 fps)
- ↑ 4=Orifice/Grate (Controls 0.00 cfs)

1901517-HYDRO

Type II 24-hr 2-yr Rainfall=3.36"

Prepared by {enter your company name here}

Printed 3/9/2020

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Pond 2A: UGS Chamber - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 17 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

25 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 176.50' Row Length +12.0" End Stone x 2 = 178.50' Base Length

17 Rows x 52.0" Wide + 6.0" Spacing x 16 + 12.0" Side Stone x 2 = 83.67' Base Width

7.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.62' Field Height

425 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 17 Rows = 22,356.7 cf Chamber Storage

54,137.6 cf Field - 22,356.7 cf Chambers = 31,780.8 cf Stone x 40.0% Voids = 12,712.3 cf Stone Storage

Chamber Storage + Stone Storage = 35,069.1 cf = 0.805 af

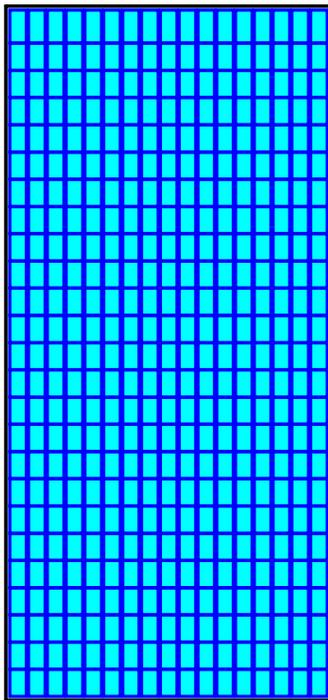
Overall Storage Efficiency = 64.8%

Overall System Size = 178.50' x 83.67' x 3.62'

425 Chambers

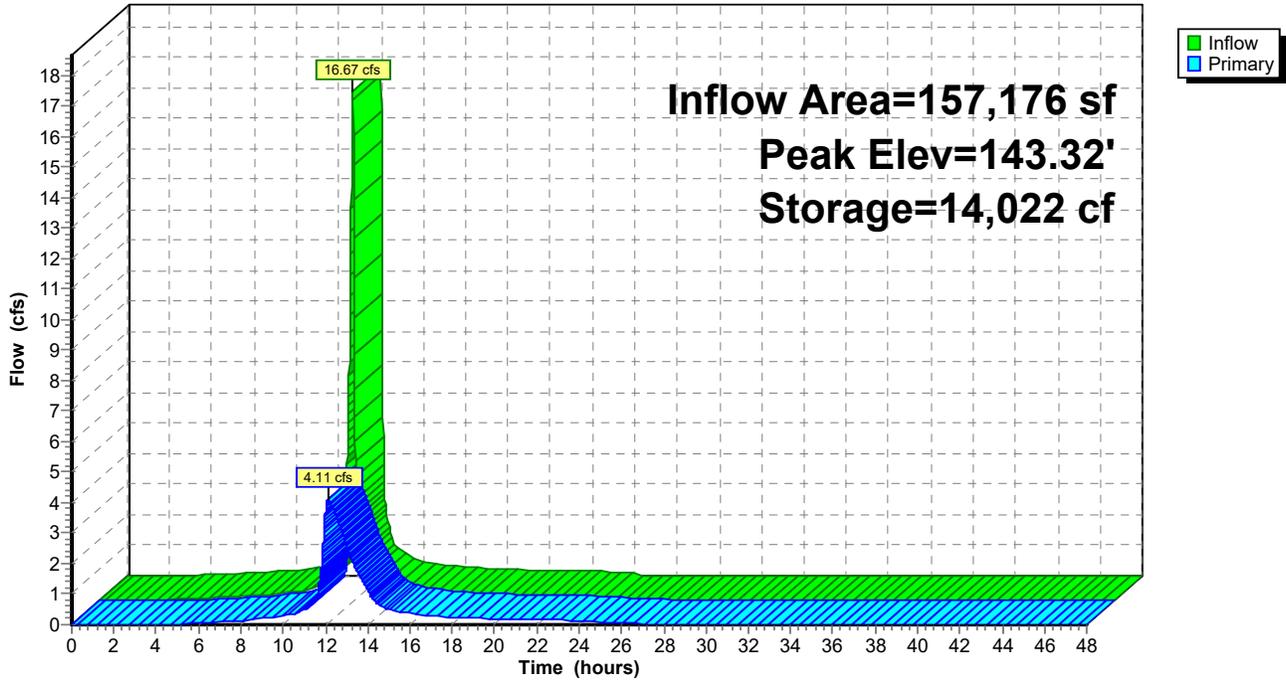
2,005.1 cy Field

1,177.1 cy Stone



Pond 2A: UGS Chamber

Hydrograph



Summary for Subcatchment PDA-1A: Southeastern Runoff

Runoff = 7.51 cfs @ 12.03 hrs, Volume= 19,051 cf, Depth= 3.19"

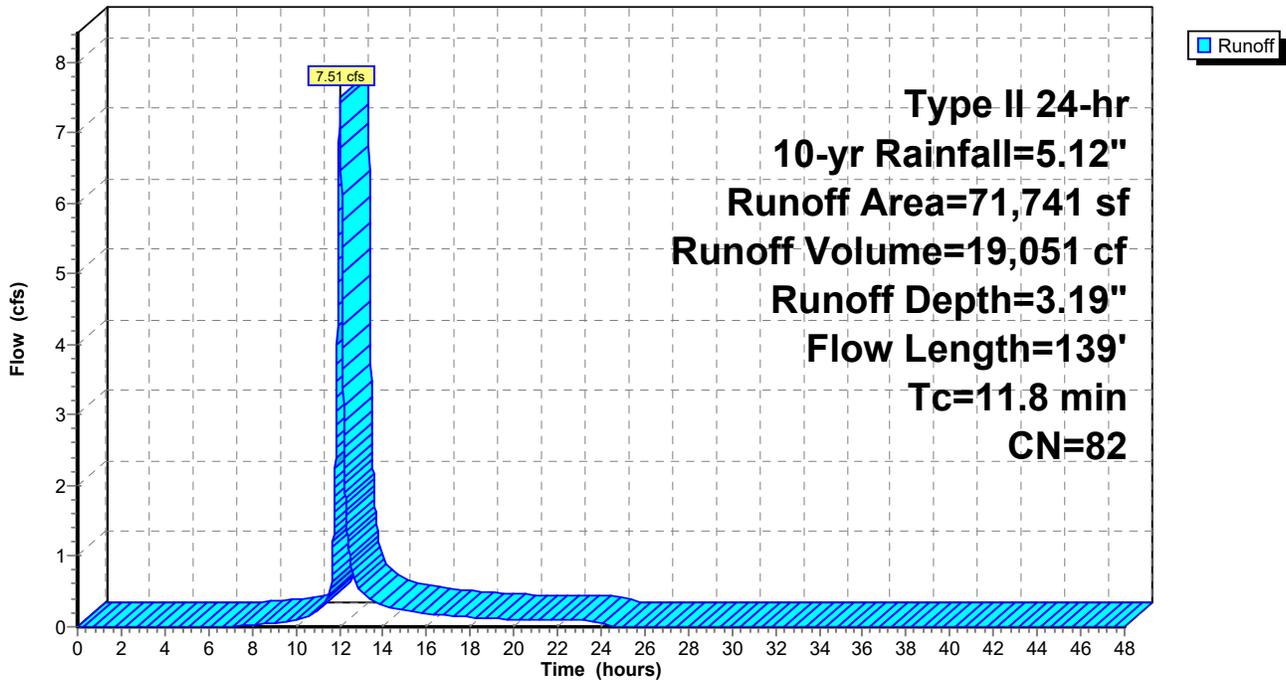
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
71,239	82	Woods/grass comb., Fair, HSG D
502	98	Paved parking, HSG D
71,741	82	Weighted Average
71,239		99.30% Pervious Area
502		0.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	103	0.0340	0.15		Sheet Flow, Grass
					Grass: Dense n= 0.240 P2= 3.36"
0.3	36	0.1100	2.32		Shallow Concentrated Flow, Grass
					Short Grass Pasture Kv= 7.0 fps
11.8	139	Total			

Subcatchment PDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1B: Northeastern Runoff

Runoff = 8.35 cfs @ 12.17 hrs, Volume= 32,346 cf, Depth= 4.10"

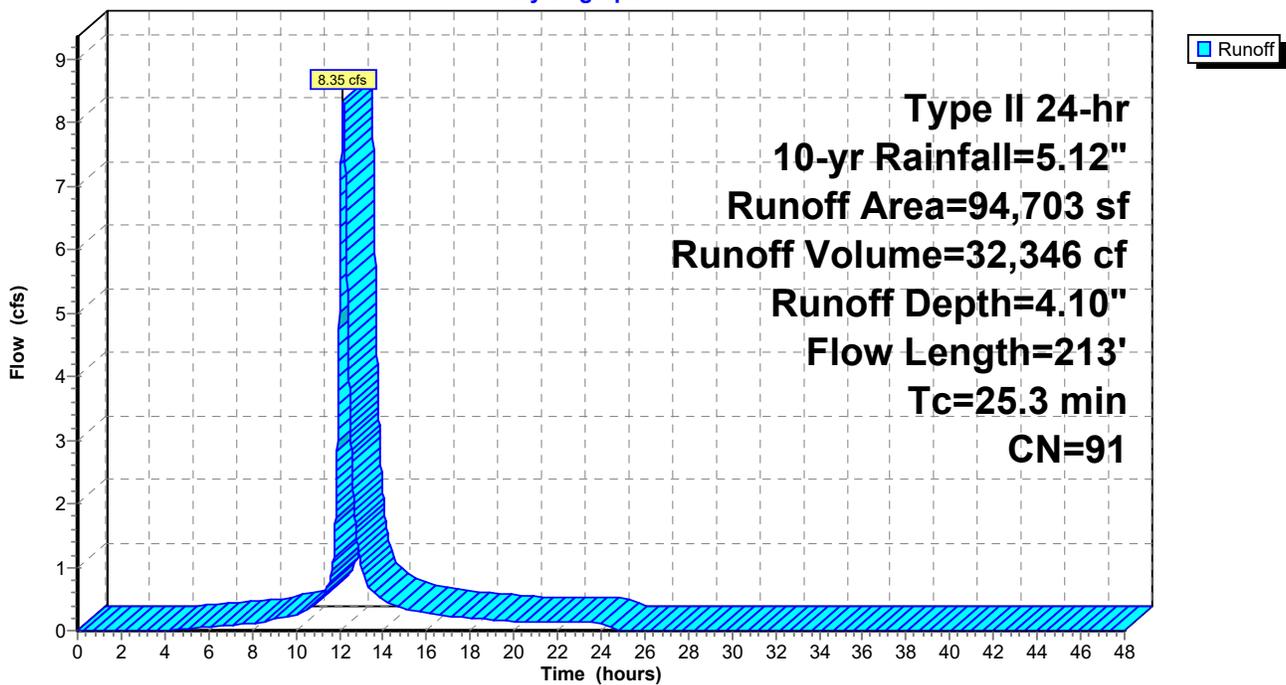
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
52,482	98	Paved parking, HSG D
12,144	84	50-75% Grass cover, Fair, HSG D
30,077	82	Woods/grass comb., Fair, HSG D
94,703	91	Weighted Average
42,221		44.58% Pervious Area
52,482		55.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.3	102	0.0143	0.07		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
0.5	35	0.0249	1.10		Shallow Concentrated Flow, Grass/Woods Short Grass Pasture Kv= 7.0 fps
0.5	76	0.0188	2.78		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
25.3	213	Total			

Subcatchment PDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1C: Building 1 Roof

Runoff = 24.01 cfs @ 11.97 hrs, Volume= 58,380 cf, Depth= 4.88"

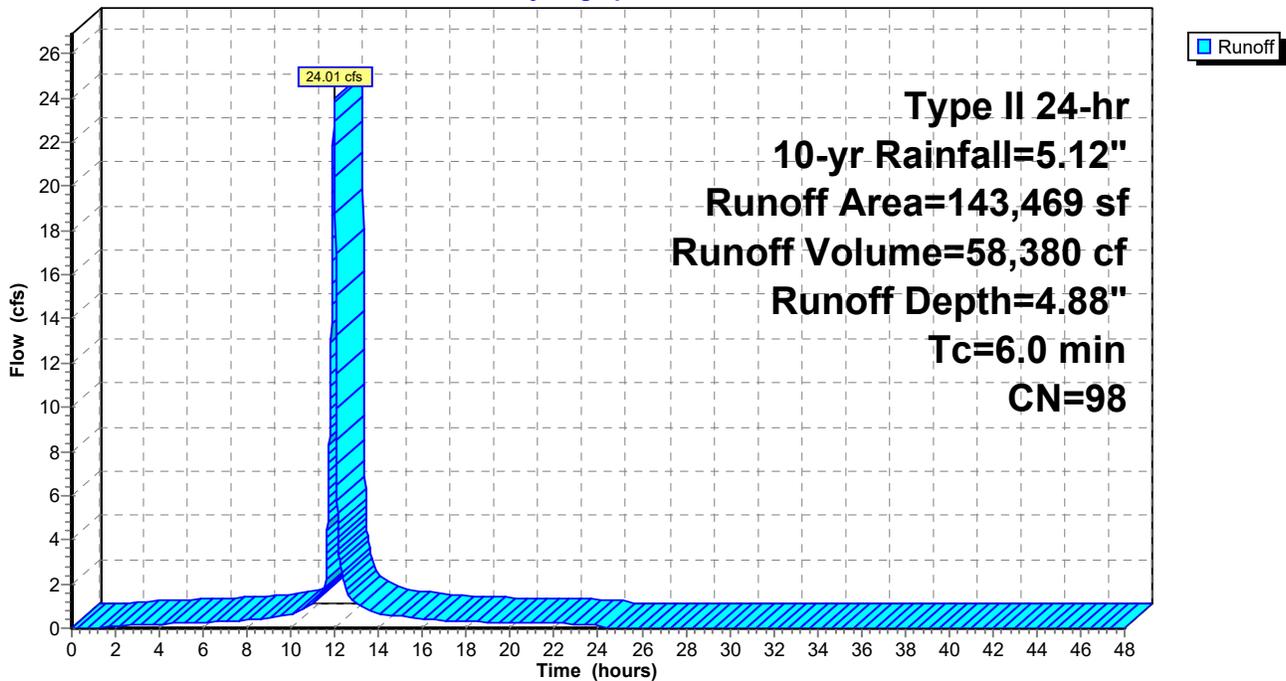
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
143,469	98	Unconnected roofs, HSG D
143,469		100.00% Impervious Area
143,469		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment PDA-1C: Building 1 Roof

Hydrograph



Summary for Subcatchment PDA-1D: Southeastern Parking Runoff

Runoff = 9.47 cfs @ 11.97 hrs, Volume= 22,625 cf, Depth= 4.77"

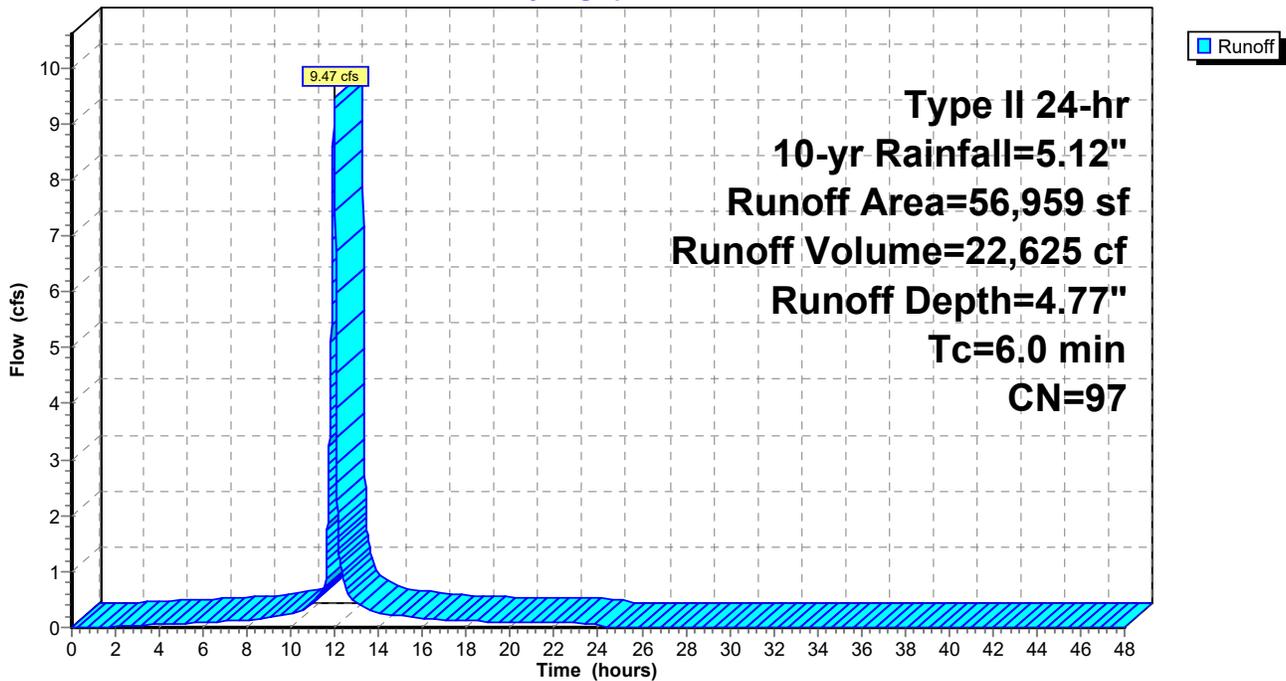
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
3,700	84	50-75% Grass cover, Fair, HSG D
53,259	98	Paved parking, HSG D
56,959	97	Weighted Average
3,700		6.50% Pervious Area
53,259		93.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment PDA-1D: Southeastern Parking Runoff

Hydrograph



Summary for Subcatchment PDA-2A: Northwestern Runoff

Runoff = 25.94 cfs @ 11.97 hrs, Volume= 60,930 cf, Depth= 4.65"

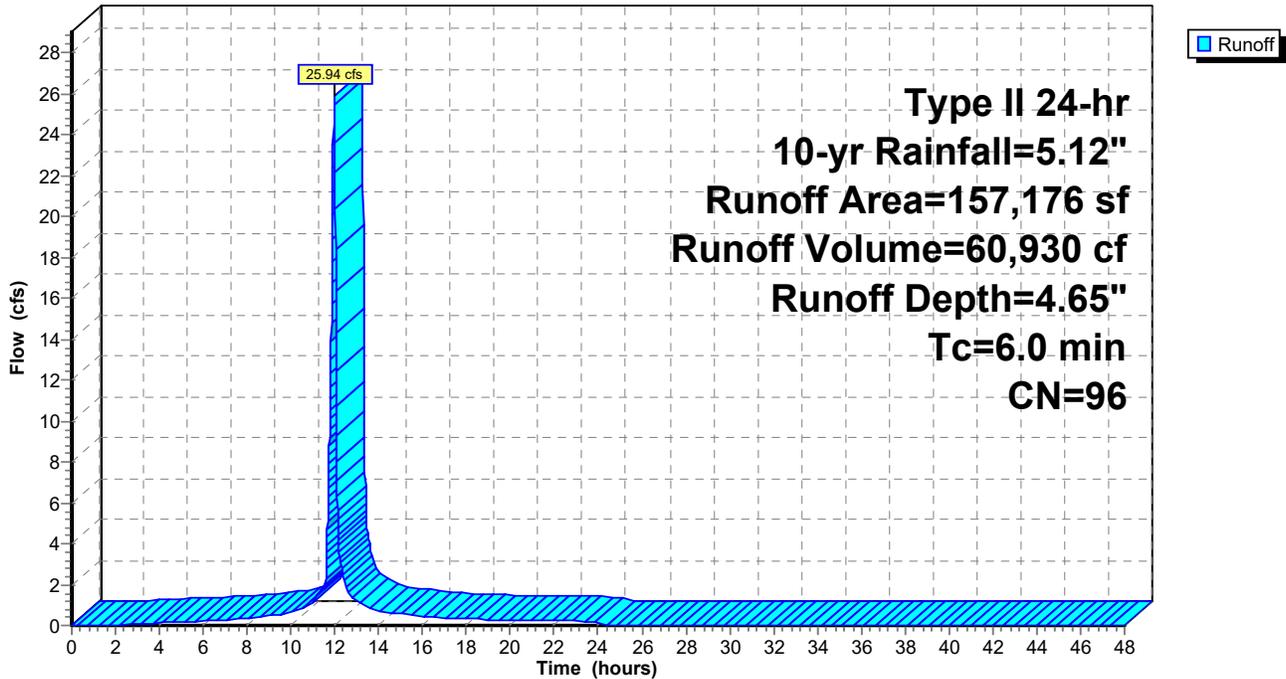
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
137,288	98	Paved parking, HSG D
19,888	80	>75% Grass cover, Good, HSG D
157,176	96	Weighted Average
19,888		12.65% Pervious Area
137,288		87.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment PDA-2A: Northwestern Runoff

Hydrograph



Summary for Subcatchment PDA-2B: Southwestern Runoff

Runoff = 21.57 cfs @ 11.99 hrs, Volume= 51,497 cf, Depth= 4.10"

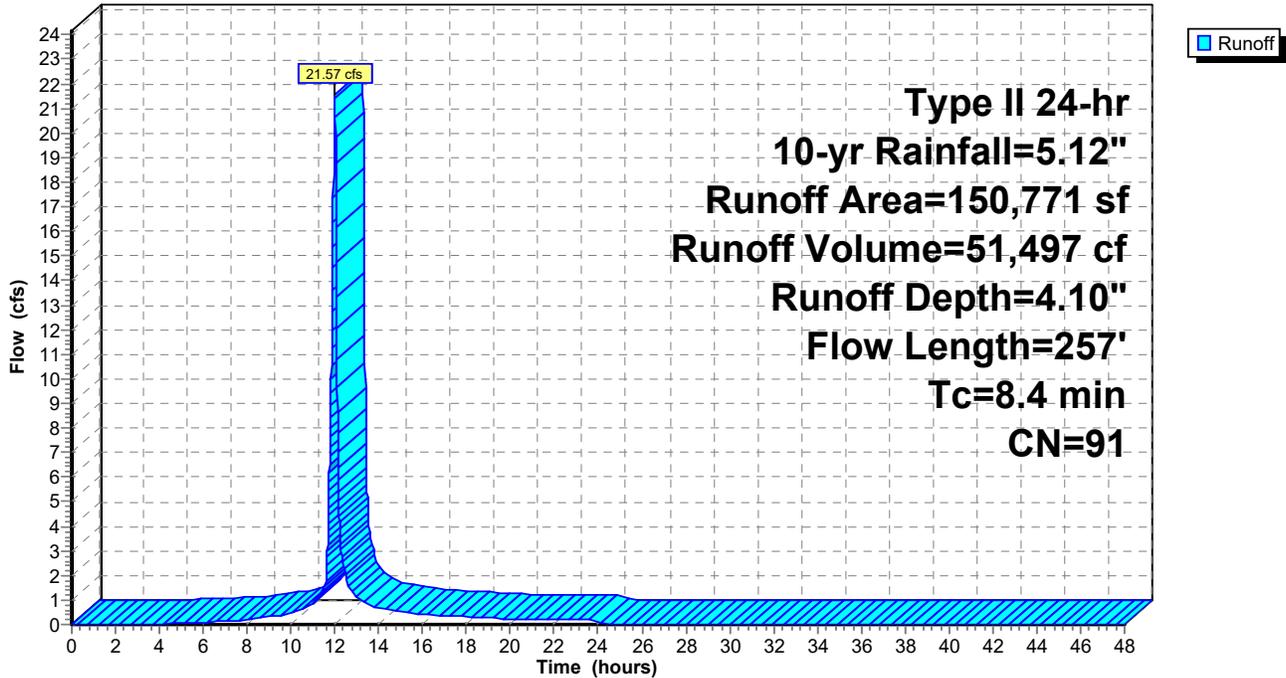
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
88,315	98	Paved parking, HSG D
62,456	80	>75% Grass cover, Good, HSG D
150,771	91	Weighted Average
62,456		41.42% Pervious Area
88,315		58.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	102	0.0392	0.23		Sheet Flow, Grass Grass: Short n= 0.150 P2= 3.36"
0.2	25	0.1400	2.62		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
0.8	130	0.0175	2.69		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
8.4	257	Total			

Subcatchment PDA-2B: Southwestern Runoff

Hydrograph



Summary for Reach PDA-1: Southeastern Wetlands

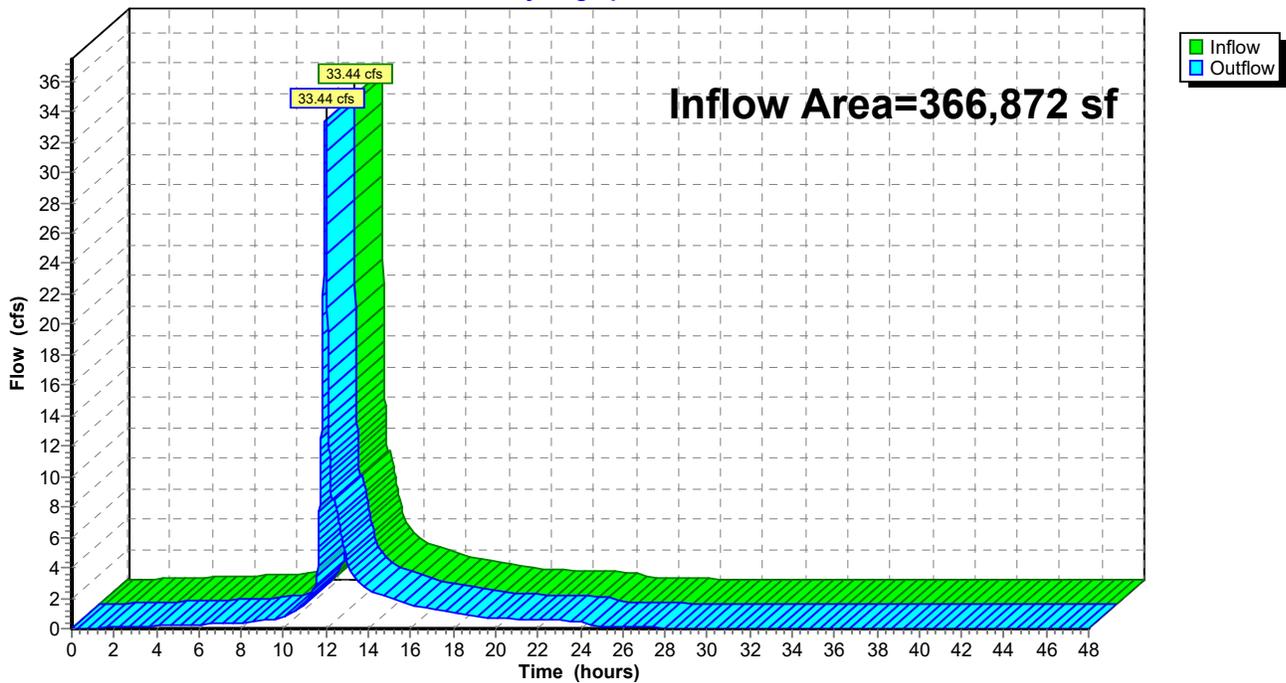
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 366,872 sf, 68.07% Impervious, Inflow Depth > 4.20" for 10-yr event
Inflow = 33.44 cfs @ 11.98 hrs, Volume= 128,311 cf
Outflow = 33.44 cfs @ 11.98 hrs, Volume= 128,311 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach PDA-1: Southeastern Wetlands

Hydrograph



Summary for Reach PDA-2: Southwestern Wetlands

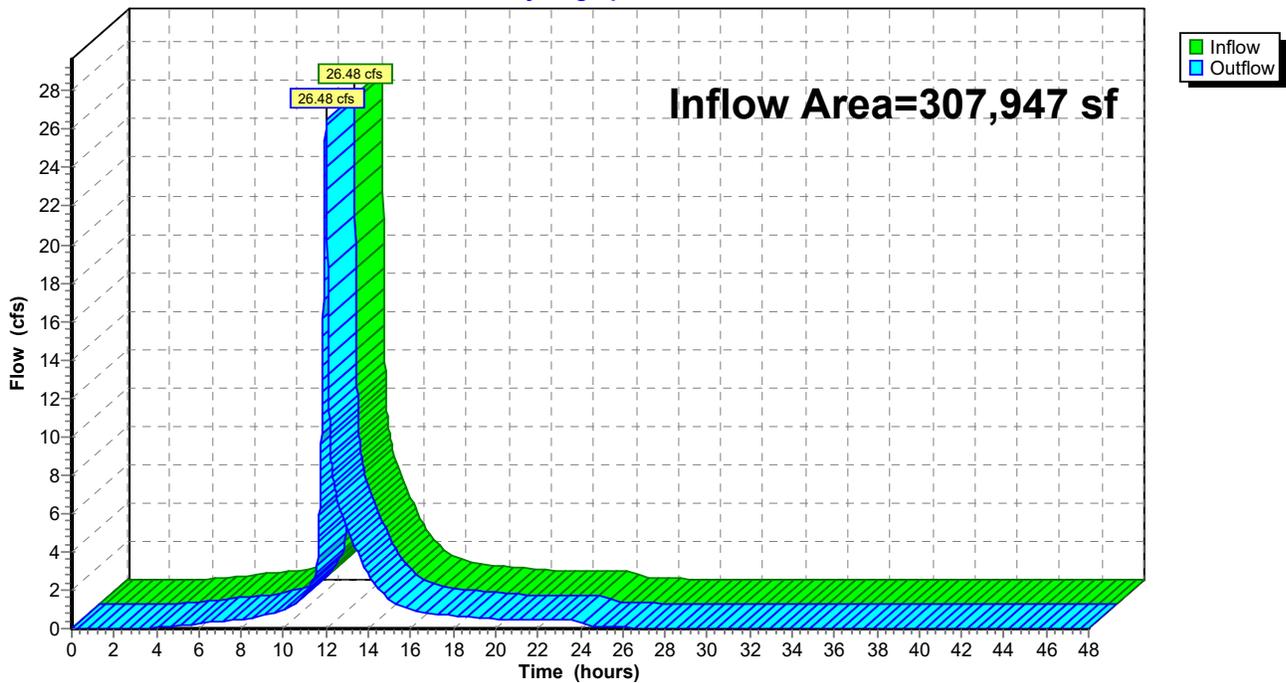
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 307,947 sf, 73.26% Impervious, Inflow Depth = 4.38" for 10-yr event
Inflow = 26.48 cfs @ 12.00 hrs, Volume= 112,384 cf
Outflow = 26.48 cfs @ 12.00 hrs, Volume= 112,384 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach PDA-2: Southwestern Wetlands

Hydrograph



Summary for Pond 1B: UGS Chamber

Inflow Area = 94,703 sf, 55.42% Impervious, Inflow Depth = 4.10" for 10-yr event
 Inflow = 8.35 cfs @ 12.17 hrs, Volume= 32,346 cf
 Outflow = 3.23 cfs @ 12.51 hrs, Volume= 30,414 cf, Atten= 61%, Lag= 20.2 min
 Primary = 3.23 cfs @ 12.51 hrs, Volume= 30,414 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 145.84' @ 12.51 hrs Surf.Area= 8,781 sf Storage= 14,999 cf

Plug-Flow detention time= 186.4 min calculated for 30,408 cf (94% of inflow)
 Center-of-Mass det. time= 152.7 min (953.3 - 800.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	143.50'	7,229 cf	64.33"W x 136.50"L x 3.54"H Field A 31,101 cf Overall - 13,028 cf Embedded = 18,073 cf x 40.0% Voids
#2A	144.00'	13,028 cf	Cultec R-330XLHD x 247 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		20,257 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	144.00'	24.0" Round Culvert L= 450.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 144.00' / 139.50' S= 0.0100 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.90'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	144.00'	6.4" Vert. Orifice/Grate C= 0.600
#4	Device 1	145.50'	36.0" W x 4.0" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=3.24 cfs @ 12.51 hrs HW=145.84' (Free Discharge)

- ↑ **1=Culvert** (Passes 3.24 cfs of 11.01 cfs potential flow)
- ↑ **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **3=Orifice/Grate** (Orifice Controls 1.35 cfs @ 6.04 fps)
- ↑ **4=Orifice/Grate** (Orifice Controls 1.89 cfs @ 1.89 fps)

Pond 1B: UGS Chamber - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

19 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 134.50' Row Length +12.0" End Stone x 2 = 136.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

247 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 13,028.1 cf Chamber Storage

31,101.1 cf Field - 13,028.1 cf Chambers = 18,073.1 cf Stone x 40.0% Voids = 7,229.2 cf Stone Storage

Chamber Storage + Stone Storage = 20,257.3 cf = 0.465 af

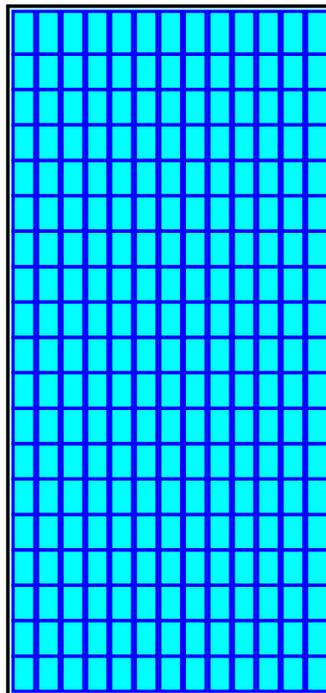
Overall Storage Efficiency = 65.1%

Overall System Size = 136.50' x 64.33' x 3.54'

247 Chambers

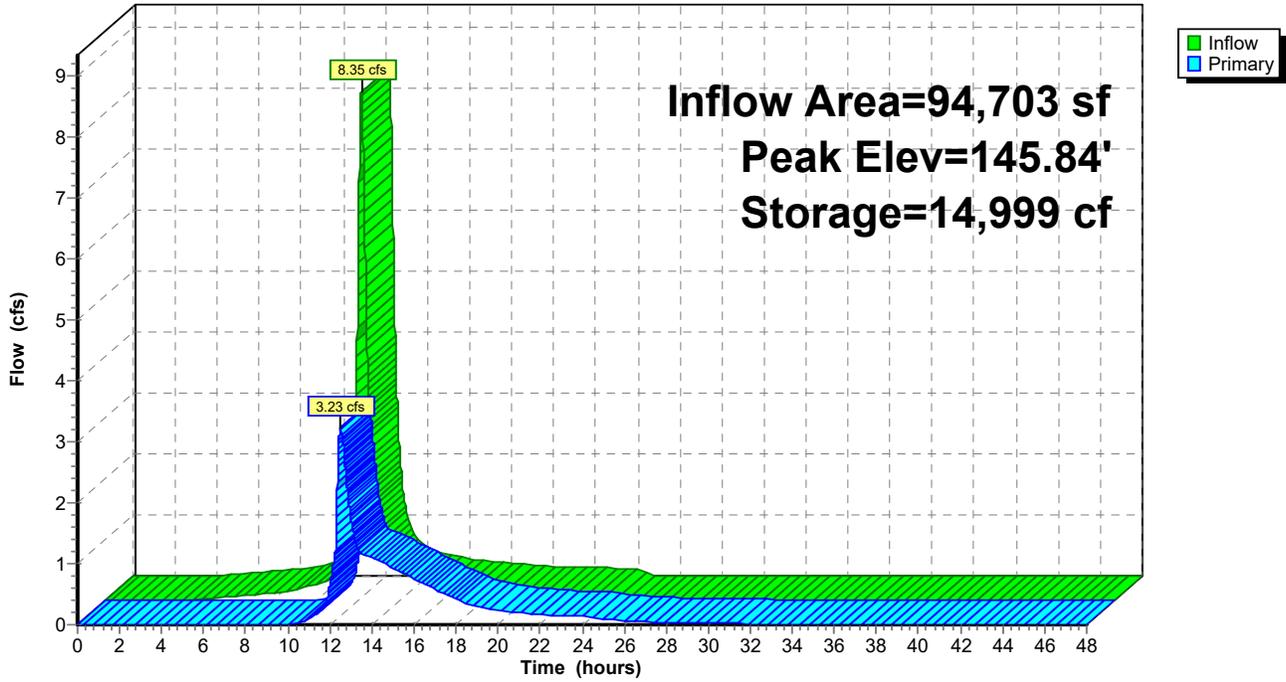
1,151.9 cy Field

669.4 cy Stone



Pond 1B: UGS Chamber

Hydrograph



Summary for Pond 1D: UGS Chamber

Inflow Area = 56,959 sf, 93.50% Impervious, Inflow Depth = 4.77" for 10-yr event
 Inflow = 9.47 cfs @ 11.97 hrs, Volume= 22,625 cf
 Outflow = 3.32 cfs @ 12.08 hrs, Volume= 20,466 cf, Atten= 65%, Lag= 6.9 min
 Primary = 3.32 cfs @ 12.08 hrs, Volume= 20,466 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 143.00' @ 12.08 hrs Surf.Area= 10,132 sf Storage= 10,682 cf

Plug-Flow detention time= 192.5 min calculated for 20,466 cf (90% of inflow)
 Center-of-Mass det. time= 142.0 min (893.3 - 751.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	141.50'	8,329 cf	64.33'W x 157.50'L x 3.54'H Field A 35,886 cf Overall - 15,062 cf Embedded = 20,824 cf x 40.0% Voids
#2A	142.00'	15,062 cf	Cultec R-330XLHD x 286 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		23,392 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	142.00'	24.0" Round Culvert L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 142.00' / 141.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	144.60'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	142.00'	14.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	143.40'	10.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=3.32 cfs @ 12.08 hrs HW=143.00' (Free Discharge)

- 1=Culvert (Passes 3.32 cfs of 3.55 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 3=Orifice/Grate (Orifice Controls 3.32 cfs @ 3.40 fps)
- 4=Orifice/Grate (Controls 0.00 cfs)

Pond 1D: UGS Chamber - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

22 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 155.50' Row Length +12.0" End Stone x 2 = 157.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

286 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 15,062.2 cf Chamber Storage

35,885.9 cf Field - 15,062.2 cf Chambers = 20,823.7 cf Stone x 40.0% Voids = 8,329.5 cf Stone Storage

Chamber Storage + Stone Storage = 23,391.7 cf = 0.537 af

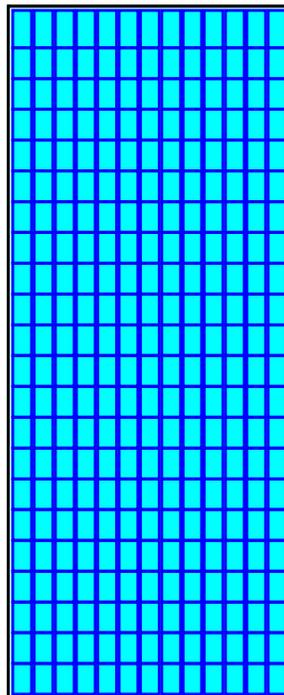
Overall Storage Efficiency = 65.2%

Overall System Size = 157.50' x 64.33' x 3.54'

286 Chambers

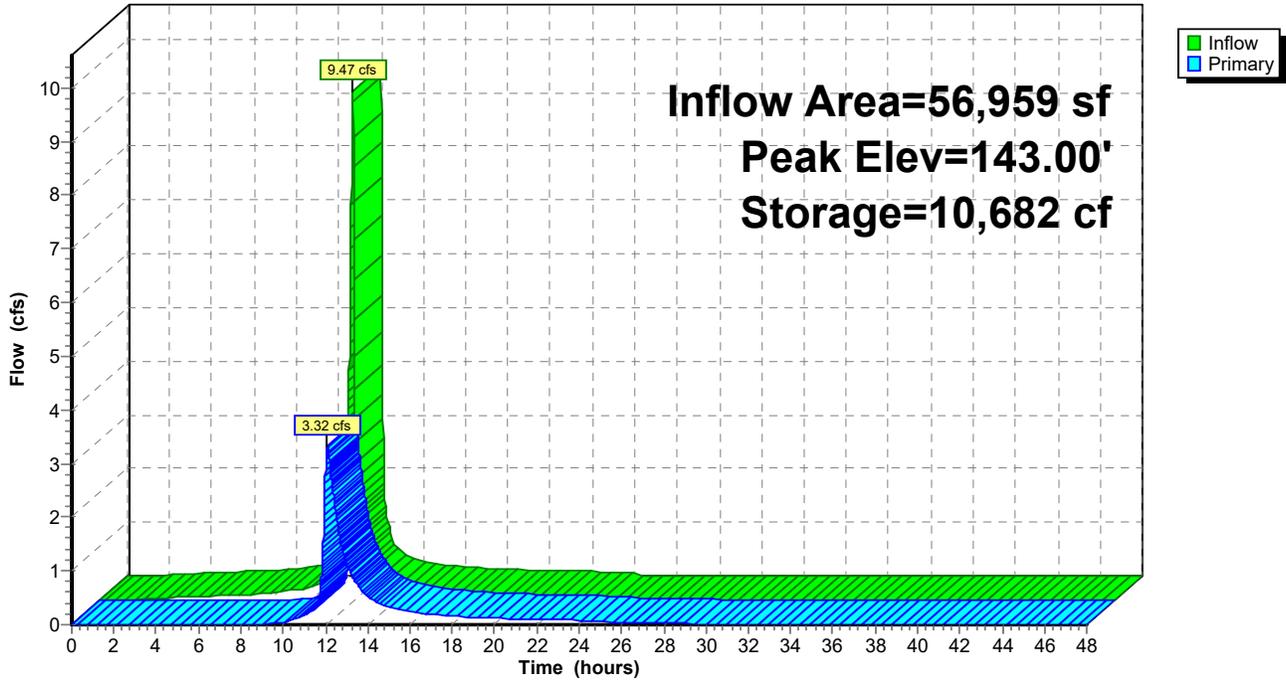
1,329.1 cy Field

771.2 cy Stone



Pond 1D: UGS Chamber

Hydrograph



Summary for Pond 2A: UGS Chamber

Inflow Area = 157,176 sf, 87.35% Impervious, Inflow Depth = 4.65" for 10-yr event
 Inflow = 25.94 cfs @ 11.97 hrs, Volume= 60,930 cf
 Outflow = 5.50 cfs @ 12.12 hrs, Volume= 60,888 cf, Atten= 79%, Lag= 9.4 min
 Primary = 5.50 cfs @ 12.12 hrs, Volume= 60,888 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 144.00' @ 12.12 hrs Surf.Area= 14,934 sf Storage= 22,296 cf

Plug-Flow detention time= 66.7 min calculated for 60,875 cf (100% of inflow)
 Center-of-Mass det. time= 66.5 min (824.5 - 758.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	141.92'	12,712 cf	83.67"W x 178.50"L x 3.62"H Field A 54,138 cf Overall - 22,357 cf Embedded = 31,781 cf x 40.0% Voids
#2A	142.50'	22,357 cf	Cultec R-330XLHD x 425 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 17 rows
		35,069 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	141.92'	24.0" Round Culvert L= 12.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 141.92' / 141.00' S= 0.0767 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#2	Device 1	145.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	141.92'	13.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	144.00'	18.0" W x 6.0" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=5.50 cfs @ 12.12 hrs HW=144.00' (Free Discharge)

- 1=Culvert (Passes 5.50 cfs of 12.40 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 3=Orifice/Grate (Orifice Controls 5.50 cfs @ 5.97 fps)
- 4=Orifice/Grate (Controls 0.00 cfs)

Pond 2A: UGS Chamber - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 17 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

25 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 176.50' Row Length +12.0" End Stone x 2 = 178.50' Base Length

17 Rows x 52.0" Wide + 6.0" Spacing x 16 + 12.0" Side Stone x 2 = 83.67' Base Width

7.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.62' Field Height

425 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 17 Rows = 22,356.7 cf Chamber Storage

54,137.6 cf Field - 22,356.7 cf Chambers = 31,780.8 cf Stone x 40.0% Voids = 12,712.3 cf Stone Storage

Chamber Storage + Stone Storage = 35,069.1 cf = 0.805 af

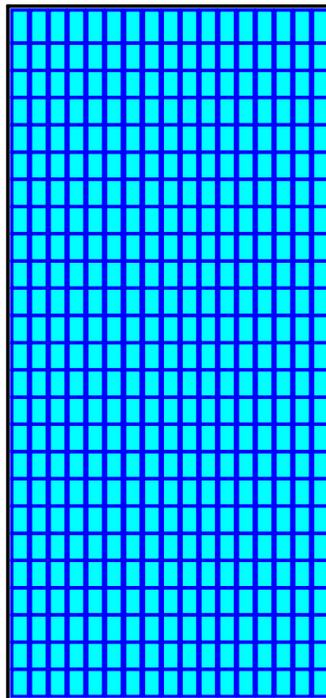
Overall Storage Efficiency = 64.8%

Overall System Size = 178.50' x 83.67' x 3.62'

425 Chambers

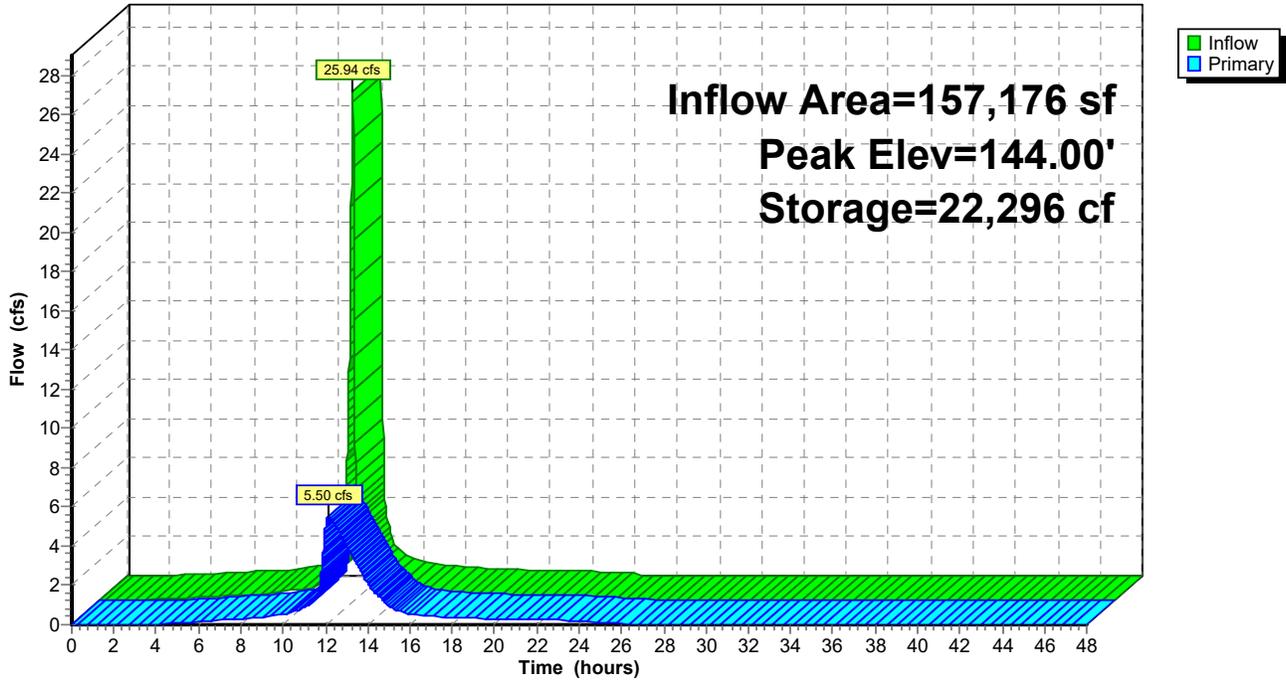
2,005.1 cy Field

1,177.1 cy Stone



Pond 2A: UGS Chamber

Hydrograph



Summary for Subcatchment PDA-1A: Southeastern Runoff

Runoff = 13.29 cfs @ 12.03 hrs, Volume= 34,578 cf, Depth= 5.78"

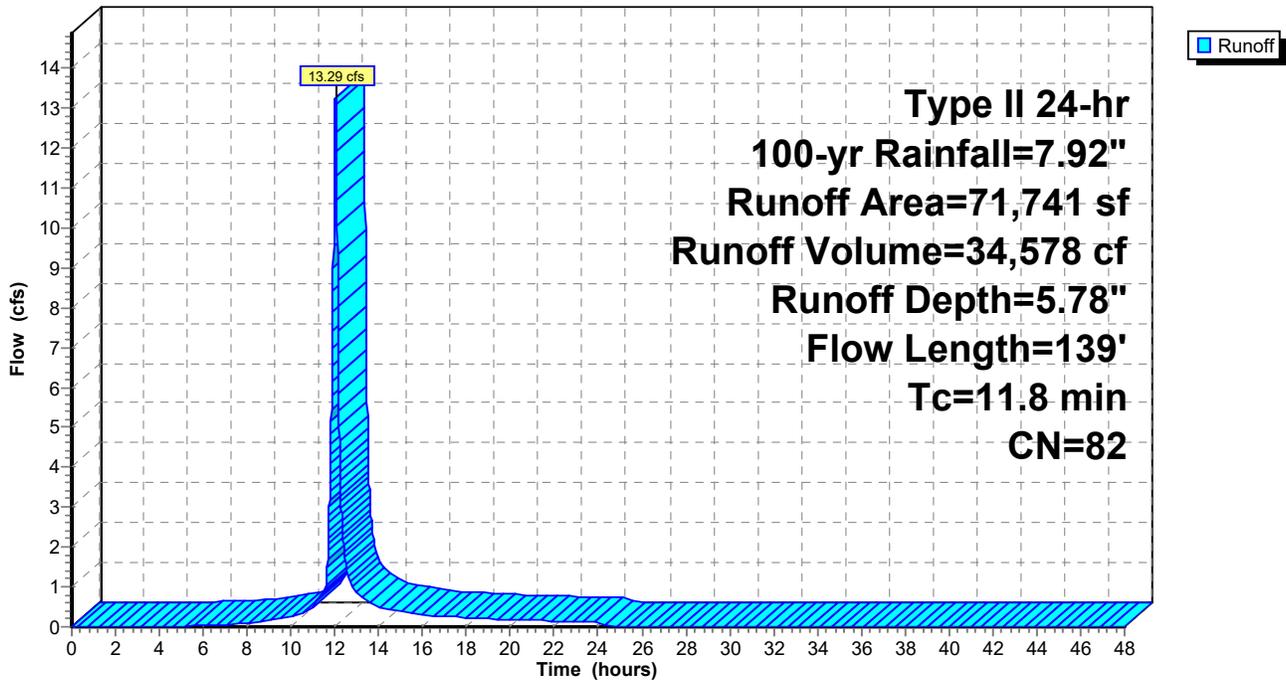
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
71,239	82	Woods/grass comb., Fair, HSG D
502	98	Paved parking, HSG D
71,741	82	Weighted Average
71,239		99.30% Pervious Area
502		0.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.5	103	0.0340	0.15		Sheet Flow, Grass
					Grass: Dense n= 0.240 P2= 3.36"
0.3	36	0.1100	2.32		Shallow Concentrated Flow, Grass
					Short Grass Pasture Kv= 7.0 fps
11.8	139	Total			

Subcatchment PDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1B: Northeastern Runoff

Runoff = 13.60 cfs @ 12.17 hrs, Volume= 54,024 cf, Depth= 6.85"

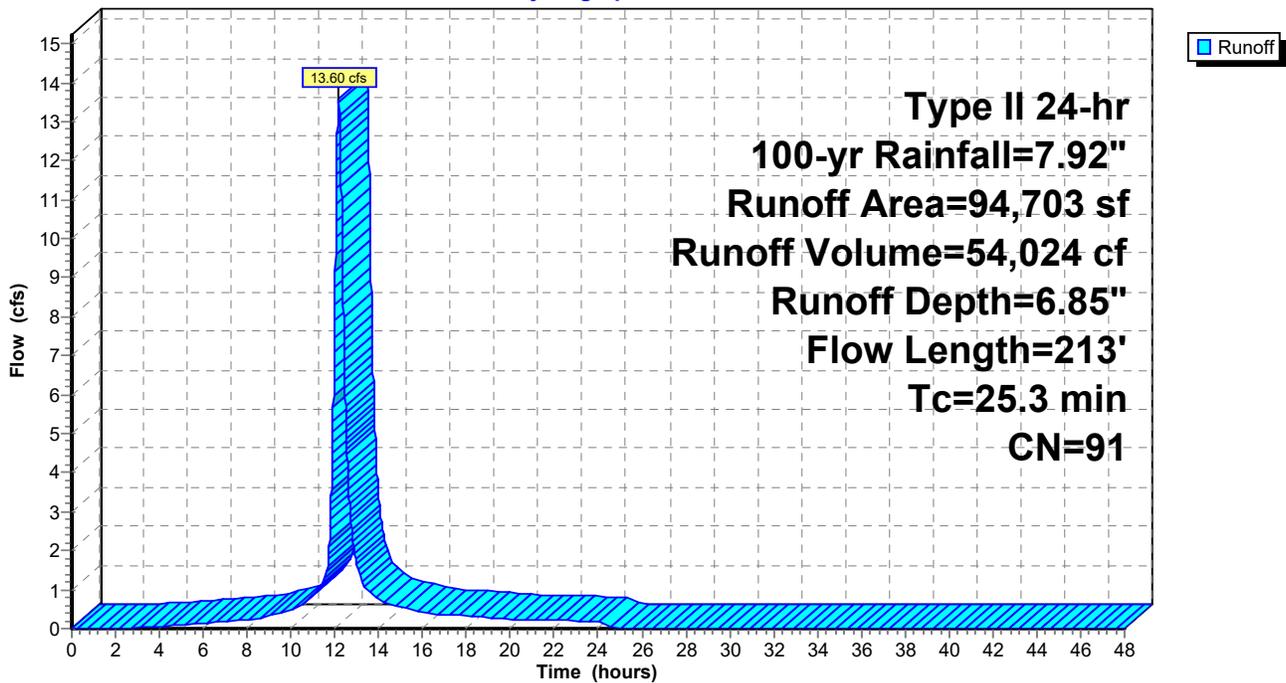
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
52,482	98	Paved parking, HSG D
12,144	84	50-75% Grass cover, Fair, HSG D
30,077	82	Woods/grass comb., Fair, HSG D
94,703	91	Weighted Average
42,221		44.58% Pervious Area
52,482		55.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.3	102	0.0143	0.07		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
0.5	35	0.0249	1.10		Shallow Concentrated Flow, Grass/Woods Short Grass Pasture Kv= 7.0 fps
0.5	76	0.0188	2.78		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
25.3	213	Total			

Subcatchment PDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1C: Building 1 Roof

Runoff = 37.24 cfs @ 11.97 hrs, Volume= 91,823 cf, Depth= 7.68"

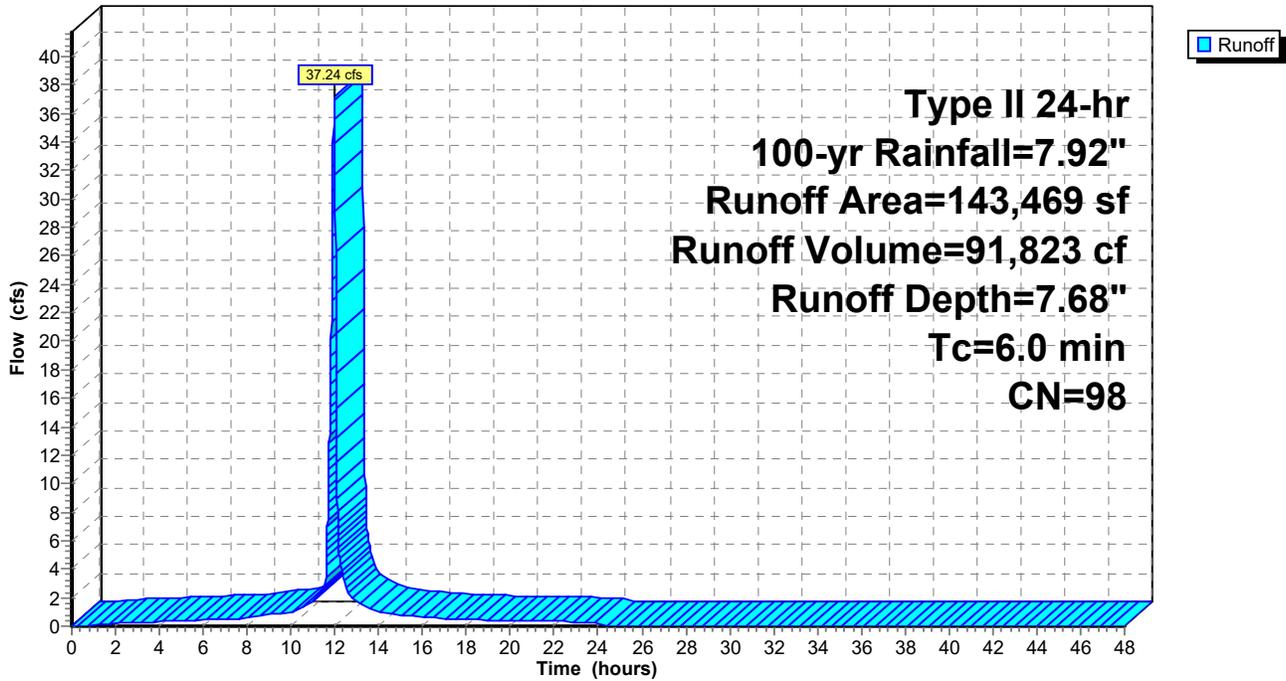
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
143,469	98	Unconnected roofs, HSG D
143,469		100.00% Impervious Area
143,469		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment PDA-1C: Building 1 Roof

Hydrograph



Summary for Subcatchment PDA-1D: Southeastern Parking Runoff

Runoff = 14.75 cfs @ 11.97 hrs, Volume= 35,887 cf, Depth= 7.56"

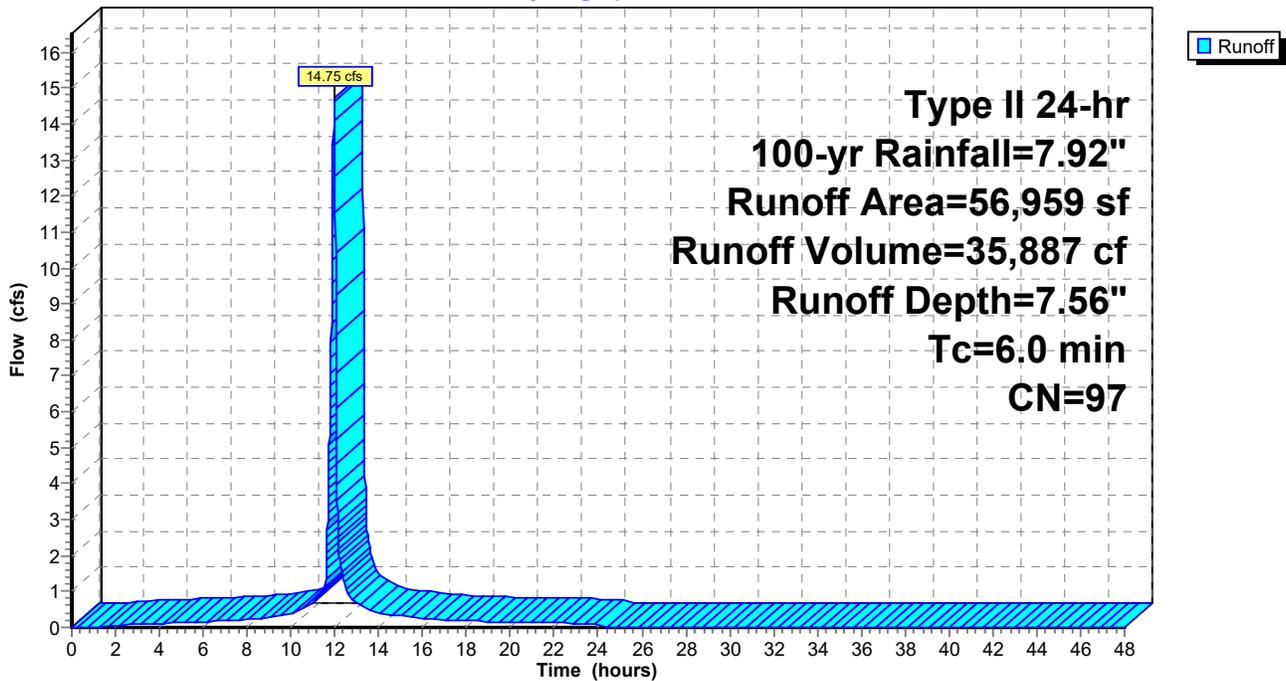
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
3,700	84	50-75% Grass cover, Fair, HSG D
53,259	98	Paved parking, HSG D
56,959	97	Weighted Average
3,700		6.50% Pervious Area
53,259		93.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment PDA-1D: Southeastern Parking Runoff

Hydrograph



Summary for Subcatchment PDA-2A: Northwestern Runoff

Runoff = 40.54 cfs @ 11.97 hrs, Volume= 97,463 cf, Depth= 7.44"

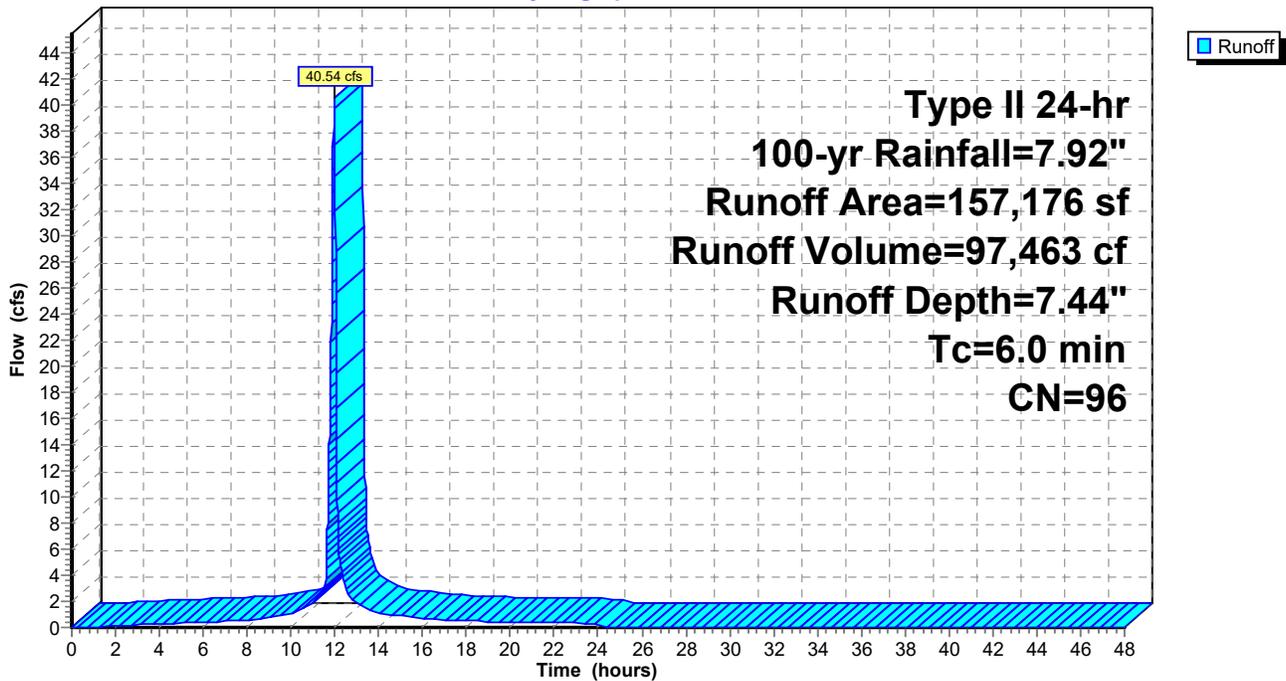
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
137,288	98	Paved parking, HSG D
19,888	80	>75% Grass cover, Good, HSG D
157,176	96	Weighted Average
19,888		12.65% Pervious Area
137,288		87.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, Tc

Subcatchment PDA-2A: Northwestern Runoff

Hydrograph



Summary for Subcatchment PDA-2B: Southwestern Runoff

Runoff = 34.88 cfs @ 11.99 hrs, Volume= 86,008 cf, Depth= 6.85"

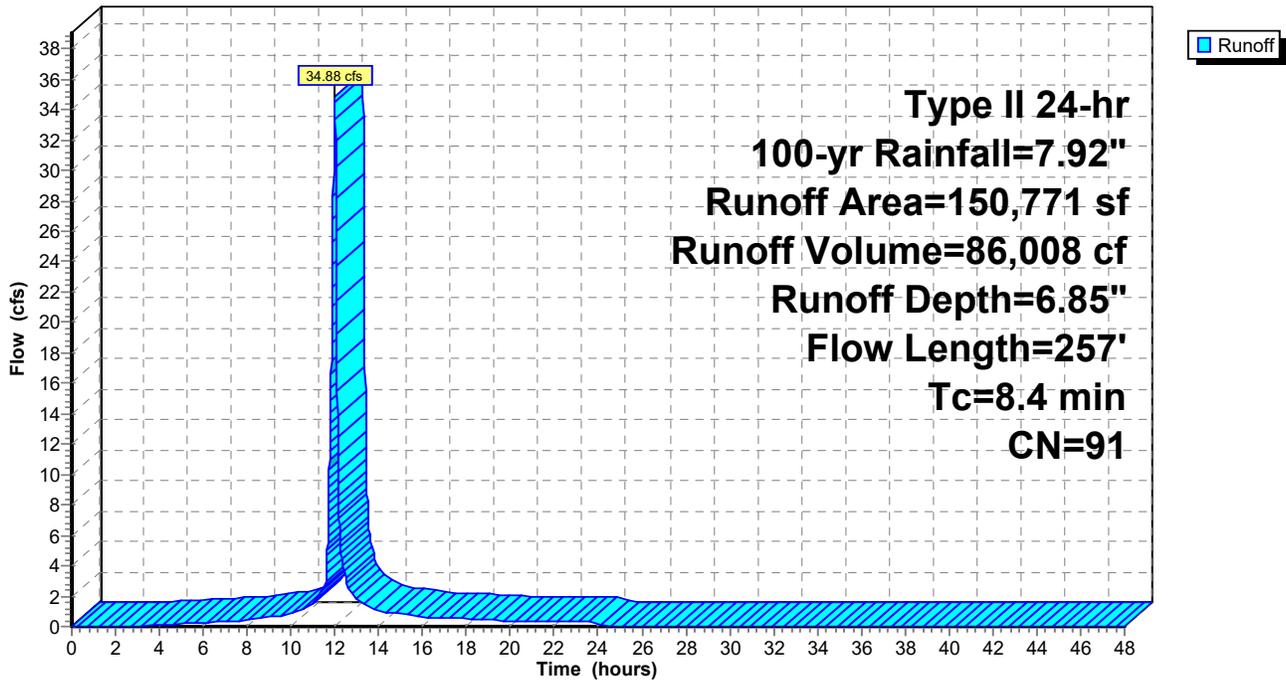
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
88,315	98	Paved parking, HSG D
62,456	80	>75% Grass cover, Good, HSG D
150,771	91	Weighted Average
62,456		41.42% Pervious Area
88,315		58.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	102	0.0392	0.23		Sheet Flow, Grass Grass: Short n= 0.150 P2= 3.36"
0.2	25	0.1400	2.62		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
0.8	130	0.0175	2.69		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
8.4	257	Total			

Subcatchment PDA-2B: Southwestern Runoff

Hydrograph



Summary for Reach PDA-1: Southeastern Wetlands

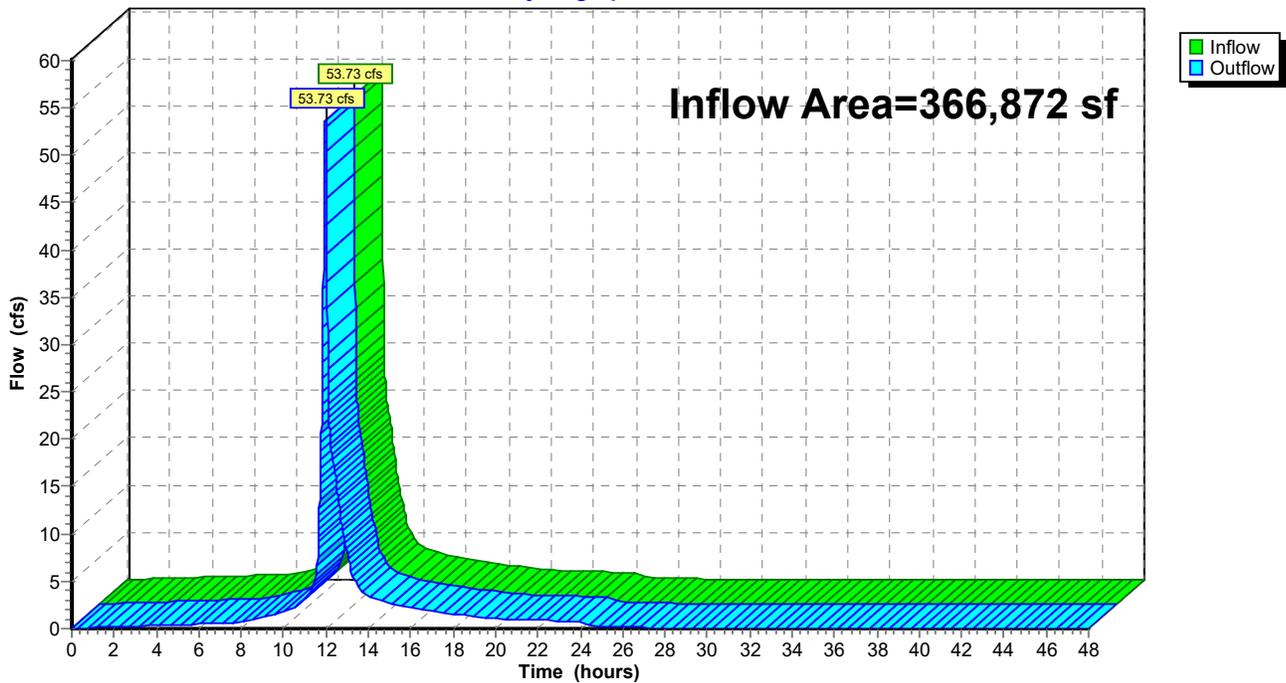
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 366,872 sf, 68.07% Impervious, Inflow Depth = 6.94" for 100-yr event
Inflow = 53.73 cfs @ 11.98 hrs, Volume= 212,209 cf
Outflow = 53.73 cfs @ 11.98 hrs, Volume= 212,209 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach PDA-1: Southeastern Wetlands

Hydrograph



Summary for Reach PDA-2: Southwestern Wetlands

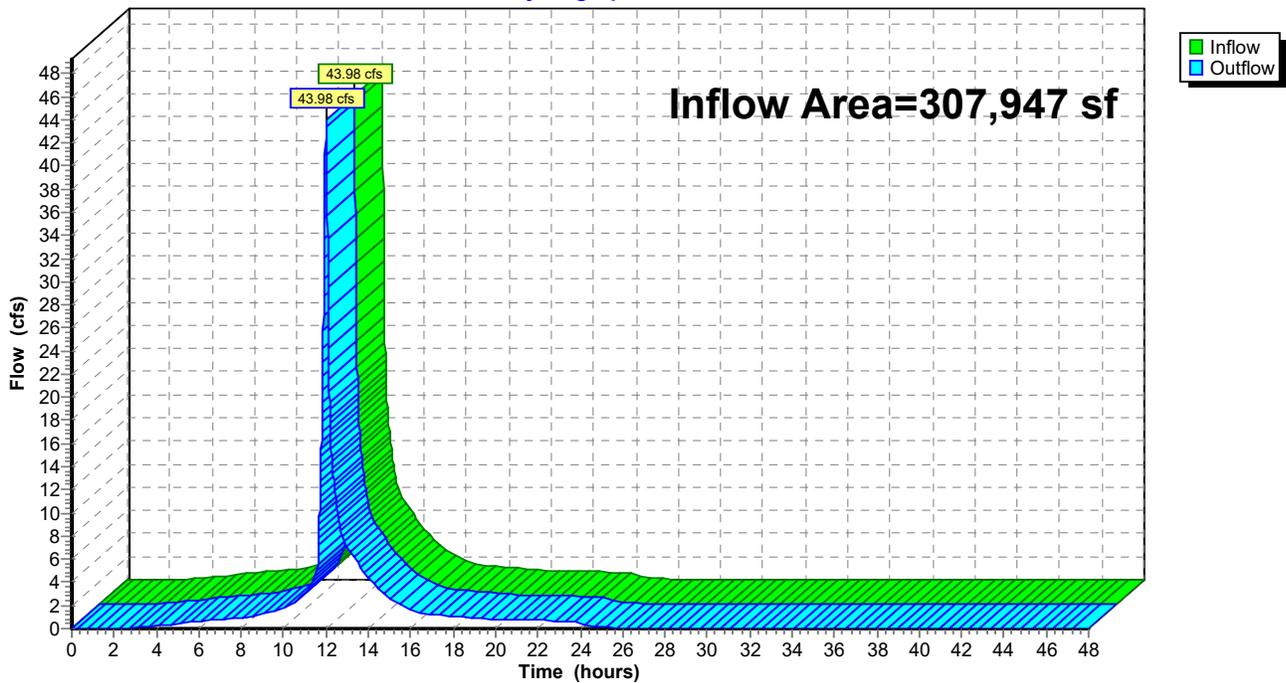
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 307,947 sf, 73.26% Impervious, Inflow Depth = 7.15" for 100-yr event
Inflow = 43.98 cfs @ 12.00 hrs, Volume= 183,427 cf
Outflow = 43.98 cfs @ 12.00 hrs, Volume= 183,427 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach PDA-2: Southwestern Wetlands

Hydrograph



Summary for Pond 1B: UGS Chamber

Inflow Area = 94,703 sf, 55.42% Impervious, Inflow Depth = 6.85" for 100-yr event
 Inflow = 13.60 cfs @ 12.17 hrs, Volume= 54,024 cf
 Outflow = 7.34 cfs @ 12.41 hrs, Volume= 52,086 cf, Atten= 46%, Lag= 14.4 min
 Primary = 7.34 cfs @ 12.41 hrs, Volume= 52,086 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 147.00' @ 12.41 hrs Surf.Area= 8,781 sf Storage= 20,124 cf

Plug-Flow detention time= 141.9 min calculated for 52,075 cf (96% of inflow)
 Center-of-Mass det. time= 120.1 min (907.3 - 787.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	143.50'	7,229 cf	64.33"W x 136.50"L x 3.54'H Field A 31,101 cf Overall - 13,028 cf Embedded = 18,073 cf x 40.0% Voids
#2A	144.00'	13,028 cf	Cultec R-330XLHD x 247 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		20,257 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	144.00'	24.0" Round Culvert L= 450.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 144.00' / 139.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	147.90'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	144.00'	6.4" Vert. Orifice/Grate C= 0.600
#4	Device 1	145.50'	36.0" W x 4.0" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=7.34 cfs @ 12.41 hrs HW=147.00' (Free Discharge)

- ↑ **1=Culvert** (Passes 7.34 cfs of 16.90 cfs potential flow)
- ↑ **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **3=Orifice/Grate** (Orifice Controls 1.78 cfs @ 7.97 fps)
- ↑ **4=Orifice/Grate** (Orifice Controls 5.56 cfs @ 5.56 fps)

Pond 1B: UGS Chamber - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

19 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 134.50' Row Length +12.0" End Stone x 2 = 136.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

247 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 13,028.1 cf Chamber Storage

31,101.1 cf Field - 13,028.1 cf Chambers = 18,073.1 cf Stone x 40.0% Voids = 7,229.2 cf Stone Storage

Chamber Storage + Stone Storage = 20,257.3 cf = 0.465 af

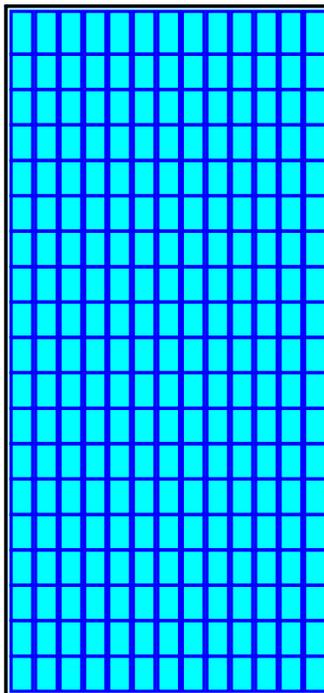
Overall Storage Efficiency = 65.1%

Overall System Size = 136.50' x 64.33' x 3.54'

247 Chambers

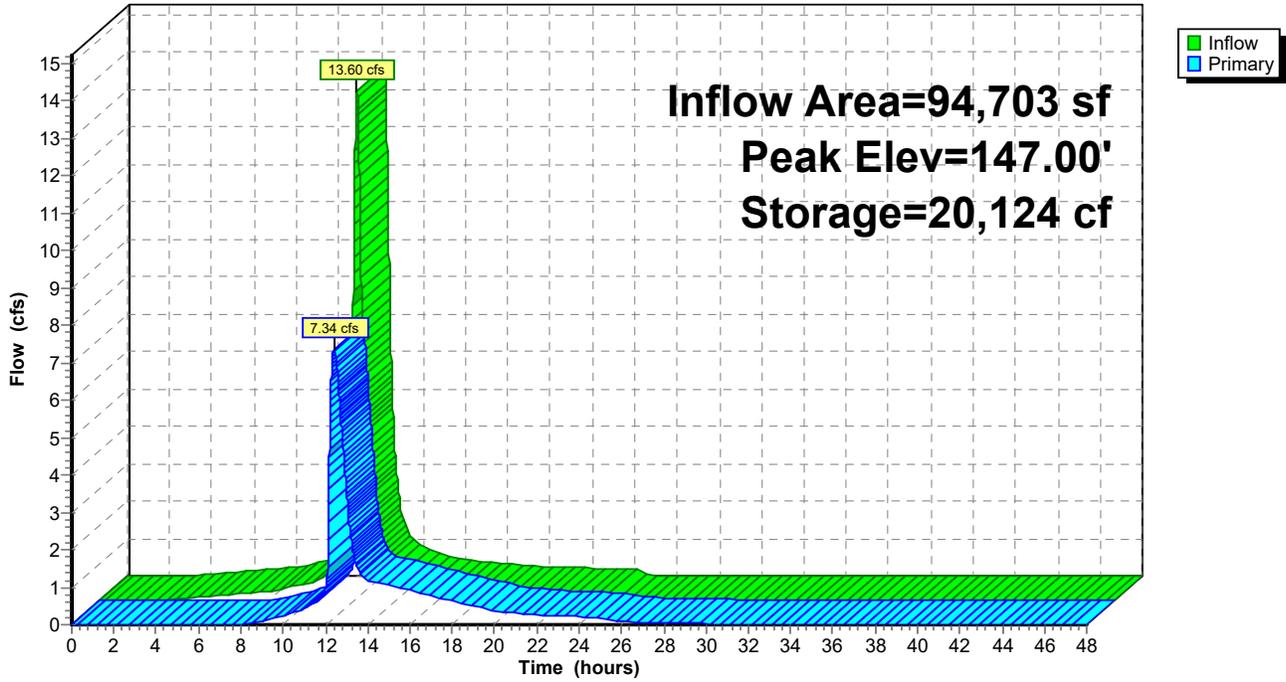
1,151.9 cy Field

669.4 cy Stone



Pond 1B: UGS Chamber

Hydrograph



Summary for Pond 1D: UGS Chamber

Inflow Area = 56,959 sf, 93.50% Impervious, Inflow Depth = 7.56" for 100-yr event
 Inflow = 14.75 cfs @ 11.97 hrs, Volume= 35,887 cf
 Outflow = 5.01 cfs @ 12.08 hrs, Volume= 33,721 cf, Atten= 66%, Lag= 7.0 min
 Primary = 5.01 cfs @ 12.08 hrs, Volume= 33,721 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 143.51' @ 12.08 hrs Surf.Area= 10,132 sf Storage= 14,880 cf

Plug-Flow detention time= 151.8 min calculated for 33,721 cf (94% of inflow)
 Center-of-Mass det. time= 116.1 min (859.3 - 743.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	141.50'	8,329 cf	64.33'W x 157.50'L x 3.54'H Field A 35,886 cf Overall - 15,062 cf Embedded = 20,824 cf x 40.0% Voids
#2A	142.00'	15,062 cf	Cultec R-330XLHD x 286 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 13 rows
		23,392 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	142.00'	24.0" Round Culvert L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 142.00' / 141.90' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	144.60'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	142.00'	14.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	143.40'	10.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=5.01 cfs @ 12.08 hrs HW=143.51' (Free Discharge)

- ↑ **1=Culvert** (Passes 5.01 cfs of 7.19 cfs potential flow)
- ↑ **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **3=Orifice/Grate** (Orifice Controls 4.96 cfs @ 4.64 fps)
- ↑ **4=Orifice/Grate** (Orifice Controls 0.05 cfs @ 1.14 fps)

Pond 1D: UGS Chamber - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 13 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

22 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 155.50' Row Length +12.0" End Stone x 2 = 157.50' Base Length

13 Rows x 52.0" Wide + 6.0" Spacing x 12 + 12.0" Side Stone x 2 = 64.33' Base Width

6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

286 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 13 Rows = 15,062.2 cf Chamber Storage

35,885.9 cf Field - 15,062.2 cf Chambers = 20,823.7 cf Stone x 40.0% Voids = 8,329.5 cf Stone Storage

Chamber Storage + Stone Storage = 23,391.7 cf = 0.537 af

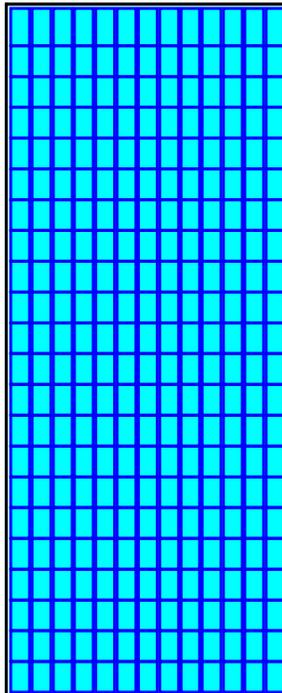
Overall Storage Efficiency = 65.2%

Overall System Size = 157.50' x 64.33' x 3.54'

286 Chambers

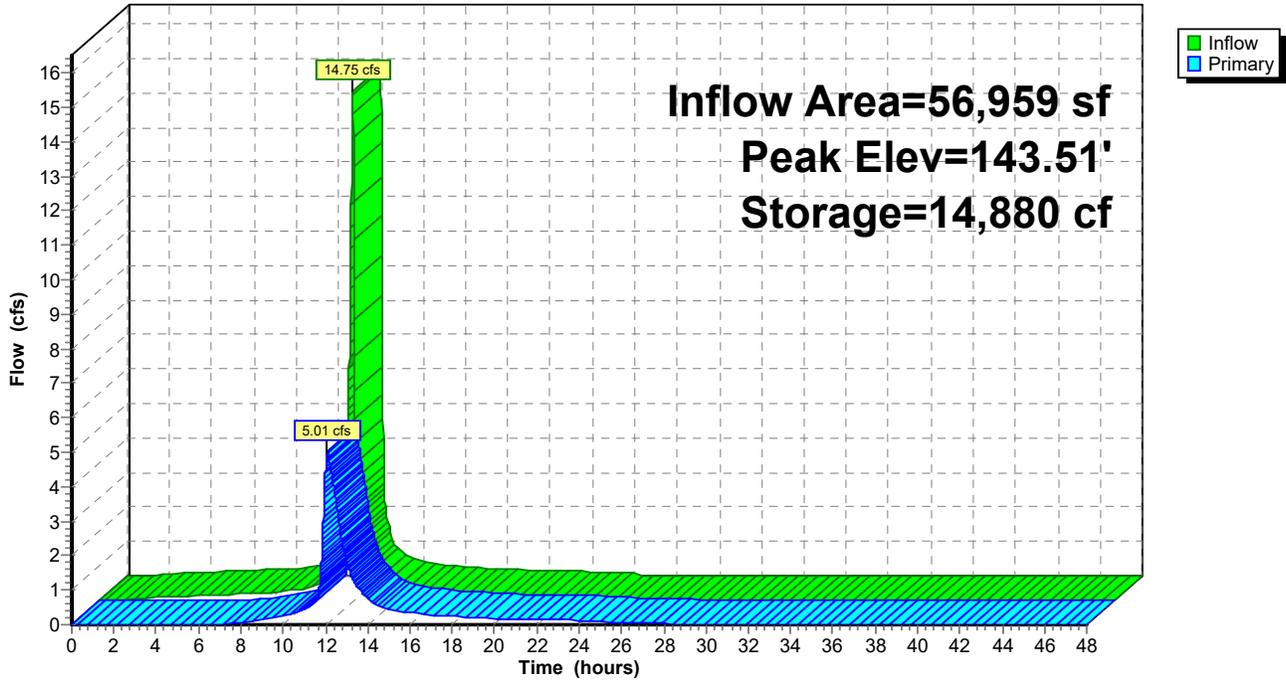
1,329.1 cy Field

771.2 cy Stone



Pond 1D: UGS Chamber

Hydrograph



Summary for Pond 2A: UGS Chamber

Inflow Area = 157,176 sf, 87.35% Impervious, Inflow Depth = 7.44" for 100-yr event
 Inflow = 40.54 cfs @ 11.97 hrs, Volume= 97,463 cf
 Outflow = 12.33 cfs @ 12.09 hrs, Volume= 97,419 cf, Atten= 70%, Lag= 7.5 min
 Primary = 12.33 cfs @ 12.09 hrs, Volume= 97,419 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 145.39' @ 12.09 hrs Surf.Area= 14,934 sf Storage= 34,160 cf

Plug-Flow detention time= 60.4 min calculated for 97,399 cf (100% of inflow)
 Center-of-Mass det. time= 60.4 min (808.9 - 748.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	141.92'	12,712 cf	83.67"W x 178.50'L x 3.62'H Field A 54,138 cf Overall - 22,357 cf Embedded = 31,781 cf x 40.0% Voids
#2A	142.50'	22,357 cf	Cultec R-330XLHD x 425 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 17 rows
		35,069 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	141.92'	24.0" Round Culvert L= 12.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 141.92' / 141.00' S= 0.0767 '/' Cc= 0.900 n= 0.011, Flow Area= 3.14 sf
#2	Device 1	145.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	141.92'	13.0" Vert. Orifice/Grate C= 0.600
#4	Device 1	144.00'	18.0" W x 6.0" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=12.32 cfs @ 12.09 hrs HW=145.39' (Free Discharge)

- ↑ **1=Culvert** (Passes 12.32 cfs of 18.78 cfs potential flow)
- ↑ **2=Sharp-Crested Rectangular Weir** (Weir Controls 0.87 cfs @ 1.23 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 7.60 cfs @ 8.24 fps)
- ↑ **4=Orifice/Grate** (Orifice Controls 3.85 cfs @ 5.14 fps)

Pond 2A: UGS Chamber - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 17 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

25 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 176.50' Row Length +12.0" End Stone x 2 = 178.50' Base Length

17 Rows x 52.0" Wide + 6.0" Spacing x 16 + 12.0" Side Stone x 2 = 83.67' Base Width

7.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.62' Field Height

425 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 17 Rows = 22,356.7 cf Chamber Storage

54,137.6 cf Field - 22,356.7 cf Chambers = 31,780.8 cf Stone x 40.0% Voids = 12,712.3 cf Stone Storage

Chamber Storage + Stone Storage = 35,069.1 cf = 0.805 af

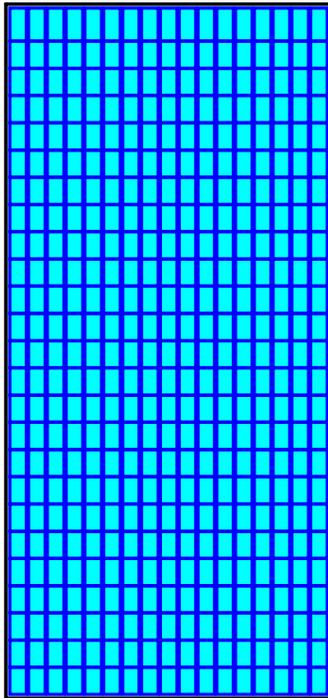
Overall Storage Efficiency = 64.8%

Overall System Size = 178.50' x 83.67' x 3.62'

425 Chambers

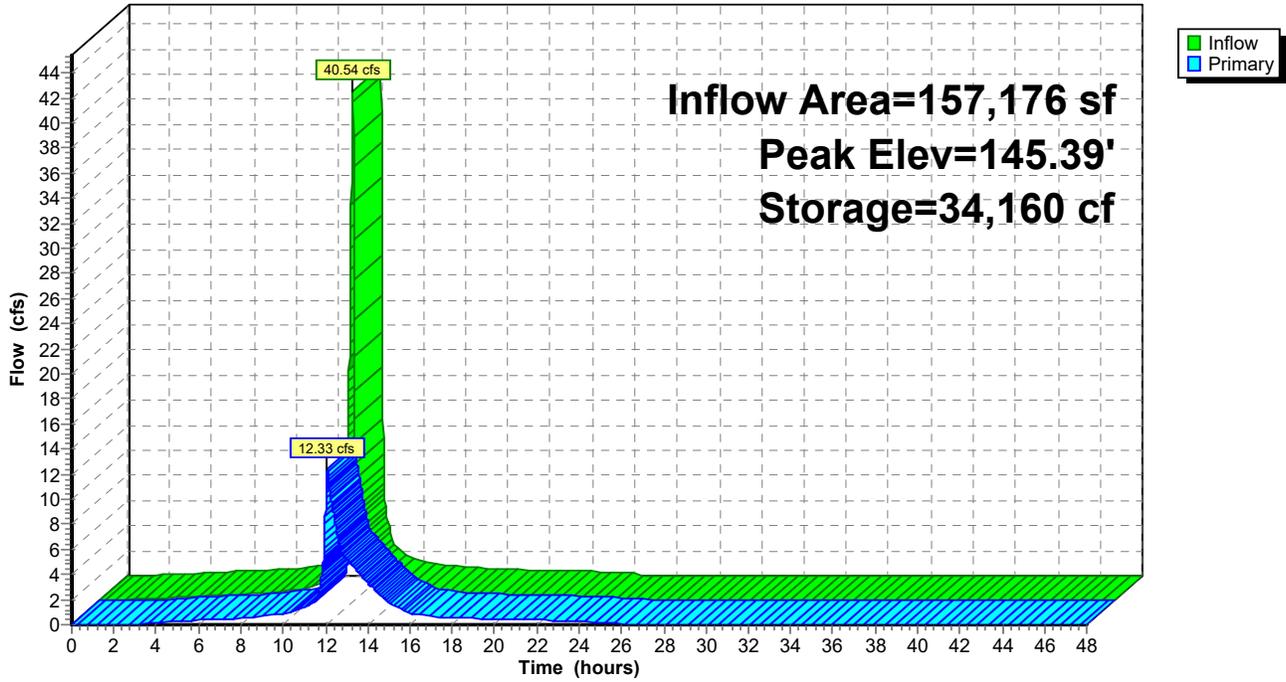
2,005.1 cy Field

1,177.1 cy Stone



Pond 2A: UGS Chamber

Hydrograph



APPENDIX C

PROPOSED HYDRAULIC ANALYSIS (10-YEAR STORM)

Computation Tables

Hydraulic Profiles

Conduit FlexTable: Hydraulic Grade Line Computations

Label	Start Node	Stop Node	Diameter (in)	Length (3D) (ft)	System Rational Flow (cfs)	Flow (cfs)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Slope (Calculated) (ft/ft)	Invert (Start) (ft)	Invert (Stop) (ft)
CO-1	CB-10	HS-1D (STORM)	18.0	67.1	6.78	6.78	8.92	3.84	0.005	143.19	142.87
CO-3	CB-13	CB-01	18.0	65.2	1.68	1.68	11.06	0.95	0.008	145.50	145.00
CO-4	2A-OUT	MH-5	24.0	63.7	0.00	7.36	74.02	15.05	0.077	141.92	141.00
CO-5	MH-5	CB-11	24.0	128.8	0.00	7.36	29.43	7.79	0.017	140.00	136.80
Pipe - (1) (STORM)	CB-01	CB-02	18.0	109.5	5.08	5.08	9.35	2.88	0.006	145.00	144.47
Pipe - (2) (STORM)	CB-02	MH-01 (STORM)	24.0	148.7	9.43	9.43	18.97	3.00	0.005	143.97	143.23
Pipe - (4) (STORM)	CB-04	CB-03	18.0	101.9	4.34	4.34	11.29	2.46	0.008	145.75	144.94
Pipe - (5) (STORM)	CB-03	MH-01 (STORM)	18.0	128.7	9.17	9.17	12.31	5.19	0.010	144.94	143.73
Pipe - (6) (STORM)	MH-01 (STORM)	HS-2A (STORM)	24.0	37.3	17.01	17.01	18.55	5.42	0.007	143.23	142.84
Pipe - (7) (STORM)	HS-2A (STORM)	2A-IN	24.0	9.6	16.79	16.79	20.23	7.20	0.008	142.84	142.80
Pipe - (9) (STORM)	CB-05	CB-06	18.0	26.5	0.72	0.72	24.58	6.16	0.039	148.00	146.00
Pipe - (10) (STORM)	CB-07	CB-08	18.0	69.1	5.56	5.56	8.11	3.15	0.004	145.50	145.18
Pipe - (11) (STORM)	CB-06	CB-07	18.0	95.0	3.12	3.12	7.82	1.76	0.004	146.00	145.50
Pipe - (12) (STORM)	MH-02 (STORM)	MH-03 (STORM)	24.0	213.5	0.00	3.23	16.19	4.02	0.005	142.38	141.34
Pipe - (13) (STORM)	MH-03 (STORM)	O-1	24.0	240.7	0.00	6.55	16.24	4.89	0.005	141.34	140.00
Pipe - (14) (STORM)	1B-OUT	MH-02 (STORM)	24.0	328.8	0.00	3.23	16.12	4.01	0.005	144.00	142.38
Pipe - (15) (STORM)	CB-09	MH-04 (STORM)	18.0	135.5	2.16	2.16	8.89	4.15	0.005	144.50	143.90
Pipe - (17) (STORM)	HS-1D (STORM)	1D-IN	18.0	19.7	6.65	6.65	14.69	8.11	0.014	142.87	142.80
Pipe - (18) (STORM)	MH-04 (STORM)	CB-10	18.0	89.1	2.09	2.09	11.03	1.18	0.008	143.90	143.19
Pipe - (19) (STORM)	1D-OUT	MH-03 (STORM)	24.0	28.4	0.00	3.32	34.13	6.89	0.023	142.00	141.34
Pipe - (22) (STORM)	HS-1B (STORM)	1B-IN	18.0	23.3	8.19	8.19	10.50	6.57	0.010	144.89	144.80
Pipe - (23) (STORM)	CB-08	HS-1B (STORM)	18.0	76.1	8.27	8.27	8.94	4.68	0.007	145.18	144.89
Pipe - (24) (STORM)	CB-11	CB-12	24.0	43.9	5.31	12.67	37.89	10.86	0.028	136.80	135.65
Pipe - (25) (STORM)	CB-12	O-2	24.0	10.1	11.96	19.32	22.71	8.12	0.010	135.65	135.60

Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
145.36	145.15	145.10	144.89	145.75	146.65
147.43	147.42	147.42	147.41	148.00	147.50
143.26	143.08	142.88	141.57	145.54	143.43
141.34	138.97	140.96	138.89	143.43	140.90
147.38	147.22	147.25	147.10	147.50	147.50
147.09	146.91	146.95	146.76	147.50	150.70
147.97	147.85	147.88	147.76	148.25	148.25
147.69	147.02	147.27	146.60	148.25	150.70
146.44	146.11	145.98	145.66	150.70	150.50
145.03	144.99	144.32	144.23	150.50	145.54
148.42	147.77	148.31	147.77	150.50	148.50
147.60	147.45	147.45	147.30	148.50	149.25
147.75	147.68	147.71	147.63	148.50	148.50
143.24	142.88	143.01	142.86	148.50	148.60
142.59	141.26	142.25	140.88	148.60	142.00
144.86	143.43	144.63	143.37	149.00	148.50
145.57	145.53	145.52	145.51	146.80	147.50
144.37	144.34	143.90	143.70	146.65	145.04
145.50	145.48	145.48	145.46	147.50	145.75
142.90	142.88	142.76	142.86	148.20	148.60
146.53	146.45	146.00	145.83	150.50	147.04
147.13	146.89	146.79	146.54	149.25	150.50
138.69	138.56	138.29	138.31	140.90	140.90
138.05	138.01	137.23	137.10	140.90	137.60

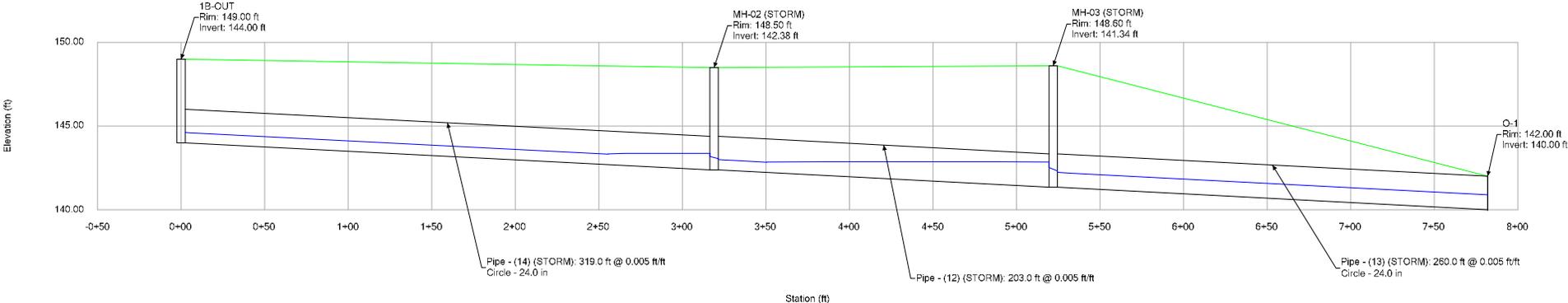
Conduit FlexTable: Storm Drain Computations

Start Node	Stop Node	Length (3D) (ft)	Upstream Inlet Area (acres)	Upstream Inlet C	System CA (acres)	System Flow Time (min)	System Intensity (in/h)	Flow (cfs)	Capacity (Full Flow) (cfs)	Diameter (in)	Manning's n
CB-02	MH-01 (STORM)	148.7	(N/A)	(N/A)	1.554	7.652	6.022	9.43	18.97	24.0	0.011
CB-03	MH-01 (STORM)	128.7	(N/A)	(N/A)	1.415	6.665	6.431	9.17	12.31	18.0	0.011
MH-01 (STORM)	HS-2A (STORM)	37.3	(N/A)	(N/A)	2.969	8.468	5.684	17.01	18.55	24.0	0.013
CB-05	CB-06	26.5	(N/A)	(N/A)	0.106	6.000	6.706	0.72	24.58	18.0	0.011
HS-2A (STORM)	2A-IN	9.6	(N/A)	(N/A)	2.969	8.646	5.611	16.79	20.23	24.0	0.013
CB-07	CB-08	69.1	(N/A)	(N/A)	0.896	7.329	6.156	5.56	8.11	18.0	0.011
CB-08	HS-1B (STORM)	76.1	(N/A)	(N/A)	1.370	7.726	5.991	8.27	8.94	18.0	0.013
CB-06	CB-07	95.0	(N/A)	(N/A)	0.465	6.138	6.649	3.12	7.82	18.0	0.011
CB-04	CB-03	101.9	(N/A)	(N/A)	0.642	6.000	6.706	4.34	11.29	18.0	0.011
HS-1B (STORM)	1B-IN	23.3	(N/A)	(N/A)	1.370	7.868	5.933	8.19	10.50	18.0	0.013
CB-01	CB-02	109.5	(N/A)	(N/A)	0.807	7.107	6.248	5.08	9.35	18.0	0.011
CB-09	MH-04 (STORM)	135.5	(N/A)	(N/A)	0.319	6.000	6.706	2.16	8.89	18.0	0.011
MH-04 (STORM)	CB-10	89.1	(N/A)	(N/A)	0.319	6.470	6.511	2.09	11.03	18.0	0.011
HS-1D (STORM)	1D-IN	19.7	(N/A)	(N/A)	1.123	8.006	5.876	6.65	14.69	18.0	0.011
MH-02 (STORM)	MH-03 (STORM)	213.5	(N/A)	(N/A)	0.000	1.326	6.706	3.23	16.19	24.0	0.013
MH-03 (STORM)	O-1	240.7	(N/A)	(N/A)	0.000	2.168	6.706	6.55	16.24	24.0	0.013
1D-OUT	MH-03 (STORM)	28.4	(N/A)	(N/A)	0.000	0.000	6.706	3.32	34.13	24.0	0.013
1B-OUT	MH-02 (STORM)	328.8	(N/A)	(N/A)	0.000	0.000	6.706	3.23	16.12	24.0	0.013
CB-11	CB-12	43.9	(N/A)	(N/A)	0.785	6.000	6.706	12.67	37.89	24.0	0.013
CB-12	O-2	10.1	(N/A)	(N/A)	1.776	6.063	6.680	19.32	22.71	24.0	0.013
CB-10	HS-1D (STORM)	67.1	(N/A)	(N/A)	1.123	7.736	5.987	6.78	8.92	18.0	0.011
CB-13	CB-01	65.2	(N/A)	(N/A)	0.248	6.000	6.706	1.68	11.06	18.0	0.011
2A-OUT	MH-5	63.7	(N/A)	(N/A)	0.000	0.000	6.706	7.36	74.02	24.0	0.011
MH-5	CB-11	128.8	(N/A)	(N/A)	0.000	0.013	6.706	7.36	29.43	24.0	0.013

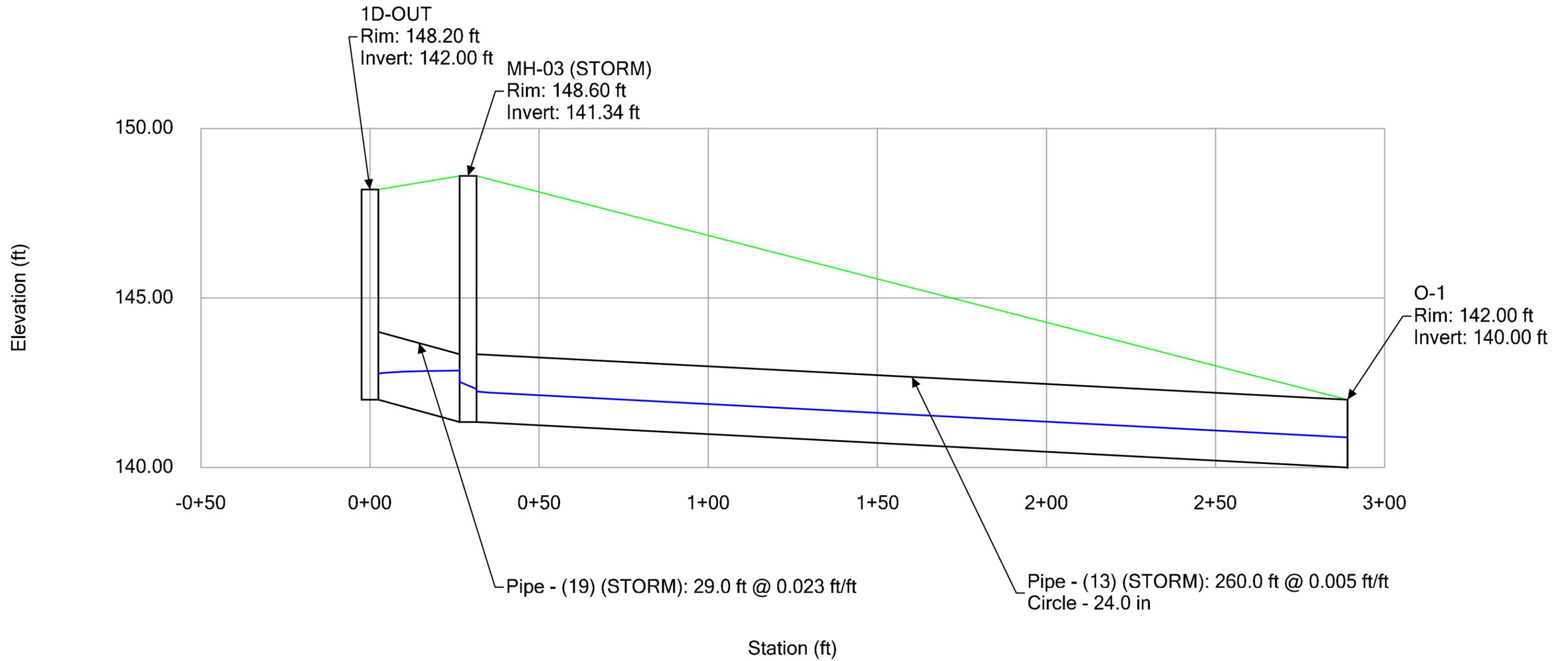
Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)
3.00	143.97	143.23	0.005
5.19	144.94	143.73	0.010
5.42	143.23	142.84	0.007
6.16	148.00	146.00	0.039
7.20	142.84	142.80	0.008
3.15	145.50	145.18	0.004
4.68	145.18	144.89	0.007
1.76	146.00	145.50	0.004
2.46	145.75	144.94	0.008
6.57	144.89	144.80	0.010
2.88	145.00	144.47	0.006
4.15	144.50	143.90	0.005
1.18	143.90	143.19	0.008
8.11	142.87	142.80	0.014
4.02	142.38	141.34	0.005
4.89	141.34	140.00	0.005
6.89	142.00	141.34	0.023
4.01	144.00	142.38	0.005
10.86	136.80	135.65	0.028
8.12	135.65	135.60	0.010
3.84	143.19	142.87	0.005
0.95	145.50	145.00	0.008
15.05	141.92	141.00	0.077
7.79	140.00	136.80	0.017

Profile Report

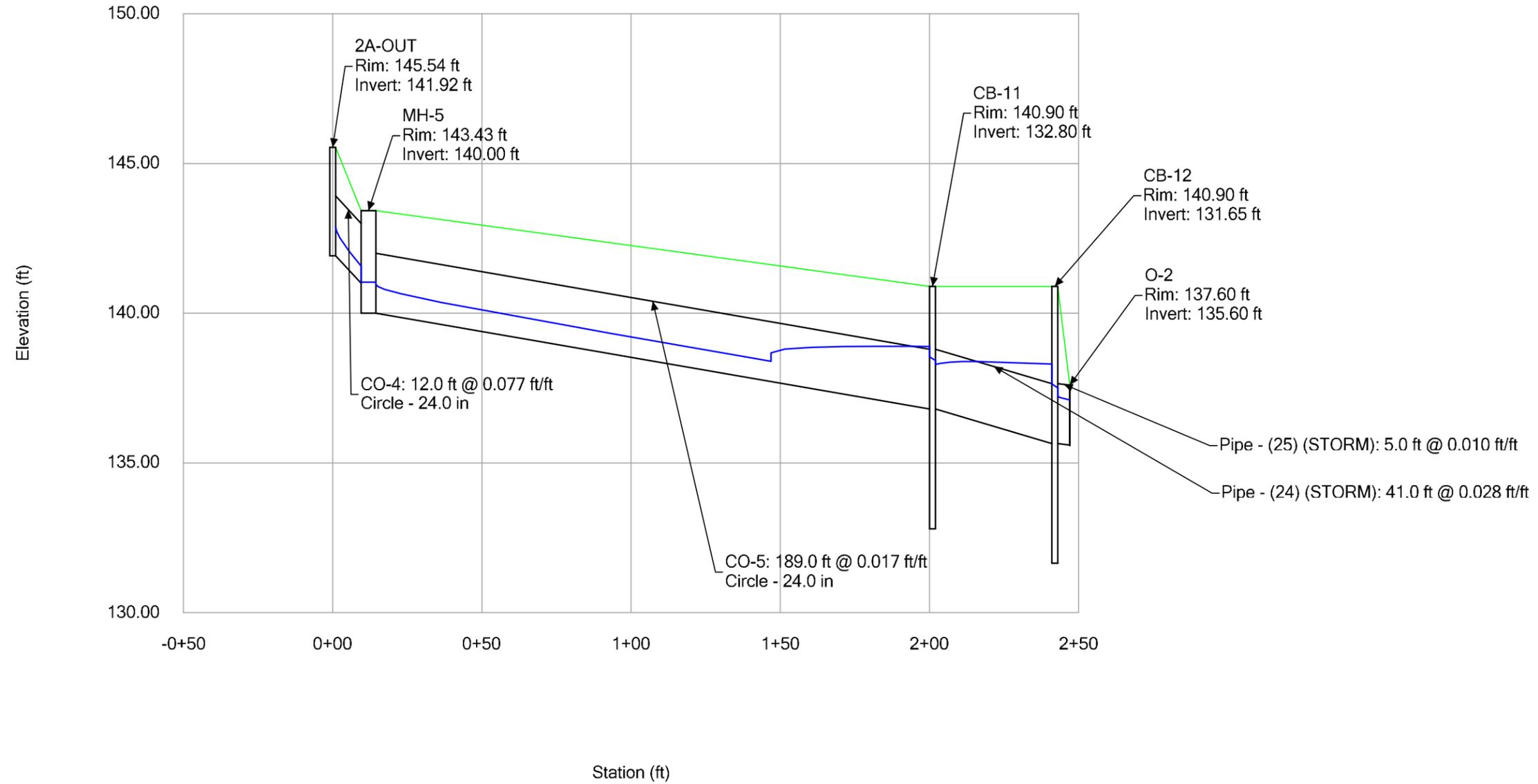
Engineering Profile - 1B-OUT to O-1 (C-DAT-1901517-Proposed-Hydraulics.stsw)



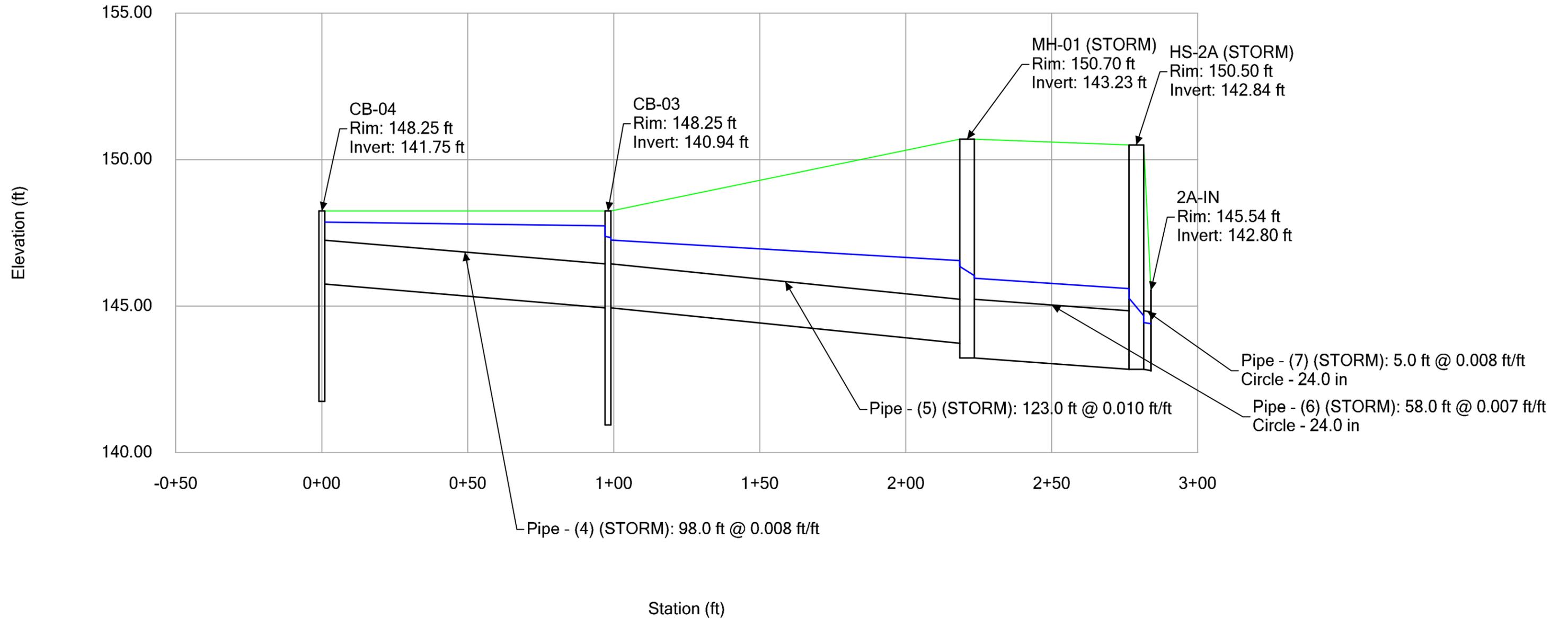
Profile Report
Engineering Profile - 1D-OUT to O-1 (C-DAT-1901517-Proposed-Hydraulics.stsw)



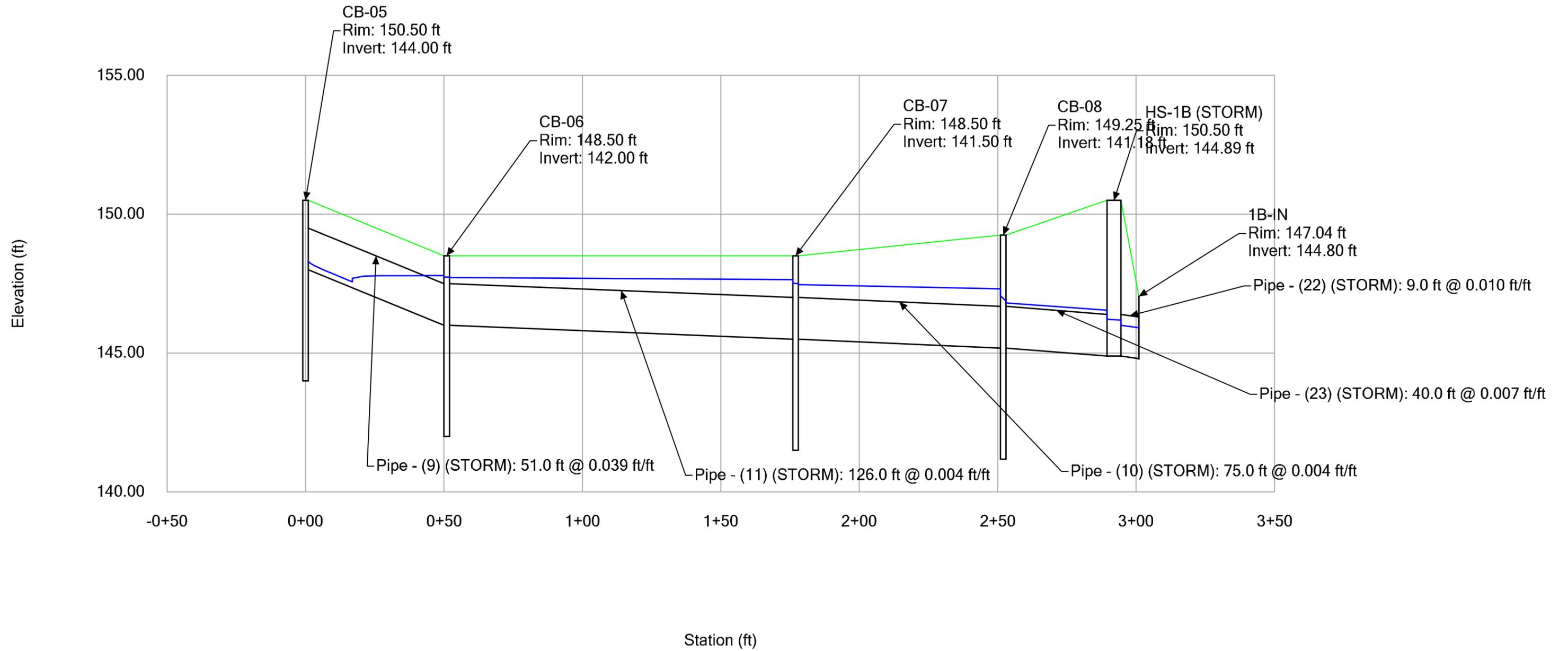
Profile Report
Engineering Profile - 2A-OUT to O-2 (C-DAT-1901517-Proposed-Hydraulics.stsw)



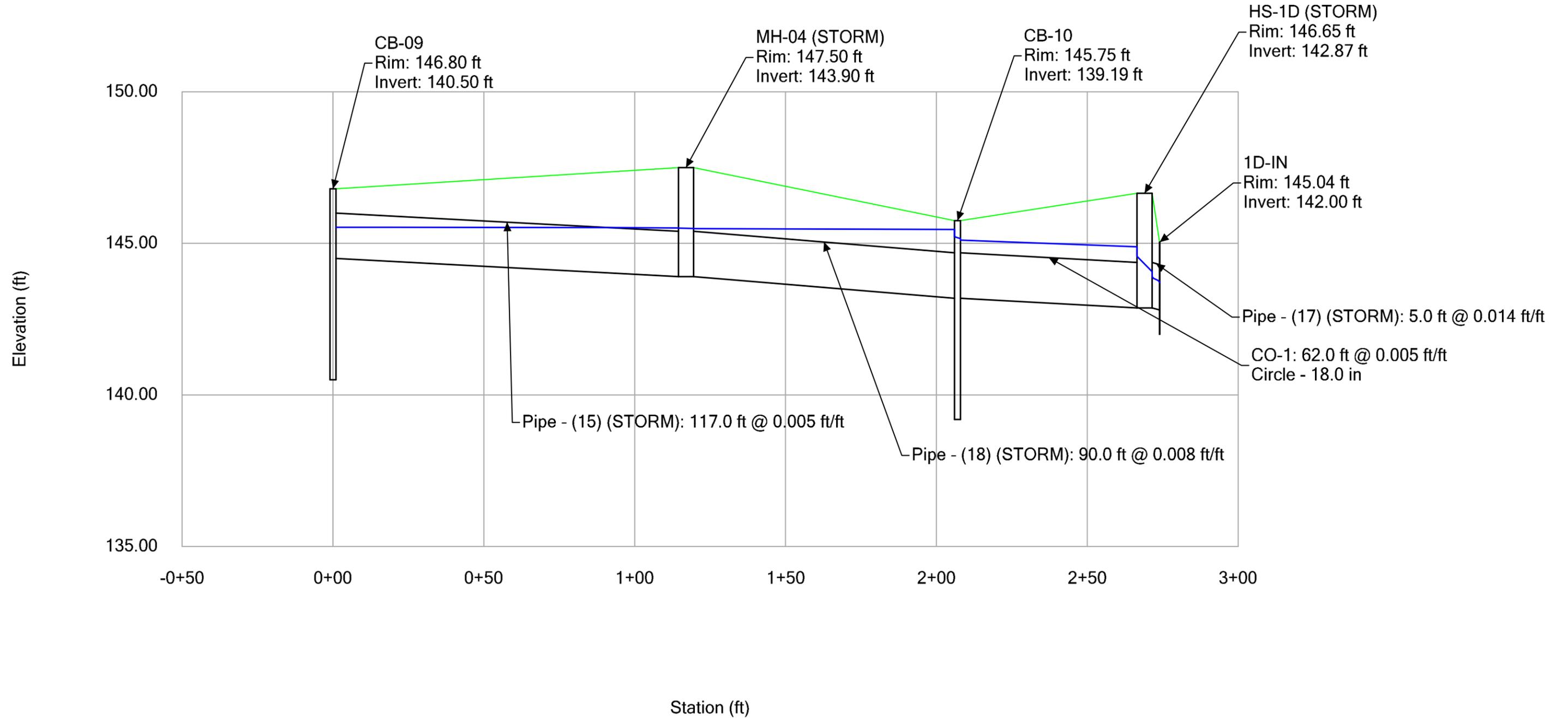
Profile Report
Engineering Profile - CB-04 to 2A-IN (C-DAT-1901517-Proposed-Hydraulics.stsw)



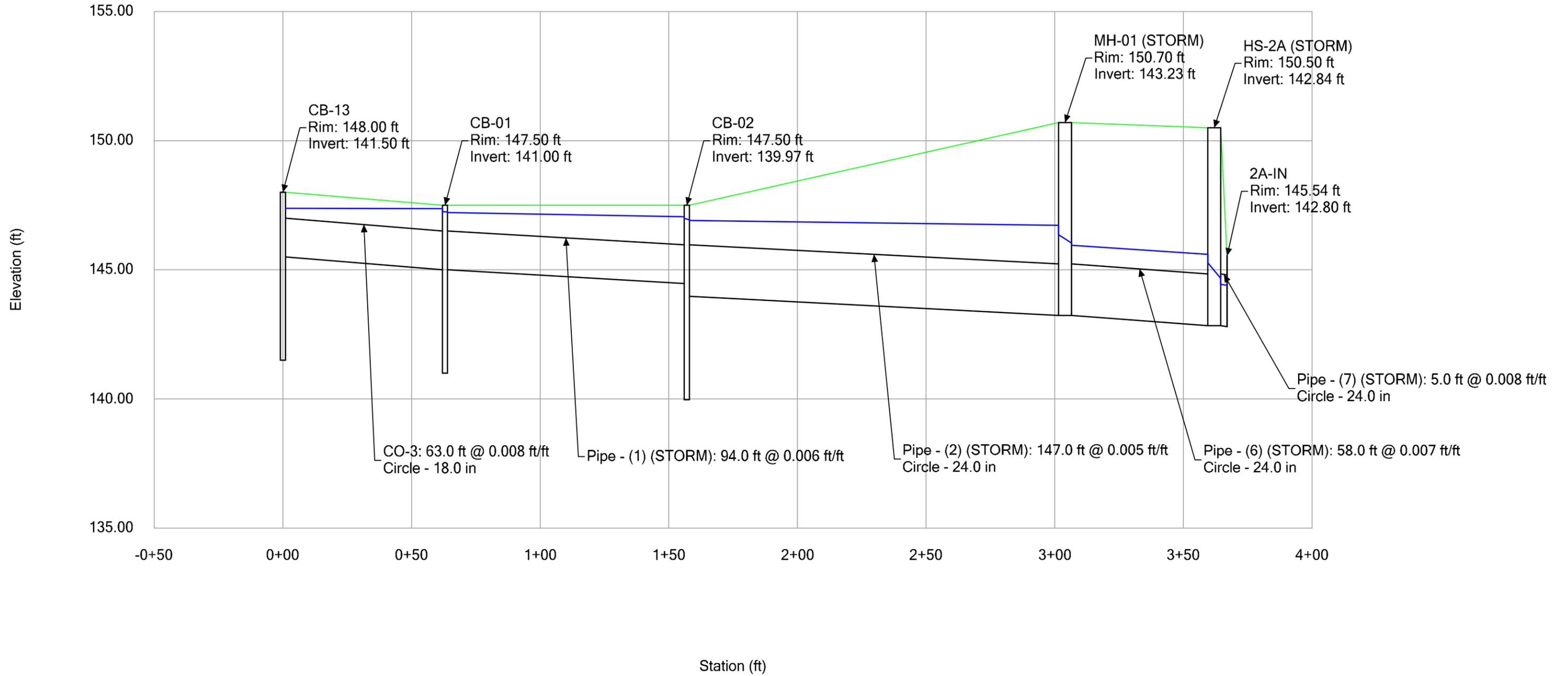
Profile Report
Engineering Profile - CB-05 to 1B-IN (C-DAT-1901517-Proposed-Hydraulics.stsw)



Profile Report
Engineering Profile - CB-09 to 1A-IN (C-DAT-1901517-Proposed-Hydraulics.stsw)



Profile Report
Engineering Profile - CB-13 to 2A-IN (C-DAT-1901517-Proposed-Hydraulics.stsw)



APPENDIX D

WATER QUALITY CALCULATIONS

Water Quality Volume and Groundwater Recharge Calculations
Treatment Train Efficiency Worksheet

Best Management Practice (BMP) Treatment Train Efficiency Worksheet

Prepared for: Town of Hingham
Proposed Development
100 Industrial Park Road
Hingham, Massachusetts

Prepared by:
BL Companies
355 Research Parkway
Meriden, Connecticut

Date prepared:
March 6, 2020

Overall Site Treatment Train Efficiency

	<u>BMP</u>	<u>BMP Description</u>	<u>Type of Treatment</u>	<u>Efficiency Rate %</u>
$E_t = [1 - (1 - E_1)(1 - E_2)(1 - E_3)(1 - E_4)(1 - E_5)] * 100$	E1	Impervious Surface Sweeping***	Pretreatment	10
	E2	Deep Sump Hooded Catch Basin	Pretreatment	25
	E3	Subsurface Chambers and Bioretention Systems	Treatment	80

Overall Treatment Train Efficiency (Et)=

87 % Total Suspended Solids (TSS) Removal

* 80% require per Mass DEP

** Manufacturers claim 80% TSS removal

*** Schueler 1996 & EPA 1993

**** University of New Hampshire

Water Quality for Detention 1A

PROJECT	Proposed Development
DATE	3/6/2020
ADDRESS	100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) =	71741	square feet
Area (A) =	1.65	acres
Area (A) =	0.00257	square miles
Design Precipitation (P) =	1	inch
% Impervious Cover (I) =	0.00	
Volumetric Runoff Coefficient (R) =	0.050	

WQV =	0.007	ac-ft
	298.92	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area =	0	square feet
Hydrologic Group A =	0.60	inch
Required Recharge Volume =	0	cu-ft

Water Quality for Detention 1B

PROJECT Proposed Development
DATE 3/6/2020
ADDRESS 100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) = 94703 square feet
Area (A) = 2.17 acres
Area (A) = 0.00340 square miles
Design Precipitation (P) = 1 inch
% Impervious Cover (I) = 55.30
Volumetric Runoff Coefficient (R) = 0.548

WQV =	0.099	ac-ft
	4322.40	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area = 21543 square feet
Hydrologic Group A = 0.60 inch
Required Recharge Volume = 1077 cu-ft

Water Quality for PDA-1C (Roof)

PROJECT	Proposed Development
DATE	3/6/2020
ADDRESS	100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) =	143469	square feet
Area (A) =	3.29	acres
Area (A) =	0.00515	square miles
Design Precipitation (P) =	1	inch
% Impervious Cover (I) =	100.00	
Volumetric Runoff Coefficient (R) =	0.950	

WQV =	0.261	ac-ft
	11357.95	cu-ft

*Note: Existing Roof Discharge

GROUNDWATER RECHARGE CALCULATION

New Impervious Area =	0	square feet
Hydrologic Group A =	0.60	inch
Required Recharge Volume =	0	cu-ft

Water Quality for Detention 1D

PROJECT	Proposed Development
DATE	3/6/2020
ADDRESS	100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) =	56959	square feet
Area (A) =	1.31	acres
Area (A) =	0.00204	square miles
Design Precipitation (P) =	1	inch
% Impervious Cover (I) =	93.00	
Volumetric Runoff Coefficient (R) =	0.887	

WQV =	0.097	ac-ft
	4210.21	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area =	9820	square feet
Hydrologic Group A =	0.60	inch
Required Recharge Volume =	491	cu-ft

Water Quality for Detention 2A

PROJECT	Proposed Development
DATE	3/6/2020
ADDRESS	100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) =	157176	square feet
Area (A) =	3.61	acres
Area (A) =	0.00564	square miles
Design Precipitation (P) =	1	inch
% Impervious Cover (I) =	87.20	
Volumetric Runoff Coefficient (R) =	0.835	

WQV =	0.251	ac-ft
	10934.19	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area =	57201	square feet
Hydrologic Group A =	0.60	inch
Required Recharge Volume =	2860	cu-ft

Water Quality for Filter Box 2Ba

PROJECT	Proposed Development
DATE	3/6/2020
ADDRESS	100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) =	32131	square feet
Area (A) =	0.74	acres
Area (A) =	0.00115	square miles
Design Precipitation (P) =	1	inch
% Impervious Cover (I) =	78.20	
Volumetric Runoff Coefficient (R) =	0.754	

WQV =	0.046	ac-ft
	2018.36	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area =	0	square feet
Hydrologic Group A =	0.60	inch
Required Recharge Volume =	0	cu-ft

Water Quality for Filter Box 2Bb

PROJECT	Proposed Development
DATE	3/6/2020
ADDRESS	100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) =	49813	square feet
Area (A) =	1.14	acres
Area (A) =	0.00179	square miles
Design Precipitation (P) =	1	inch
% Impervious Cover (I) =	85.40	
Volumetric Runoff Coefficient (R) =	0.819	

WQV =	0.078	ac-ft
	3398.07	cu-ft

GROUNDWATER RECHARGE CALCULATION

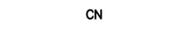
New Impervious Area =	47	square feet
Hydrologic Group A =	0.60	inch
Required Recharge Volume =	2	cu-ft

APPENDIX E

DRAINAGE MAPS

- ED-1 – Existing Drainage Area Mapping
- PD-1 – Proposed Drainage Area Mapping
- CB-1 – Proposed Sub-catchment Drainage Area Mapping
- GD-0-2 – Grading and Drainage Plan
- EC-0-5 – Erosion Control Plan, Notes, and Details
- 1 OF 1 – Resource Area Delineation Plan

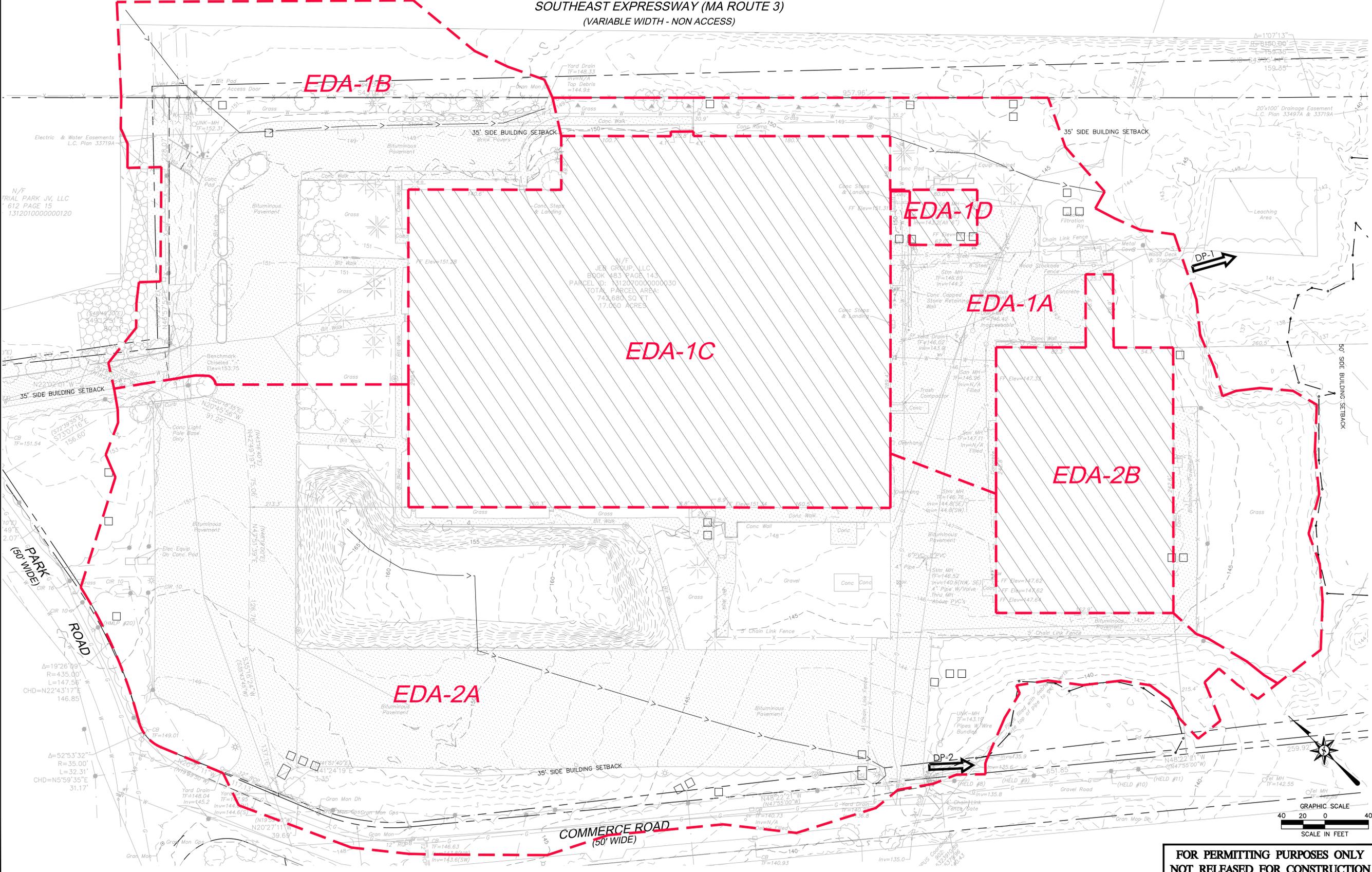
LEGEND

-  PROPERTY LINE
-  EXISTING DRAINAGE AREA BOUNDARY
-  TIME OF CONCENTRATION FLOW PATH
-  DESIGN POINT
-  CURVE NUMBER
-  TIME OF CONCENTRATION

SOUTHEAST EXPRESSWAY (MA ROUTE 3)
(VARIABLE WIDTH - NON ACCESS)

EXISTING HYDROLOGY INFORMATION

DRAINAGE AREA	TOTAL AREA (S.F.)	IMPERVIOUS AREA (S.F.)	PERVIOUS AREA (S.F.)	PERCENT IMPERVIOUS (%)	CN	TIME OF CONCENTRATIONS (MIN.)
EDA-1A	101,071	36,485	64,586	36.1%	88	29.7
EDA-1B	105,544	37,851	67,693	35.9%	88	31.9
EDA-1C	143,469	143,469	0	100.0%	98	6.0
EDA-1D	3,147	3,147	0	100.0%	98	6.0
EDA-2A	280,385	153,862	126,523	54.9%	89	20.1
EDA-2B	41,203	41,203	0	100.0%	98	6.0



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PROPOSED HYDROLOGY INFORMATION

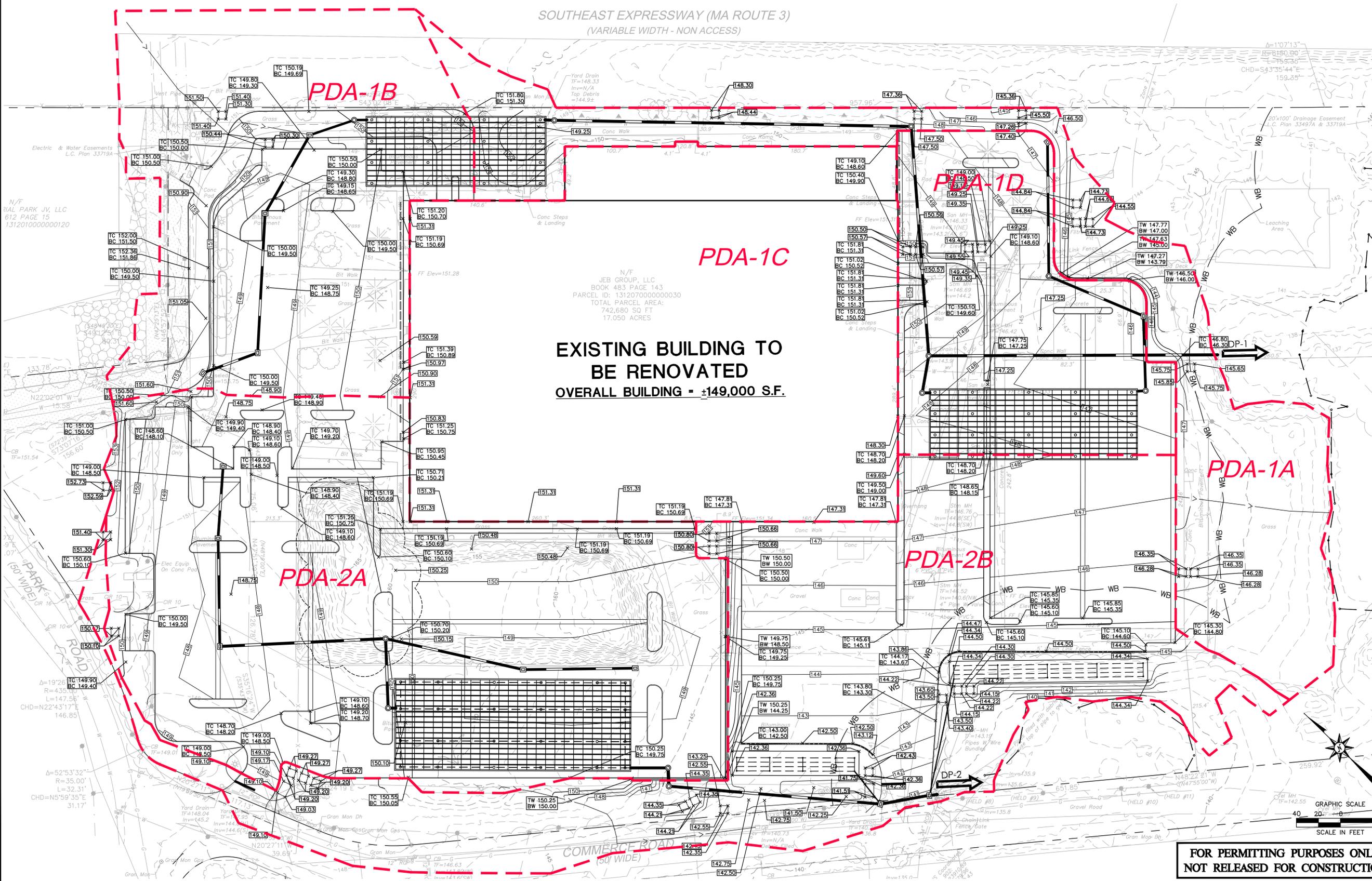
DRAINAGE AREA	TOTAL AREA (S.F.)	IMPERVIOUS AREA (S.F.)	PERVIOUS AREA (S.F.)	PERCENT IMPERVIOUS (%)	CN	TIME OF CONCENTRATIONS (MIN.)
PDA-1A	71,741	502	71,239	0.7%	82	11.8
PDA-1B	94,703	52,580	42,123	55.5%	91	25.3
PDA-1C	143,469	143,469	0	100.0%	98	6.0
PDA-1D	56,959	53,259	3,700	93.5%	97	6.0
PDA-2A	157,176	137,288	19,888	87.3%	96	6.0
PDA-2B	150,771	88,315	62,456	58.6%	91	8.4

LEGEND

- PROPERTY LINE
- PROPOSED DRAINAGE AREA BOUNDARY
- TIME OF CONCENTRATION FLOW PATH
- DESIGN POINT
- CURVE NUMBER
- TIME OF CONCENTRATION

SOUTHEAST EXPRESSWAY (MA ROUTE 3)
(VARIABLE WIDTH - NON ACCESS)

EXISTING BUILDING TO BE RENOVATED
OVERALL BUILDING = ±149,000 S.F.



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REVISIONS	No.	Date	Desc.
Designed			P.G.M.
Drawn			P.G.M.
Reviewed			
Scale			1"=40'
Project No.			1901517
Date			03/06/2020
CAD File:			PD190151701
Title			PROPOSED DRAINAGE AREA MAP
Sheet No.			PD-1

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 2020/03/06 10:58:58 AM PAVIA\PAVIA\OneDrive\Documents\190151701.dwg

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PROPOSED HYDROLOGY INFORMATION

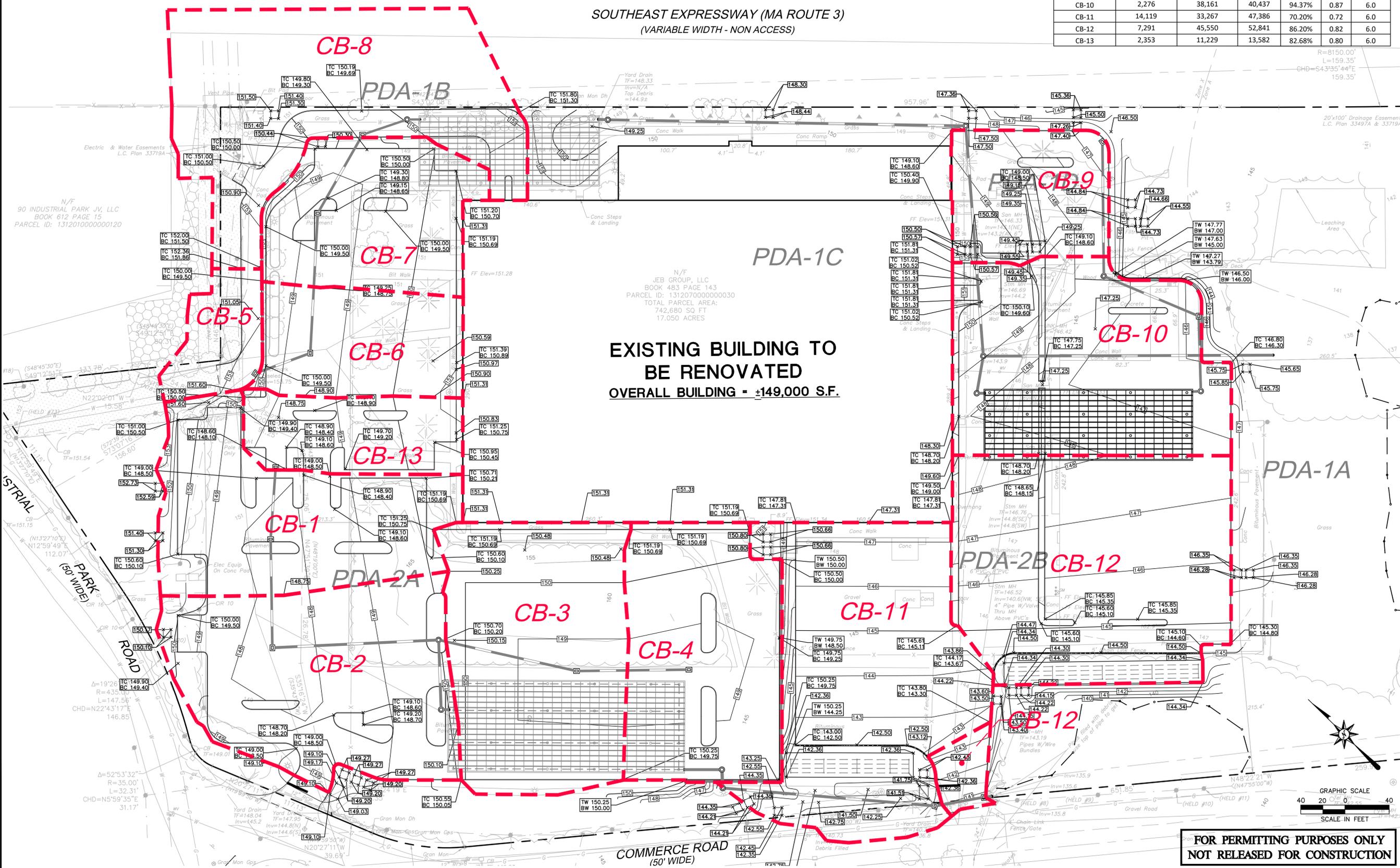
Catchment Area	Pervious (sf)	Impervious (sf)	Total (sf)	% Imp	RC	Tc (min)
CB-1	8,579	24,179	32,758	73.81%	0.74	6.0
CB-2	6,391	34,016	40,407	84.18%	0.81	6.0
CB-3	1,509	36,900	38,409	96.07%	0.88	6.0
CB-4	1,316	30,653	31,969	95.88%	0.88	6.0
CB-5	4,025	3,808	7,833	48.61%	0.59	6.0
CB-6	436	17,208	17,644	97.53%	0.89	6.0
CB-7	4,426	19,392	23,818	81.42%	0.79	6.0
CB-8	33,754	11,686	45,440	25.72%	0.45	6.0
CB-9	1,620	14,904	16,524	90.20%	0.84	6.0
CB-10	2,276	38,161	40,437	94.37%	0.87	6.0
CB-11	14,119	33,267	47,386	70.20%	0.72	6.0
CB-12	7,291	45,550	52,841	86.20%	0.82	6.0
CB-13	2,353	11,229	13,582	82.68%	0.80	6.0

LEGEND

- PROPERTY LINE
- - - PROPOSED SUB-CATCHMENT DRAINAGE AREA BOUNDARY
- RC RATIONAL COEFFICIENT
- Tc TIME OF CONCENTRATION

NOTES

THE FOLLOWING IS CONSIDERED "IMPERVIOUS AREA": BITUMINOUS DRIVEWAYS, BITUMINOUS WALKS, BITUMINOUS CURB, CONCRETE DRIVEWAYS, CONCRETE WALKS, CONCRETE PADS, CONCRETE CURB AND BUILDINGS.



SOUTHEAST EXPRESSWAY (MA ROUTE 3)
(VARIABLE WIDTH - NON ACCESS)

EXISTING BUILDING TO BE RENOVATED
OVERALL BUILDING - ±149,000 S.F.

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PLOT DATE: 03/06/2020 11:51:17 AM
PLOT BY: JACOB C. BROWN

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B-1 SURFACE EL.=140.0 BOTTOM EL.=138.5 GROUNDWATER TRAITS EL.=141	
DEPTH (FT)	DESCRIPTION
0-0.25	ASPHALT: APPROXIMATELY 3.0-INCHES OF ASPHALT AND APPROXIMATELY 3-INCHES OF BASE COURSE.
0.25-0.5	FILL (S-1A): MEDIUM DENSE, BROWN TO BROWN, FINE TO MEDIUM SAND, LITTLE SILT, SEVERAL ASPHALT PARTICLES/FRAGMENTS. MOST. [USDA CLASSIFICATION: SANDY LOAM]
0.5-2.5	GLACIAL DRIFT (S-1B): MEDIUM DENSE, BROWN, FINE TO COARSE SAND, SOME SILT, LITTLE FINE GRAVEL. [USDA CLASSIFICATION: SANDY LOAM]
2.5-4.5	GLACIAL DRIFT (S-2): MEDIUM DENSE, DARK BROWN TO GRAY, SILT, SOME FINE TO MEDIUM SAND, VERY FEW ROOTS AND ORGANIC FIBERS. MOST TO WET. [USDA CLASSIFICATION: SILT LOAM]
4.5-8.5	GLACIAL DRIFT (S-3): MEDIUM DENSE, TAN TO GRAY, FINE TO MEDIUM SAND, SOME SILT, VERY FEW ROOTS. MOST, VERY FANT REDOXIMORPHIC STAINING PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
6.5-8.5	GLACIAL DRIFT (S-4): MEDIUM DENSE, GRAY TO ORANGISH-BROWN, FINE SAND, SOME SILT, MOST TO WET. SEVERAL REDOXIMORPHIC STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
8.5-10.5	GLACIAL DRIFT (S-5): MEDIUM DENSE, GRAY TO BROWN, FINE SAND, SOME SILT, WET, FEW REDOXIMORPHIC STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SANDY LOAM]

B-2 SURFACE EL.=142.0 BOTTOM EL.=138.5 GROUNDWATER TRAITS EL.=138.5	
DEPTH (FT)	DESCRIPTION
0-0.4	ASPHALT: APPROXIMATELY 5.0-INCHES OF ASPHALT AND APPROXIMATELY 6-INCHES OF BASE COURSE.
0.4-1.5	FILL (S-1A): MEDIUM DENSE, BROWN TO GRAY, FINE TO COARSE SAND AND FINE GRAVEL, TRACE SILT, MOST. [USDA CLASSIFICATION: VERY GRAVELLY SAND]
1.5-2.5	GLACIAL DRIFT (S-1B): MEDIUM DENSE, BROWN TO DARK GRAY, SILT, SOME FINE TO MEDIUM SAND, MOST. [USDA CLASSIFICATION: SILT LOAM]
2.5-3.0	GLACIAL DRIFT (S-2A): MEDIUM DENSE, DARK BROWN TO GRAY, SILT, SOME FINE TO MEDIUM SAND, VERY FEW ROOTS AND ORGANIC FIBERS. MOST TO WET. [USDA CLASSIFICATION: SILT LOAM]
3.0-4.5	GLACIAL DRIFT (S-2B): MEDIUM DENSE, BROWN TO GRAY, FINE TO MEDIUM SAND, SOME SILT, WET. [USDA CLASSIFICATION: SANDY LOAM]
4.5-8.5	GLACIAL DRIFT (S-3): DENSE, BROWN TO GRAY, FINE TO MEDIUM SAND AND SILT, WET, SEVERAL REDOXIMORPHIC STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
6.5-8.5	GLACIAL DRIFT (S-4): MEDIUM DENSE, TAN TO ORANGISH-BROWN, SILT AND FINE TO MEDIUM SAND, TRACE CLAY, WET. SEVERAL REDOXIMORPHIC STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SILT LOAM]

B-3 SURFACE EL.=150.0 BOTTOM EL.=143.7 GROUNDWATER TRAITS EL.=145.0	
DEPTH (FT)	DESCRIPTION
0-0.2	ASPHALT: APPROXIMATELY 2.0-INCHES OF ASPHALT AND APPROXIMATELY 2-INCHES OF BASE COURSE.
0.2-1.5	FILL (S-1A): MEDIUM DENSE, BROWN, FINE TO COARSE SAND, TRACE SILT, VERY FINE ASPHALT PARTICLES/FRAGMENTS. MOST. [USDA CLASSIFICATION: SANDY LOAM]
1.5-2.25	GLACIAL DRIFT (S-1B): MEDIUM DENSE, BROWN TO ORANGISH-BROWN, FINE TO COARSE SAND AND SILT, TRACE FINE GRAVEL, MOST, END OF SPLIT SPOON SAMPLE PRESENT WITH REDOXIMORPHIC STAINING. [USDA CLASSIFICATION: SANDY LOAM]
2.25-4.5	GLACIAL DRIFT (S-2): S-2, MEDIUM DENSE, BROWN TO PINK TO GRAY, SILT AND FINE TO COARSE SAND, LITTLE LITTLE FINE GRAVEL, MOST. WEATHERED BEDROCK FRAGMENTS PRESENT IN SOIL CUTTINGS AND TIP OF SPLIT-SPOON. [USDA CLASSIFICATION: SILT LOAM]
4.5-6.3	WEATHERED BEDROCK (S-3): VERY DENSE, ORANGISH-BROWN TO PINK TO GRAY, WEATHERED BEDROCK PARTICLES/FRAGMENTS. MOST TO WET, BORING TERMINATED AT 6.3 FEET ON AUGER REFUSAL.

B-4 SURFACE EL.=148.0 BOTTOM EL.=142.5 GROUNDWATER TRAITS EL.=NOT ENCOUNTERED	
DEPTH (FT)	DESCRIPTION
0-0.2	ASPHALT: APPROXIMATELY 1.8-INCHES OF ASPHALT AND APPROXIMATELY 3-INCHES OF BASE COURSE.
0.2-0.5	FILL
0.5-2.5	GLACIAL DRIFT (S-1): MEDIUM DENSE, BROWN TO LIGHT GRAY, FINE TO COARSE SAND, SOME FINE TO COARSE GRAVEL, SOME SILT, MOST. [USDA CLASSIFICATION: GRAVELLY SANDY LOAM]
2.5-3.3	GLACIAL DRIFT (S-2): VERY DENSE, BROWN TO WHITE FINE TO COARSE SAND AND FINE GRAVEL, LITTLE SILT, MOST, WEATHERED BEDROCK FRAGMENTS PRESENT IN SOIL CUTTINGS AND TIP OF SPLIT-SPOON. APPROXIMATELY 1200 PSI OF DOWNWARD PRESSURE PERFORMED AT 3.5 FEET BGS. [USDA CLASSIFICATION: VERY GRAVELLY SANDY LOAM]
3.3-3.5	WEATHERED BEDROCK (S-3): BORING TERMINATED AT 3.5 FEET ON AUGER REFUSAL.

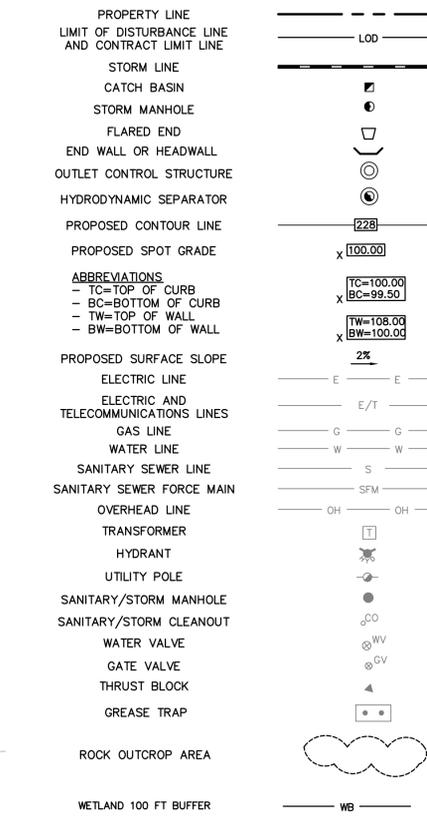
B-5 SURFACE EL.=150.0 BOTTOM EL.=141.5 GROUNDWATER TRAITS EL.=143.5	
DEPTH (FT)	DESCRIPTION
0-0.2	ASPHALT: APPROXIMATELY 1.8-INCHES OF ASPHALT AND APPROXIMATELY 3-INCHES OF BASE COURSE.
0.2-0.5	FILL
0.5-2.5	GLACIAL DRIFT (S-1): DENSE, BROWN, FINE TO MEDIUM SAND, SOME SILT, LITTLE FINE GRAVEL, MOST. STRONG RESISTANCE WHEN ADVANCING AUGERS TO 2.5 FEET BGS. [USDA CLASSIFICATION: SANDY LOAM]
2.5-4.5	GLACIAL DRIFT (S-2): S-2, VERY DENSE, TAN TO LIGHT GRAY, FINE TO COARSE SAND AND SILT, SOME FINE TO COARSE GRAVEL, MOST. FANT REDOXIMORPHIC STAINING PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
4.5-6.3	GLACIAL DRIFT (S-3): VERY DENSE, GRAY, ONE PIECE OF COARSE GRAVEL PRESENT WITHIN SPLIT-SPOON SAMPLE. WEATHERED BEDROCK FRAGMENTS PRESENT IN SOIL CUTTINGS AND TIP OF SPLIT-SPOON. [USDA CLASSIFICATION: GRAVELLY SANDY LOAM]
6.5-8.5	GLACIAL DRIFT (S-4): DENSE, TAN TO LIGHT GRAY, FINE TO COARSE SAND, SOME SILT, LITTLE FINE GRAVEL, WET, FANT REDOXIMORPHIC STAINING PRESENT. [USDA CLASSIFICATION: SANDY LOAM]

B-6 SURFACE EL.=145.0 BOTTOM EL.=136.0 GROUNDWATER TRAITS EL.=142.0	
DEPTH (FT)	DESCRIPTION
0-0.5	ASPHALT: APPROXIMATELY 5.4-INCHES OF ASPHALT AND APPROXIMATELY 4-INCHES OF BASE COURSE.
0.5-2.5	FILL (S-1): MEDIUM DENSE, BROWN TO TAN, FINE TO MEDIUM SAND, SOME SILT, MOST. [USDA CLASSIFICATION: SANDY LOAM]
2.5-4.5	GLACIAL DRIFT (S-2): MEDIUM DENSE, DARK BROWN TO TAN, FINE TO COARSE SAND, SOME SILT, WET. VERY FANT REDOXIMORPHIC STAINING PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
4.5-6.3	GLACIAL DRIFT (S-3): VERY DENSE, GRAY, ONE PIECE OF COARSE GRAVEL PRESENT WITHIN SPLIT-SPOON SAMPLE. WEATHERED BEDROCK FRAGMENTS PRESENT IN SOIL CUTTINGS AND TIP OF SPLIT-SPOON. [USDA CLASSIFICATION: SANDY LOAM]
6.5-8.5	GLACIAL DRIFT (S-4): DENSE, DARK BROWN TO DARK GRAY, FINE TO COARSE SAND, SOME SILT, WET. REDOXIMORPHIC STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SANDY LOAM]

B-7 SURFACE EL.=148.0 BOTTOM EL.=137.0 GROUNDWATER TRAITS EL.=141.5	
DEPTH (FT)	DESCRIPTION
0-0.5	ASPHALT: APPROXIMATELY 5.6-INCHES OF ASPHALT AND APPROXIMATELY 3-INCHES OF BASE COURSE.
0.5-2.5	FILL (S-1): DENSE, BROWN TO DARK GRAY, FINE TO COARSE SAND AND FINE TO COARSE GRAVEL, LITTLE SILT, VERY FEW ASPHALT PARTICLES/FRAGMENTS. MOST. [USDA CLASSIFICATION: SANDY LOAM]
2.5-4.5	GLACIAL DRIFT (S-2): MEDIUM DENSE, BROWN TO DARK GRAY, FINE TO COARSE SAND, SOME SILT, LITTLE FINE GRAVEL, VERY FEW ASPHALT PARTICLES, MOST TO WET. [USDA CLASSIFICATION: SANDY LOAM]
4.5-6.3	GLACIAL DRIFT (S-3): DENSE, DARK BROWN TO DARK GRAY, FINE TO COARSE SAND, SOME SILT, WET. REDOXIMORPHIC STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
6.5-8.5	GLACIAL DRIFT (S-4): DENSE, DARK BROWN TO ORANGISH-BROWN, SILT, SOME FINE TO COARSE SAND, TRACE FINE WOOD PARTICLES/FRAGMENTS, VERY FEW ROOTS, WET. [USDA CLASSIFICATION: SILT LOAM]

B-8 SURFACE EL.=147.0 BOTTOM EL.=136.5 GROUNDWATER TRAITS EL.=140.2	
DEPTH (FT)	DESCRIPTION
0-0.5	ASPHALT: APPROXIMATELY 3.5 TO 4.2-INCHES OF ASPHALT AND APPROXIMATELY 4-INCHES OF BASE COURSE.
0.5-2.5	FILL (S-1): S-1, MEDIUM DENSE, BROWN, FINE TO COARSE SAND, LITTLE SILT, TRACE FINE GRAVEL, VERY FINE BRICK AND ASPHALT PARTICLES/FRAGMENTS. MOST. [USDA CLASSIFICATION: SANDY LOAM]
2.5-3.0	GLACIAL DRIFT (S-2B): MEDIUM DENSE, TAN TO GRAY, FINE TO MEDIUM SAND, TRACE SILT, MOST, VERY FANT REDOXIMORPHIC STAINING PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
3.0-4.5	GLACIAL DRIFT (S-3): LOOSE TO MEDIUM DENSE, TAN, FINE TO MEDIUM SAND, TRACE SILT, MOST TO WET. FEW REDOXIMORPHIC STAINING POCKETS PRESENT. [USDA CLASSIFICATION: LOAMY SAND]
4.5-6.5	GLACIAL DRIFT (S-4): LOOSE, BROWN, FINE TO MEDIUM SAND, LITTLE SILT, WET, FEW REDOXIMORPHIC STAINING POCKETS PRESENT. [USDA CLASSIFICATION: LOAMY SAND]
6.5-8.5	GLACIAL DRIFT (S-5): LOOSE TO MEDIUM DENSE, BROWN, FINE TO MEDIUM SAND, LITTLE SILT, WET, FEW REDOXIMORPHIC STAINING POCKETS PRESENT. [USDA CLASSIFICATION: LOAMY SAND]

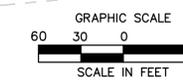
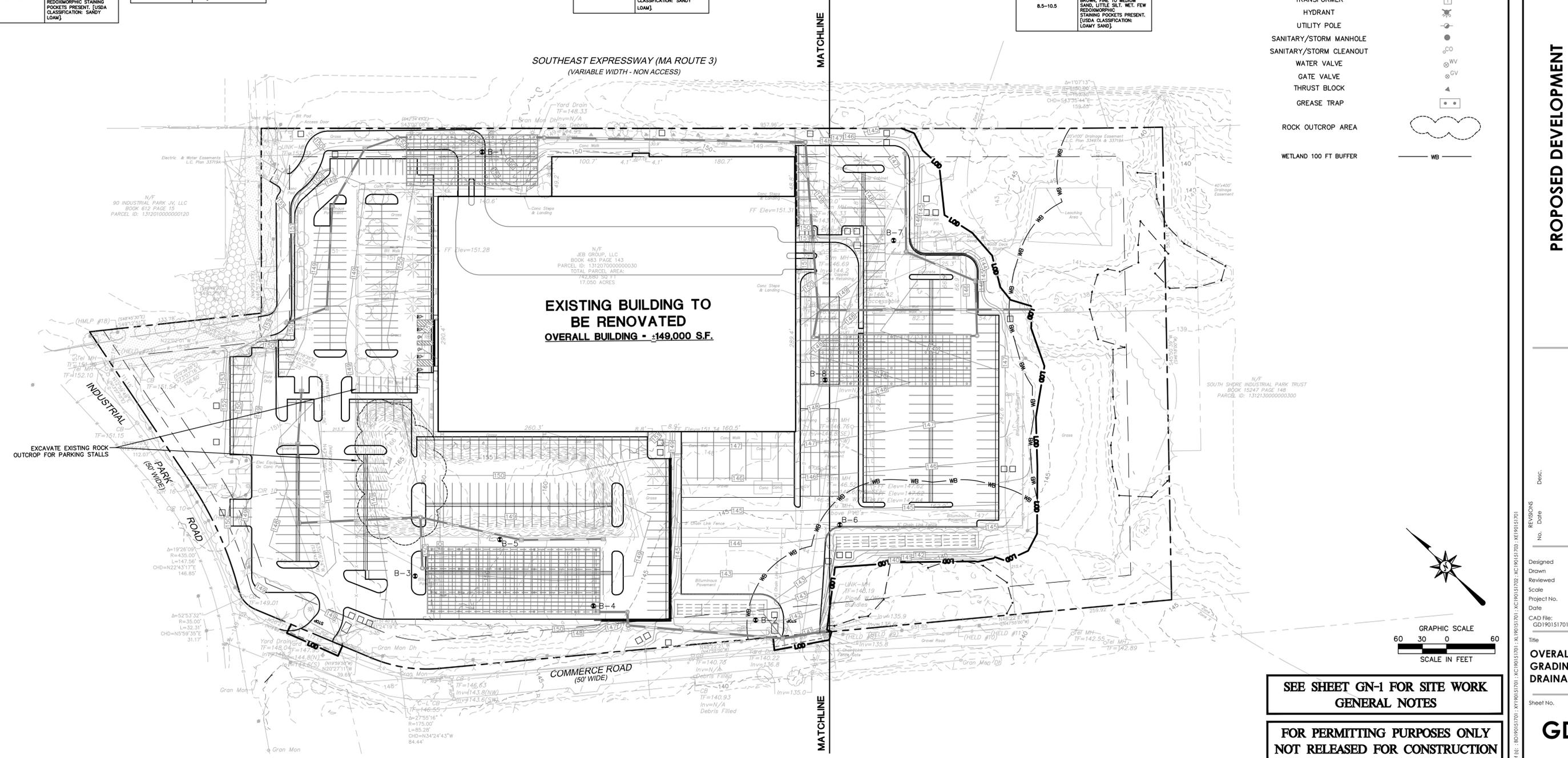
GRADING AND DRAINAGE LEGEND



SOUTHEAST EXPRESSWAY (MA ROUTE 3)
(VARIABLE WIDTH - NON ACCESS)

EXISTING BUILDING TO
BE RENOVATED
OVERALL BUILDING - 149,000 S.F.

COMMERCE ROAD
(50' WIDE)



SEE SHEET GN-1 FOR SITE WORK
GENERAL NOTES

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REVISIONS	
No.	Date

Designed A.T.K.
Drawn A.T.K.
Reviewed
Scale 1"=60'
Project No. 1901517
Date 03/06/2020
CAD File: GD190151701
Title
OVERALL GRADING AND DRAINAGE PLAN
Sheet No.

Mar 09, 2020 10:30am adduser C:\Users\PAV\OneDrive\GD190151701.dwg
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GRADING AND DRAINAGE LEGEND

PROPERTY LINE	---
LIMIT OF DISTURBANCE LINE AND CONTRACT LIMIT LINE	---
STORM LINE	---
CATCH BASIN	⊠
STORM MANHOLE	⊙
FLARED END	⊔
END WALL OR HEADWALL	⊔
OUTLET CONTROL STRUCTURE	⊙
HYDRODYNAMIC SEPARATOR	⊙
PROPOSED CONTOUR LINE	---(228)---
PROPOSED SPOT GRADE	x [100.00]
ABBREVIATIONS	
- TC=TOP OF CURB	[TC=100.00]
- BC=BOTTOM OF CURB	x [BC=99.50]
- TW=TOP OF WALL	[TW=108.00]
- BW=BOTTOM OF WALL	x [BW=100.00]
PROPOSED SURFACE SLOPE	2%
ELECTRIC LINE	E --- E
ELECTRIC AND TELECOMMUNICATIONS LINES	E/T --- E/T
GAS LINE	G --- G
WATER LINE	W --- W
SANITARY SEWER LINE	S --- S
SANITARY SEWER FORCE MAIN	SFM --- SFM
OVERHEAD LINE	OH --- OH
TRANSFORMER	⊠
HYDRANT	⊙
UTILITY POLE	⊙
SANITARY/STORM MANHOLE	⊙
SANITARY/STORM CLEANOUT	⊙
WATER VALVE	⊙
GATE VALVE	⊙
THRUST BLOCK	⊙
GREASE TRAP	⊙
ROCK OUTCROP AREA	⊙
WETLAND 100 FT BUFFER	WB --- WB



355 Research Parkway
Meriden, CT 06450
(203) 630-1406
(203) 630-2615 Fax

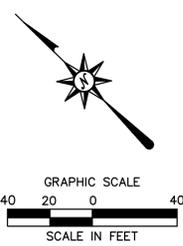
PROPOSED DEVELOPMENT
100 INDUSTRIAL PARK ROAD
HINGHAM, MASSACHUSETTS

REVISIONS	No.	Date	Desc.
Designed			A.T.K.
Drawn			A.T.K.
Reviewed			
Scale			1"=40'
Project No.			1901517
Date			03/06/2020
CAD File:			GD190151701
Title			GRADING AND DRAINAGE PLAN
Sheet No.			GD-1

SOUTHEAST EXPRESSWAY (MA ROUTE 3)
(VARIABLE WIDTH - NON ACCESS)

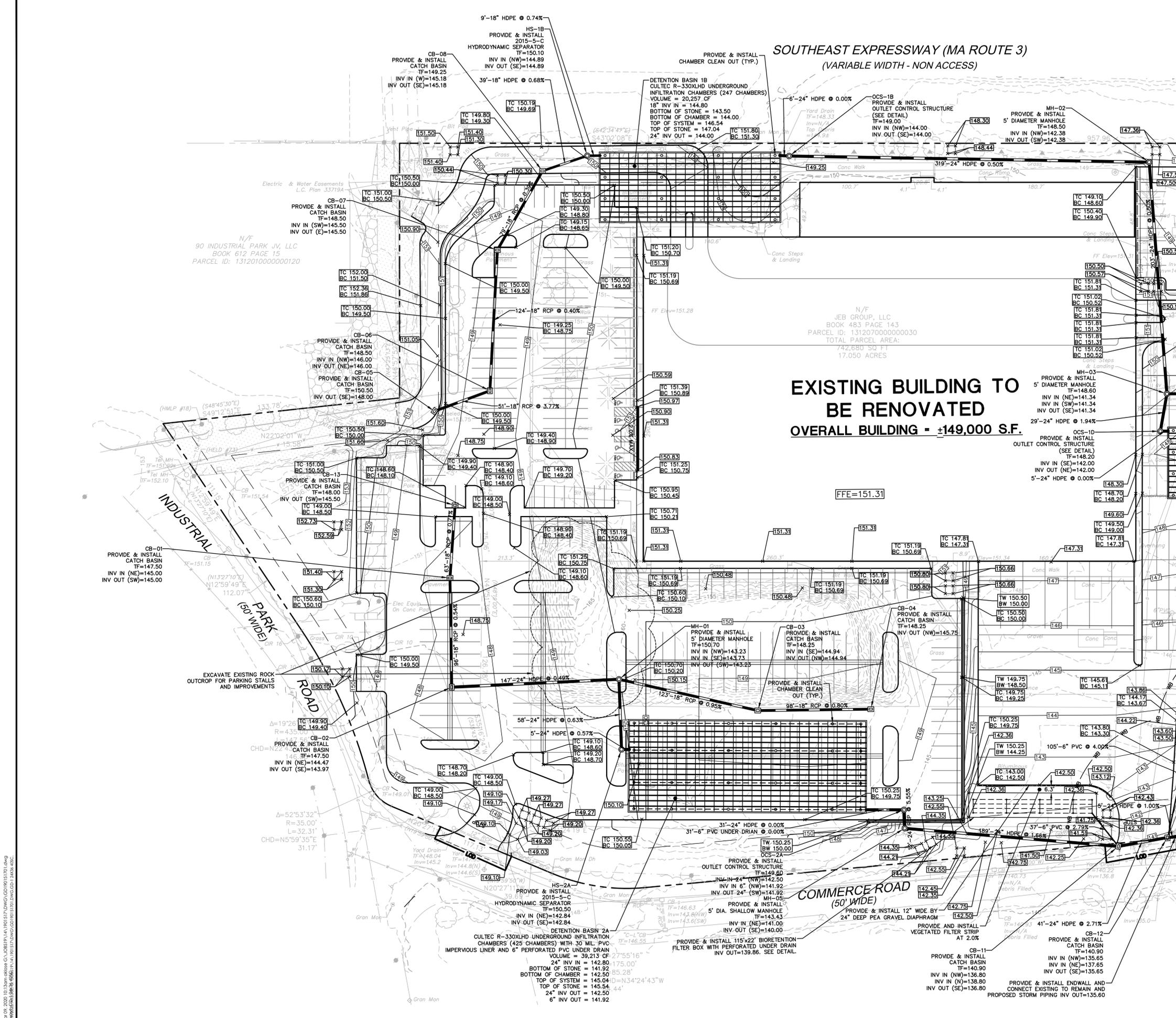
EXISTING BUILDING TO BE RENOVATED
OVERALL BUILDING - ±149,000 S.F.

MATCHLINE SEE SHEET GD-2



SEE SHEET GN-1 FOR SITE WORK GENERAL NOTES

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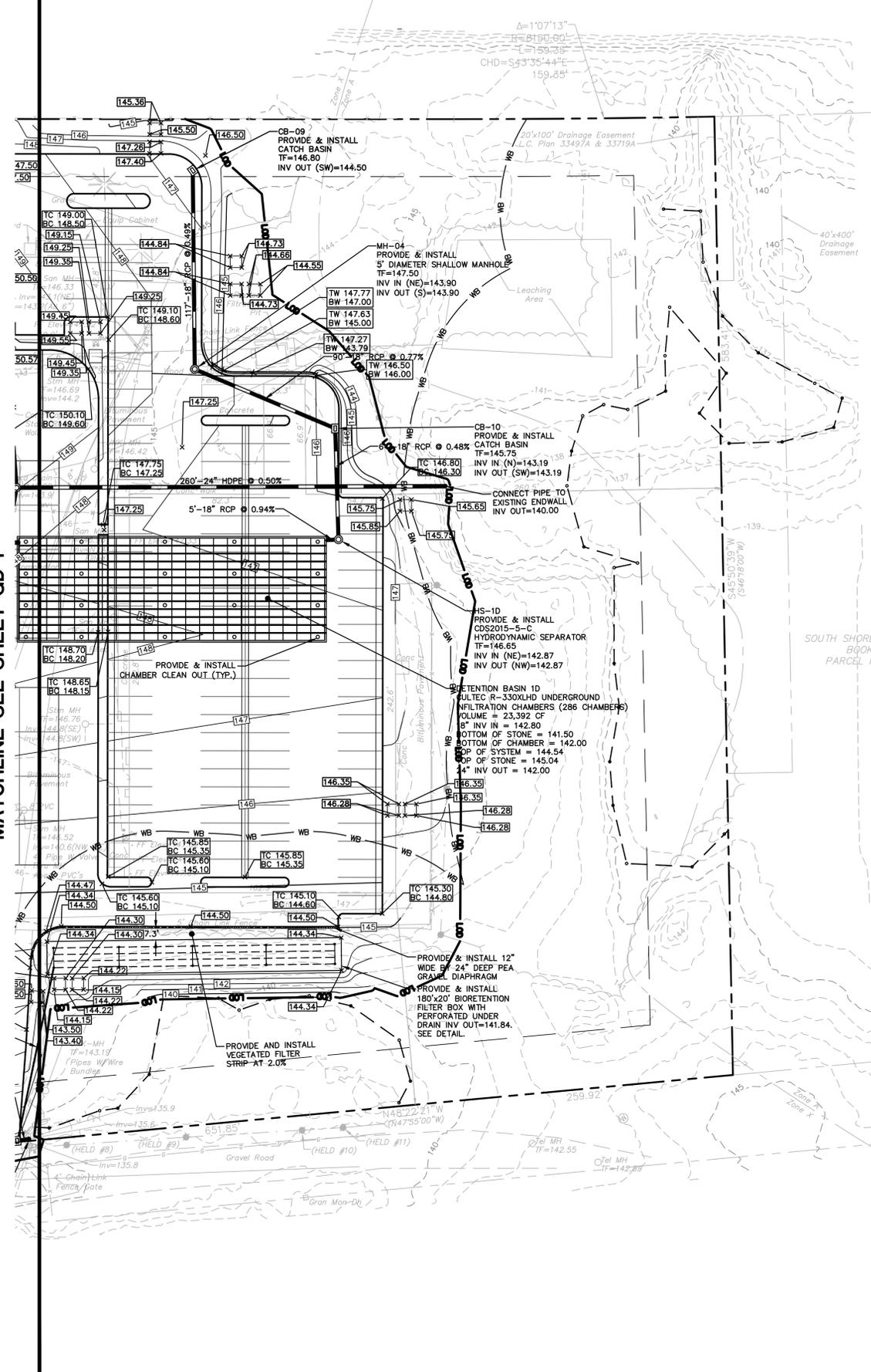
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PROPOSED DEVELOPMENT
100 INDUSTRIAL PARK ROAD
HINGHAM, MASSACHUSETTS

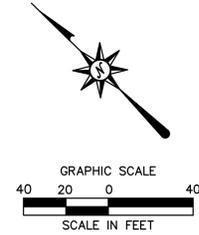
GRADING AND DRAINAGE LEGEND

PROPERTY LINE	---
LIMIT OF DISTURBANCE LINE AND CONTRACT LIMIT LINE	---
STORM LINE	---
CATCH BASIN	⊠
STORM MANHOLE	⊙
FLARED END	⊖
END WALL OR HEADWALL	⊔
OUTLET CONTROL STRUCTURE	⊙
HYDRODYNAMIC SEPARATOR	⊙
PROPOSED CONTOUR LINE	---
PROPOSED SPOT GRADE	x 100.00
ABBREVIATIONS	
- TC=TOP OF CURB	TC=100.00
- BC=BOTTOM OF CURB	BC=99.50
- TW=TOP OF WALL	TW=108.00
- BW=BOTTOM OF WALL	BW=100.00
PROPOSED SURFACE SLOPE	2%
ELECTRIC LINE	E E
ELECTRIC AND TELECOMMUNICATIONS LINES	E/T
GAS LINE	G G
WATER LINE	W W
SANITARY SEWER LINE	S
SANITARY SEWER FORCE MAIN	SFM
OVERHEAD LINE	OH OH
TRANSFORMER	⊠
HYDRANT	⊙
UTILITY POLE	⊙
SANITARY/STORM MANHOLE	⊙
SANITARY/STORM CLEANOUT	⊙
WATER VALVE	⊙
GATE VALVE	⊙
THRUST BLOCK	⊙
GREASE TRAP	⊙
ROCK OUTCROP AREA	⊖
WETLAND 100 FT BUFFER	WB

MATCHLINE SEE SHEET GD-1



N/F
SOUTH SHORE INDUSTRIAL PARK TRUST
BOOK 15247 PAGE 148
PARCEL ID: 1312130000000300



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REVISIONS	Desc.
No.	Date
Designed	A.T.K.
Drawn	A.T.K.
Reviewed	
Scale	1"=40'
Project No.	1901517
Date	03/06/2020
CAD File:	GD190151701
Title	GRADING AND DRAINAGE PLAN
Sheet No.	GD-2

PROPOSED DEVELOPMENT
100 INDUSTRIAL PARK ROAD
HINGHAM, MASSACHUSETTS

REVISIONS	Desc.
No.	Date

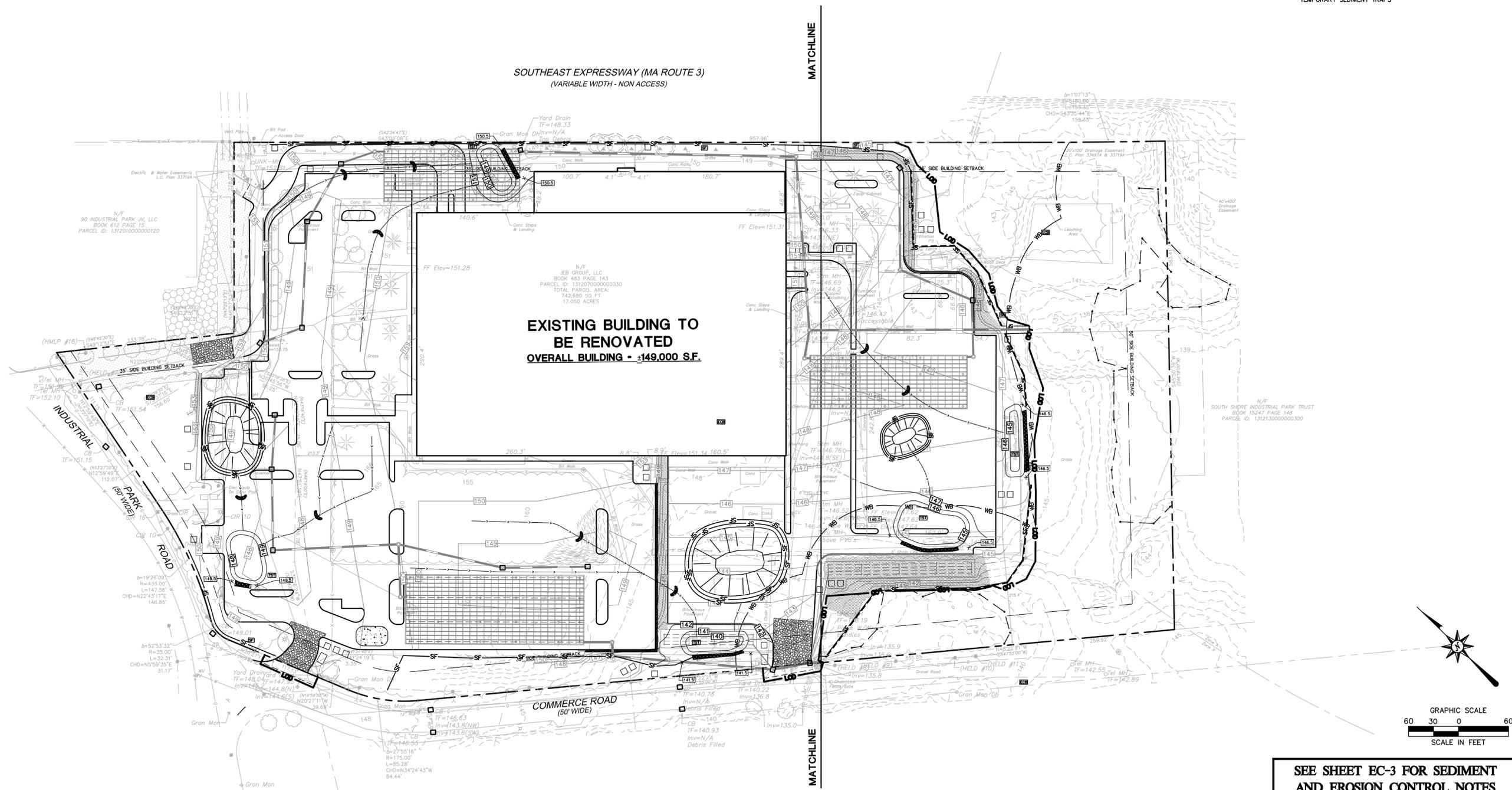
Designed	P.G.M.
Drawn	P.G.M.
Reviewed	
Scale	1"=60'
Project No.	1901517
Date	03/06/2020

CAD File:
EC190151701
Title
**OVERALL
SEDIMENT AND
EROSION
CONTROL PLAN**
Sheet No.

EC-0

EROSION CONTROL LEGEND:

CONTROL MEASURE	ILLUSTRATION
SILT SACK AT CATCH BASINS	
STONE CHECK DAM	
SILT FENCE	
SILT FENCE WITH HAYBALE BACKING (UTILIZE AT BASE OF SLOPE)	
CONSTRUCTION ENTRANCE	
LIMIT OF CLEARING	
LIMIT OF DISTURBANCE LINE AND CONTRACT LIMIT LINE	
STOCKPILE AREA WITH DOUBLE ROW OF SILT FENCE	
DIVERSION SWALE	
TEMPORARY SEDIMENT TRAP	
EROSION CONTROL BLANKET	
WETLAND 100 FT BUFFER	
RIP RAP SPILLWAY WITH WASHED AGGREGATE AT TEMPORARY SEDIMENT TRAPS	



**SEE SHEET EC-3 FOR SEDIMENT
AND EROSION CONTROL NOTES**

**FOR PERMITTING PURPOSES ONLY
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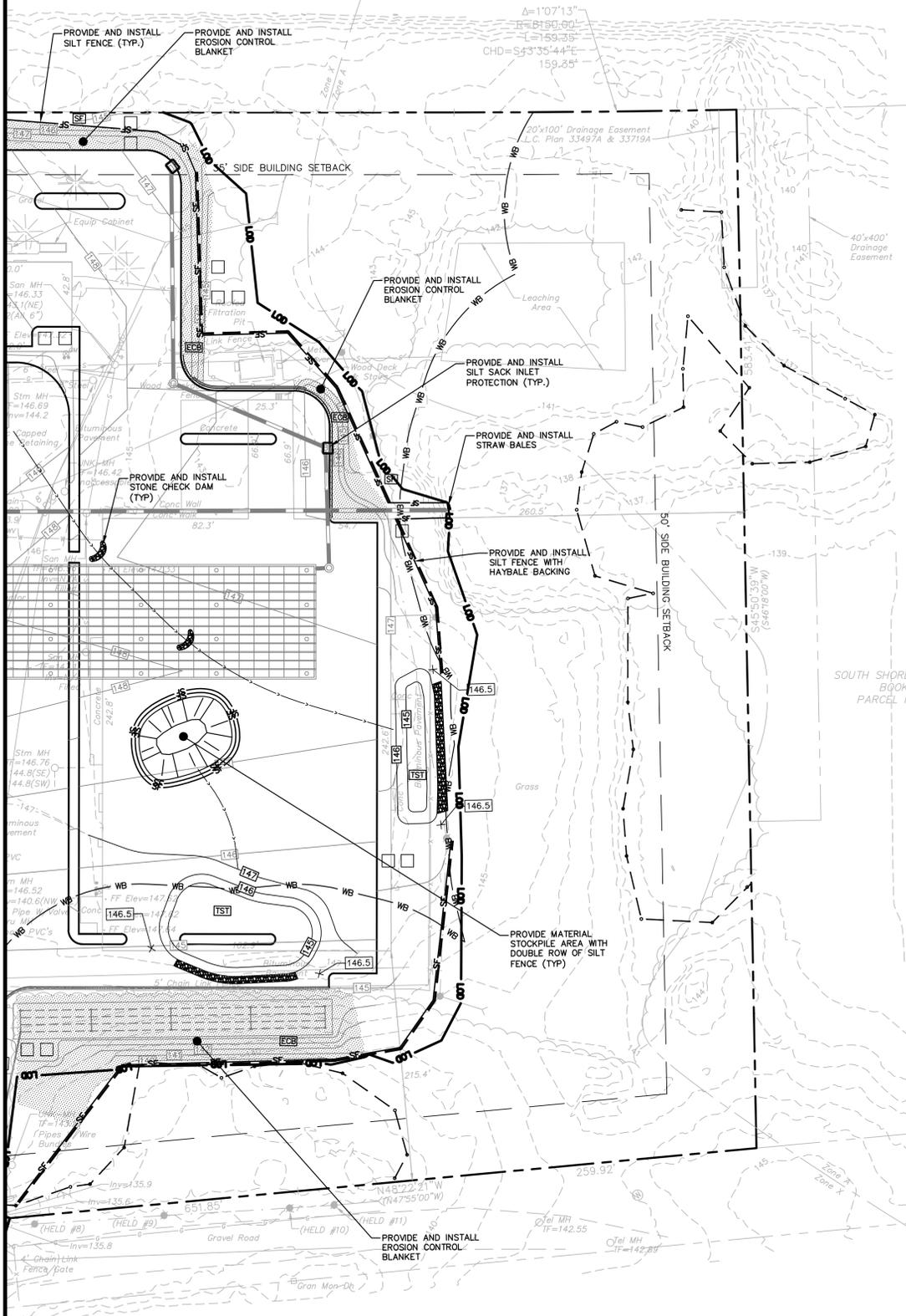
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PROPOSED DEVELOPMENT
100 INDUSTRIAL PARK ROAD
HINGHAM, MASSACHUSETTS

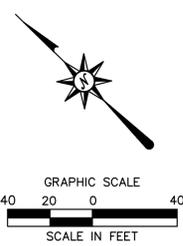
EROSION CONTROL LEGEND:

CONTROL MEASURE	ILLUSTRATION
SILT SACK AT CATCH BASINS	
STONE CHECK DAM	
SILT FENCE	
SILT FENCE WITH HAYBALE BACKING (UTILIZE AT BASE OF SLOPE)	
CONSTRUCTION ENTRANCE	
LIMIT OF CLEARING	
LIMIT OF DISTURBANCE LINE AND CONTRACT LIMIT LINE	
STOCKPILE AREA WITH DOUBLE ROW OF SILT FENCE	
DIVERSION SWALE	
TEMPORARY SEDIMENT TRAP	
EROSION CONTROL BLANKET	
WETLAND 100 FT BUFFER	
RIP RAP SPILLWAY WITH WASHED AGGREGATE AT TEMPORARY SEDIMENT TRAPS	

MATCHLINE SEE SHEET EC-1



N/F
SOUTH SHORE INDUSTRIAL PARK TRUST
BOOK 15247 PAGE 148
PARCEL ID: 1312130000000300



SEE SHEET EC-3 FOR SEDIMENT AND EROSION CONTROL NOTES

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REVISIONS	Desc.
No.	Date

Designed P.G.M.
Drawn P.G.M.
Reviewed
Scale 1"=40'
Project No. 1901517
Date 03/06/2020
CAD File: EC190151701
Title
SEDIMENT AND EROSION CONTROL PLAN
Sheet No.

EC-2

SEDIMENT AND EROSION CONTROL NOTES

SEDIMENT AND EROSION CONTROL NOTES – MASSACHUSETTS
 SEDIMENT & EROSION CONTROL NARRATIVE
 THE SEDIMENT AND EROSION CONTROL PLAN WAS DEVELOPED TO PROTECT THE EXISTING ROADWAY AND STORM DRAINAGE SYSTEMS, ADJACENT PROPERTIES, AND ANY ADJACENT WETLAND AREA AND ANY ADJACENT WATER COURSE FROM SEDIMENT LADEN SURFACE RUNOFF AND EROSION. A CONSTRUCTION SEQUENCE IS PROVIDED TO PROVIDE SURFACE RUNOFF EROSION CONTROLS PRIOR TO THE BEGINNING OF PROJECT DEMOLITION AND/OR CONSTRUCTION.

CONSTRUCTION SCHEDULE
 THE ANTICIPATED STARTING DATE FOR CONSTRUCTION IS SPRING 2020 WITH COMPLETION ANTICIPATED FALL 2020. APPROPRIATE SEDIMENT AND EROSION CONTROL MEASURES AS DESCRIBED HEREIN SHALL BE INSTALLED BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF ALL DEMOLITION OR CONSTRUCTION ACTIVITY. SCHEDULE WORK TO MINIMIZE THE LENGTH OF TIME THAT BARE SOIL WILL BE EXPOSED.

CONTINGENCY EROSION PLAN
 THE CONTRACTOR SHALL INSTALL ALL SPECIFIED SEDIMENT AND EROSION CONTROL MEASURES AND WILL BE REQUIRED TO MAINTAIN THEM IN THEIR INTENDED FUNCTIONING CONDITION. THE AGENTS OF THE MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT OR CONSERVATION COMMISSION AND/OR CIVIL ENGINEER SHALL HAVE THE AUTHORITY TO REQUIRE SUPPLEMENTAL MAINTENANCE OR ADDITIONAL MEASURES IF FIELD CONDITIONS ARE ENCOUNTERED BEYOND WHAT WOULD NORMALLY BE ANTICIPATED.

CONSTRUCTION SEQUENCE
 THE FOLLOWING CONSTRUCTION SEQUENCE IS RECOMMENDED:

- CONTACT MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT OR CONSERVATION COMMISSION AGENT AT LEAST FORTY-EIGHT (48) HOURS PRIOR TO COMMENCEMENT OF ANY DEMOLITION, CONSTRUCTION OR REGULATED ACTIVITY ON THIS PROJECT.
- CLEARING LIMITS SHALL BE PHYSICALLY MARKED IN THE FIELD AND APPROVED BY THE MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT OR CONSERVATION COMMISSION AGENT PRIOR TO THE START OF WORK ON THE SITE. INSTALL TREE PROTECTION AND PERIMETER SILT FENCE.
- CONSTRUCT STONE CONSTRUCTION ENTRANCE ANTI-TRACKING PADS AT CONSTRUCTION ENTRANCES/EXITS AND INSTALL FILTER FABRIC AROUND GRATES OF CATCH BASINS OR INSTALL SILT SACKS ON CATCH BASIN INLETS ON OFF SITE ROADS. INSTALL SILT FENCE AND OTHER EROSION CONTROL DEVICES INDICATED ON THESE PLANS AT PERIMETER OF PROPOSED SITE DISTURBANCE AND INSTALL ALL EROSION CONTROL MEASURES AND TREE PROTECTION INDICATED ON THESE PLANS. INSTALL SEDIMENT BASINS AND SEDIMENT TRAPS IF REQUIRED AT LOW AREAS OF SITE OR AS ORDERED BY THE ENGINEER OR AS SHOWN ON THESE PLANS.
- CLEAR AND GRUB SITE. STOCKPILE CHIPS. STOCKPILE TOPSOIL. INSTALL SEDIMENT AND EROSION CONTROLS AT STOCKPILES.
- SELECTIVE BUILDING AND SITE DEMOLITION AND REMOVAL. PAVEMENT REMOVAL.
- INSTALL SILT FENCE, CONSTRUCT DIVERSION SWALES AND SEDIMENT TRAPS. COMMENCE INSTALLATION OF STORM DRAINAGE SYSTEM.
- COMMENCE EARTHWORK. CONSTRUCT FILL SLOPE AND RETAINING WALL. INSTALL ADDITIONAL SEDIMENT AND EROSION CONTROLS AS WORK PROGRESSES AND CONTINUE STORM DRAINAGE SYSTEM CONSTRUCTION, TOPSOIL AND SEED SLOPES WHICH HAVE ACHIEVED FINAL SITE GRADING.
- CONSTRUCTION STAKING OF ALL BUILDING CORNERS, UTILITIES, ACCESS DRIVES, AND PARKING AREAS.
- ROUGH GRADING AND FILLING OF SUBGRADES AND SLOPES.
- IMMEDIATELY UPON DISCOVERING UNFORESEEN CIRCUMSTANCES POSING THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION, THE OPERATOR SHALL IMPLEMENT APPROPRIATE BEST MANAGEMENT PRACTICES TO ELIMINATE THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION.
- BEFORE DISPOSING OF SOIL OR RECEIVING BORROW FOR THE SITE, THE CONTRACTOR MUST PROVIDE EVIDENCE THAT EACH SPOIL OR BORROW AREA HAS A SEDIMENT AND EROSION CONTROL PLAN APPROVED BY THE MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT AND/OR CONSERVATION COMMISSION AND WHICH IS BEING IMPLEMENTED AND MAINTAINED. THE CONTRACTOR SHALL ALSO NOTIFY THE APPROPRIATE MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT AND/OR CONSERVATION COMMISSION IN WRITING OF ALL RECEIVING SPOIL AND BORROW AREAS WHEN THEY HAVE BEEN IDENTIFIED.
- CONTINUE INSTALLATION OF STORM DRAINAGE AS SUBGRADE ELEVATIONS ARE ACHIEVED.
- THROUGHOUT CONSTRUCTION SEQUENCE, REMOVE SEDIMENT FROM BEHIND SILT FENCES, HAY BALES AND OTHER EROSION CONTROL DEVICES, AND FROM SEDIMENT BASINS AND SEDIMENT TRAPS AS REQUIRED. REMOVAL SHALL BE ON A PERIODIC BASIS (EVERY SIGNIFICANT RAINFALL OF 0.25 INCH OR GREATER). INSPECTION OF SEDIMENT AND EROSION CONTROL MEASURES SHALL BE ON A WEEKLY BASIS AND AFTER EACH RAINFALL OF 0.25 INCHES OR GREATER. SEDIMENT COLLECTED SHALL BE DEPOSITED AND SPREAD EVENLY UPLAND ON SLOPES DURING CONSTRUCTION.
- INSTALL UTILITIES. COMPLETE STORM DRAINAGE SYSTEM.
- INSTALL SITE LIGHTING.
- COMPLETE GRADING TO SUBGRADES AND CONSTRUCT PARKING AREA SUBGRADE.
- CONSTRUCT CURBS, PAVEMENT STRUCTURE AND SIDEWALKS.
- CONDUCT FINE GRADING.
- PAVE PARKING AREAS AND DRIVEWAYS
- FINAL FINE GRADING OF SLOPE AND NON-PAVED AREAS.
- PLACE TOPSOIL ON SLOPES AFTER FINAL GRADING IS COMPLETED. FERTILIZE SEED AND MULCH. REFER TO LANDSCAPE PLAN FOR NOTES ON SEED MIXTURES AND TOPSOIL. USE EROSION CONTROL BLANKETS AS REQUIRED OR ORDERED FOR SLOPES GREATER THAN 3:1 AND AS SHOWN ON LANDSCAPE PLANS OR EROSION CONTROL PLANS. FOR TEMPORARY STABILIZATION BEYOND SEEDING DATES USE ANNUAL RYE AT 4.0 LBS/1,000 S.F. FERTILIZE WITH 10-10-10 AT 1.0 LBS. OF NITROGEN PER 1,000 S.F. AND LIME AT 100 LBS/1,000 S.F. (MAX).
- LANDSCAPE ISLANDS, INTERIOR NON-PAVED AREAS, AND PERIMETER AREAS.
- INSTALL SIGNING AND PAVEMENT MARKINGS
- CLEAN STORM DRAINAGE PIPE STRUCTURES, DETENTION SYSTEMS AND WATER QUALITY DEVICES OF DEBRIS AND SEDIMENT.
- UPON DIRECTION OF THE MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT AND/OR CONSERVATION COMMISSION AGENT, SEDIMENT AND EROSION CONTROL MEASURES SHALL BE REMOVED FOLLOWING STABILIZATION OF THE SITE.

OPERATION REQUIREMENTS

CLEARING AND GRUBBING OPERATIONS

- ALL SEDIMENT AND EROSION CONTROL MEASURES, INCLUDING THE CONSTRUCTION OF STONE CONSTRUCTION ENTRANCE ANTI-TRACKING PADS, WILL BE INSTALLED PRIOR TO THE START OF CLEARING AND GRUBBING AND DEMOLITION OPERATIONS.
- FOLLOWING INSTALLATION OF ALL SEDIMENT AND EROSION CONTROL MEASURES, THE CONTRACTOR SHALL NOT PROCEED WITH GRADING, FILLING OR OTHER CONSTRUCTION OPERATIONS UNTIL THE ENGINEER HAS INSPECTED AND APPROVED ALL INSTALLATIONS.
- THE CONTRACTOR SHALL TAKE EXTREME CARE DURING CLEARING AND GRUBBING OPERATIONS SO AS NOT TO DISTURB UNPROTECTED WETLAND AREAS OR SEDIMENT AND EROSION CONTROL DEVICES.
- FOLLOWING THE COMPLETION OF CLEARING AND GRUBBING OPERATIONS, ALL AREAS SHALL BE STABILIZED WITH TOPSOIL AND SEEDING OR CRUSHED STONE AS SOON AS PRACTICAL.

ROUGH GRADING OPERATIONS

- DURING THE REMOVAL AND/OR PLACEMENT OF EARTH AS INDICATED ON THE GRADING PLAN, TOPSOIL SHALL BE STRIPPED AND APPROPRIATELY STOCKPILED FOR REUSE.
- ALL STOCKPILED TOPSOIL SHALL BE SEEDED, MULCHED WITH HAY, AND ENCLOSED BY A SILTATION FENCE.

FILLING OPERATIONS

- PRIOR TO FILLING, ALL SEDIMENT AND EROSION CONTROL DEVICES SHALL BE PROPERLY IMPLEMENTED, MAINTAINED AND FULLY INSTALLED, AS DIRECTED BY THE ENGINEER AND AS SHOWN ON THIS PLAN.
- ALL FILL MATERIAL ADJACENT TO ANY WETLAND AREAS, IF APPLICABLE TO THIS PROJECT, SHALL BE GOOD QUALITY, WITH LESS THAN 5% FINES PASSING THROUGH A #200 SIEVE (BANK RUN), SHALL BE PLACED IN LIFT THICKNESSES NOT GREATER THAN THAT SPECIFIED IN PROJECT SPECIFICATIONS AND/OR THE PROJECT GEOTECHNICAL REPORT. LIFTS SHALL BE COMPACTED TO 95% MAX. DRY DENSITY MODIFIED PROCTOR OR AS SPECIFIED IN THE CONTRACT SPECIFICATIONS OR IN THE GEOTECHNICAL REPORT.
- AS GENERAL GRADING OPERATIONS PROGRESS, ANY TEMPORARY DIVERSION DITCHES SHALL BE RAISED OR LOWERED, AS NECESSARY, TO DIVERT SURFACE RUNOFF TO THE SEDIMENT BASINS OR SEDIMENT TRAPS.

PLACEMENT OF DRAINAGE STRUCTURES, UTILITIES, AND BUILDING CONSTRUCTION OPERATIONS.

- SILT FENCES SHALL BE INSTALLED AT THE DOWNHILL SIDES OF BUILDING EXCAVATIONS, MUD PUMP DISCHARGES, AND UTILITY TRENCH MATERIAL STOCKPILES. HAY BALES/STRAW BALES MAY BE USED IF SHOWN ON THE SEDIMENT AND EROSION CONTROL PLANS OR IF DIRECTED BY THE CIVIL ENGINEER.

FINAL GRADING AND PAVING OPERATIONS

- ALL INLET AND OUTLET PROTECTION SHALL BE PLACED AND MAINTAINED AS SHOWN ON SEDIMENT AND EROSION CONTROL PLANS AND DETAILS, AND AS DESCRIBED IN SPECIFICATIONS AND AS DESCRIBED HEREIN.
- NO CUT OR FILL SLOPES SHALL EXCEED 3:1 EXCEPT WHERE STABILIZED BY ROCK FACED EMBANKMENTS OR EROSION CONTROL BLANKETS, OR JUTE MESH AND VEGETATION. ALL SLOPES SHALL BE SEEDED, AND ANY ROAD OR DRIVEWAY SHOULDER AND BANKS SHALL BE STABILIZED IMMEDIATELY UPON COMPLETION OF FINAL GRADING UNTIL TURF IS ESTABLISHED.
- PAVEMENT SUB-BASE AND BASE COURSES SHALL BE INSTALLED OVER AREAS TO BE PAVED AS SOON AS FINAL SUB-GRADES ARE ESTABLISHED AND UNDERGROUND UTILITIES AND STORM DRAINAGE SYSTEMS HAVE BEEN INSTALLED.
- AFTER CONSTRUCTION OF PAVEMENT, TOPSOIL, FINAL SEED, MULCH AND LANDSCAPING, REMOVE ALL TEMPORARY SEDIMENT AND EROSION CONTROL DEVICES ONLY AFTER ALL AREAS HAVE BEEN PAVED AND/OR GRASS HAS BEEN WELL ESTABLISHED AND THE SITE IS STABLE AND HAS BEEN INSPECTED AND APPROVED BY THE MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT AND/OR CONSERVATION COMMISSION.

INSTALLATION OF SEDIMENTATION AND EROSION CONTROL MEASURES

- SILTATION FENCE
 - DIG A SIX INCH TRENCH ON THE UPHILL SIDE OF THE DESIGNATED FENCE LINE LOCATION.
 - POSITION THE POST AT THE BACK OF THE TRENCH (DOWNHILL SIDE), AND HAMMER THE POST AT LEAST 1.5 FEET INTO THE GROUND.
 - LAY THE BOTTOM SIX INCHES OF THE FABRIC INTO THE TRENCH TO PREVENT UNDERMINING BY STORM WATER RUN-OFF.
 - BACKFILL THE TRENCH AND COMPACT.
- HAY BALES/STRAW BALES
 - BALES SHALL BE PLACED IN A SINGLE ROW, LENGTHWISE, ORIENTED PARALLEL TO THE CONTOUR, WITH ENDS OF ADJACENT BALES TIGHTLY ABUTTING ONE ANOTHER.
 - BALES SHALL BE ENTRENCHED AND BACKFILLED. A TRENCH SHALL BE EXCAVATED THE WIDTH OF A BALE AND THE LENGTH OF THE PROPOSED BARRIER TO A MINIMUM DEPTH OF FOUR INCHES. AFTER THE BALES ARE STAKED, THE EXCAVATED SOIL SHALL BE BACKFILLED AGAINST THE BARRIER.
 - EACH BALE SHALL BE SECURELY ANCHORED BY AT LEAST TWO (2) STAKES.
 - THE GAPS BETWEEN BALES SHALL BE WEDGED WITH STRAW TO PREVENT WATER LEAKAGE.
- THE BARRIER SHALL BE EXTENDED TO SUCH A LENGTH THAT THE BOTTOMS OF THE END BALES ARE HIGHER IN ELEVATION THAN THE TOP OF THE LOWEST MIDDLE BALE, TO ENSURE THAT RUN-OFF WILL FLOW EITHER THROUGH OR OVER THE BARRIER, BUT NOT AROUND IT.

OPERATION AND MAINTENANCE OF SEDIMENT AND EROSION CONTROL MEASURES

- SILTATION FENCE
 - ALL SILTATION FENCES SHALL BE INSPECTED AS A MINIMUM WEEKLY OR AFTER EACH RAINFALL. ALL DETERIORATED FABRIC AND DAMAGED POSTS SHALL BE REPLACED AND PROPERLY REPOSITIONED IN ACCORDANCE WITH THIS PLAN.
 - SEDIMENT DEPOSITS SHALL BE REMOVED FROM BEHIND THE FENCE WHEN THEY REACH A MAXIMUM HEIGHT OF ONE FOOT.
- HAY BALES/STRAW BALES
 - ALL HAY BALE/STRAW BALE RINGS SHALL BE INSPECTED FOLLOWING EACH RAINFALL. REPAIR OR REPLACEMENT SHALL BE PROMPTLY MADE AS NEEDED.
 - DEPOSITS SHALL BE REMOVED AND CLEANED-OUT IF ONE HALF OF THE ORIGINAL HEIGHT OF THE BALES BECOMES FILLED WITH SEDIMENT.
- SEDIMENT BASINS/SEDIMENT TRAPS
 - CONTRACTOR TO KEEP WEEKLY CHECKLIST LOGS FOR INSPECTIONS OF ALL SEDIMENT AND EROSION CONTROL DEVICES AND HAVE THEM READILY AVAILABLE ON-SITE AT ALL TIMES FOR INSPECTION BY MASSDEP LOCAL AUTHORITIES OR ENGINEER.
 - ALL SEDIMENT BASINS AND/OR SEDIMENT TRAPS SHALL BE INSPECTED FOLLOWING EACH RAINFALL. REPAIR OF SLOPES SHALL BE PROMPTLY MADE AS NEEDED.
 - SEDIMENT DEPOSITS SHALL BE REMOVED FROM SEDIMENT BASINS AND/OR SEDIMENT TRAPS WHEN THEY REACH A MAXIMUM HEIGHT OF ONE FOOT UNLESS OTHERWISE INDICATED ON THE EROSION CONTROL PLANS AND DETAILS TO BE AT A SPECIFIC ELEVATION PER CLEAN OUT MARKERS.
- SEDIMENT SHALL BE DISPOSED OF ON-SITE OR AS DIRECTED BY THE ENGINEER AND LOCAL GOVERNING OFFICIALS. SEE SEDIMENT AND EROSION CONTROL NOTES HEREIN REGARDING DISPOSAL REQUIREMENTS FOR OFF SITE SPOIL DISPOSAL.

SEDIMENT AND EROSION CONTROL PLAN

- HAY BALE/STRAW BALE FILTERS WILL BE INSTALLED BEHIND THE SILTATION FENCE CLOSEST TO THE EXISTING WETLANDS AND SILTATION FENCE INSTALLED ALONG THE TOE OF ALL CRITICAL CUT AND FILL SLOPES.
- CULVERT DISCHARGE AREAS WILL BE PROTECTED WITH RIP RAP CHANNELS. ENERGY DISSIPATORS WILL BE INSTALLED AS SHOWN ON THESE PLANS AND AS NECESSARY.
- CATCH BASINS WILL BE PROTECTED WITH SILT SACKS THROUGHOUT THE CONSTRUCTION PERIOD AND UNTIL ALL DISTURBED AREAS ARE THOROUGHLY STABILIZED.
- ALL SEDIMENT AND EROSION CONTROL MEASURES WILL BE INSTALLED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS IN THE LATEST EDITION OF THE MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS.
- SEDIMENT AND EROSION CONTROL MEASURES WILL BE INSTALLED PRIOR TO DEMOLITION AND/OR CONSTRUCTION WHENEVER POSSIBLE.
- ALL CONTROL MEASURES WILL BE MAINTAINED IN EFFECTIVE CONDITION THROUGHOUT THE DEMOLITION AND CONSTRUCTION PERIOD UNTIL THE SITE IS DETERMINED TO BE STABILIZED BY THE AUTHORITY HAVING JURISDICTION.
- ADDITIONAL CONTROL MEASURES WILL BE INSTALLED DURING THE CONSTRUCTION PERIOD, IF NECESSARY OR REQUIRED OR AS DIRECTED BY THE CIVIL ENGINEER OR BY THE AUTHORITY HAVING JURISDICTION.
- SEDIMENT REMOVED FROM EROSION CONTROL STRUCTURES WILL BE DISPOSED IN A MANNER WHICH IS CONSISTENT WITH THE INTENT AND REQUIREMENTS OF THE SEDIMENT AND EROSION CONTROL PLANS, NOTES, AND DETAILS.
- THE CONTRACTOR IS ASSIGNED THE RESPONSIBILITY FOR IMPLEMENTING THIS SEDIMENT AND EROSION CONTROL PLAN. THIS RESPONSIBILITY INCLUDES THE INSTALLATION AND MAINTENANCE OF CONTROL MEASURES, INFORMING ALL PARTIES ENGAGED ON THE CONSTRUCTION SITE OF THE REQUIREMENTS AND OBJECTIVES OF THE PLAN, NOTIFICATION OF THE MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT AND/OR CONSERVATION COMMISSION OFFICE OR AUTHORITY HAVING JURISDICTION OF ANY TRANSFER OF THIS RESPONSIBILITY AND FOR CONVEYING A COPY OF THE SEDIMENT AND EROSION CONTROL PLAN IF THE TITLE TO THE LAND IS TRANSFERRED.

SEDIMENT AND EROSION CONTROL NOTES

- THE SEDIMENT AND EROSION CONTROL PLAN IS ONLY INTENDED TO DESCRIBE THE SEDIMENT AND EROSION CONTROL TREATMENT FOR THIS SITE. SEE SEDIMENT AND EROSION CONTROL DETAILS AND CONSTRUCTION SEQUENCE. REFER TO SITE PLAN FOR GENERAL INFORMATION AND OTHER CONTRACT PLANS FOR APPROPRIATE INFORMATION.
- THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTING THIS SEDIMENT AND EROSION CONTROL PLAN. THIS RESPONSIBILITY INCLUDES THE PROPER INSTALLATION AND MAINTENANCE OF SEDIMENT AND EROSION CONTROL MEASURES, INFORMING ALL PARTIES ENGAGED WITH CONSTRUCTION ON THE SITE OF THE REQUIREMENTS AND OBJECTIVES OF THIS PLAN, INFORMING THE AUTHORITY HAVING JURISDICTION OR COUNTY SOILS CONSERVATION DISTRICT, INLAND WETLANDS AGENCY OR CONSERVATION COMMISSION OF ANY TRANSFER OF THIS RESPONSIBILITY, AND FOR CONVEYING A COPY OF THE SEDIMENT & EROSION CONTROL PLAN IF THE TITLE TO THE LAND IS TRANSFERRED.
- AN EROSION CONTROL BOND MAY BE REQUIRED TO BE POSTED WITH THE TOWN OF HINGHAM TO ENSURE IMPLEMENTATION OF THE SEDIMENT AND EROSION CONTROL MEASURES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE POSTING OF THIS BOND AND FOR INQUIRIES TO THE TOWN OF HINGHAM FOR INFORMATION ON THE METHOD, TYPE AND AMOUNT OF THE BOND POSTING UNLESS OTHERWISE DIRECTED BY THE OWNER.
- VISUAL SITE INSPECTIONS SHALL BE CONDUCTED WEEKLY, AND AFTER EACH MEASURABLE PRECIPITATION EVENT OF 0.25 INCHES OR GREATER BY QUALIFIED PERSONNEL, TRAINED AND EXPERIENCED IN SEDIMENT AND EROSION CONTROL, TO ASCERTAIN THAT THE SEDIMENT AND EROSION CONTROL (E&S) BMPs ARE OPERATIONAL AND EFFECTIVE IN PREVENTING POLLUTION. A WRITTEN REPORT OF EACH INSPECTION SHALL BE KEPT, AND INCLUDE: A) A SUMMARY OF THE SITE CONDITIONS, E&S BMPs, AND COMPLIANCE; AND B) THE DATE, TIME, AND THE NAME OF THE PERSON CONDUCTING THE INSPECTION
- THE CONTRACTOR SHALL CONSTRUCT ALL SEDIMENT AND EROSION CONTROLS IN ACCORDANCE WITH THE LATEST EDITION OF THE MASSACHUSETTS EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN AND SUBURBAN AREAS IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, AND AS DIRECTED BY THE MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT AND/OR CONSERVATION COMMISSION. THE CONTRACTOR SHALL KEEP A COPY OF THE GUIDELINES ON-SITE FOR REFERENCE DURING CONSTRUCTION.
- ADDITIONAL AND/OR ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES MAY BE INSTALLED DURING THE CONSTRUCTION PERIOD IF FOUND NECESSARY BY THE CONTRACTOR, OWNER, SITE ENGINEER, MUNICIPALITY AND/OR COUNTY SOILS CONSERVATION DISTRICT AND/OR CONSERVATION COMMISSION, OR OTHER GOVERNING AGENCIES. THE CONTRACTOR SHALL CONTACT THE OWNER AND APPROPRIATE GOVERNING AGENCIES FOR APPROVAL IF ALTERNATIVE CONTROLS OTHER THAN THOSE SHOWN ON THE PLANS ARE PROPOSED.
- THE CONTRACTOR SHALL INSPECT ALL SEDIMENT AND EROSION CONTROLS BEFORE AND AFTER EACH STORM (0.25 INCHES OR GREATER RAINFALL), OR AT LEAST WEEKLY, TO VERIFY THAT THE CONTROLS ARE OPERATING PROPERLY AND MAKE REPAIRS WHERE NECESSARY.

- THE CONTRACTOR SHALL KEEP A SUPPLY OF SEDIMENT AND EROSION CONTROL MATERIAL (HAY BALES, SILT FENCE, JUTE MESH, RIP RAP, ETC.) ON-SITE FOR MAINTENANCE AND EMERGENCY REPAIRS.
- PROTECT EXISTING TREES THAT ARE TO BE SAVED BY FENCING AT THE DRIP LINE OR AS SHOWN WITH SNOW FENCE, ORANGE SAFETY FENCE, OR EQUIVALENT FENCING. ANY LMB TRIMMING SHOULD BE DONE BEFORE CONSTRUCTION BEGINS IN THAT AREA; FENCING SHALL BE MAINTAINED AND REPAIRED DURING CONSTRUCTION.
- INSTALL PERIMETER SEDIMENT AND EROSION CONTROLS PRIOR TO CLEARING OR CONSTRUCTION. ALL CONSTRUCTION SHALL BE CONTAINED WITHIN THE LIMIT OF DISTURBANCE, WHICH SHALL BE MARKED WITH SILT FENCE, SAFETY FENCE, HAY BALES, RIBBONS, OR OTHER MEANS PRIOR TO CLEARING. CONSTRUCTION ACTIVITY SHALL REMAIN ON THE UPHILL SIDE OF THE SILT FENCE UNLESS WORK IS SPECIFICALLY CALLED FOR ON THE DOWNHILL SIDE OF THE FENCE.
- STONE CONSTRUCTION ENTRANCE ANTI-TRACKING PADS SHALL BE INSTALLED AT START OF CONSTRUCTION AND MAINTAINED THROUGHOUT THE DURATION OF CONSTRUCTION. THE LOCATION OF THE TRACKING PADS MAY CHANGE AS VARIOUS PHASES OF CONSTRUCTION ARE COMPLETED.
- TOPSOIL SHALL BE STRIPPED AND STOCKPILED FOR USE IN FINAL LANDSCAPING. ALL EARTH STOCKPILES SHALL HAVE HAY BALES OR SILT FENCE AROUND THE LIMIT OF PILE. PILES SHALL BE TEMPORARILY SEEDED IF PILE IS TO REMAIN IN PLACE FOR MORE THAN ONE (1) MONTH.
- SEDIMENT BASINS AND SEDIMENT TRAPS SHALL PROVIDE 134 CUBIC YARDS OF SEDIMENT STORAGE PER ACRE CONTRIBUTING TO THE BASIN. PROVIDE BASIN VOLUMES FOR ALL DISTURBANCE ON SITE.
- COMPLY WITH REQUIREMENTS OF NPDES GENERAL PERMIT FOR CONSTRUCTION DEWATERING ACTIVITY DISCHARGES, FOR STORMWATER DISCHARGE FROM CONSTRUCTION ACTIVITIES AND WITH MASSACHUSETTS DEP RECORD KEEPING AND INSPECTION REQUIREMENTS.
- STONE CONSTRUCTION ENTRANCE ANTI-TRACKING PADS SHALL BE INSTALLED PRIOR TO ANY ON SITE EXCAVATION AND SHALL BE MAINTAINED DURING ALL DEMOLITION, EXCAVATION AND CONSTRUCTION ACTIVITIES.
- MINIMIZE LAND DISTURBANCES. SEED AND MULCH DISTURBED AREAS WITH TEMPORARY MIX AS SOON AS PRACTICABLE (ONE WEEK MAXIMUM UNSTABILIZED PERIOD) USING PERENNIAL RYEGRASS AT 40 LBS PER ACRE. MULCH ALL CUT AND FILL SLOPES AND SWALES WITH LOOSE HAY AT A RATE OF 2 TONS PER ACRE. IF NECESSARY, REPLACE LOOSE HAY ON SLOPES WITH EROSION CONTROL BLANKETS OR JUTE CLOTH. MODERATELY GRADED AREAS, ISLANDS, AND TEMPORARY CONSTRUCTION STAGING AREAS MAY BE HYDROSEEDED WITH TACKIFIER.
- MAINTAIN EXISTING PAVED AREAS FOR CONSTRUCTION STAGING FOR AS LONG AS POSSIBLE.
- SILT FENCE AND OTHER SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSTALLED IN ACCORDANCE WITH CONTRACT DRAWINGS AND MANUFACTURER'S RECOMMENDATIONS PRIOR TO WORK IN ANY UPLAND AREAS.
- EXCAVATED MATERIAL FROM TEMPORARY SILT TRAPS MUST BE STOCKPILED ON UPHILL SIDE OF SILT FENCE.
- INSTALL SILT FENCE ACCORDING TO MANUFACTURER'S INSTRUCTION, PARTICULARLY, BURY LOWER EDGE OF FABRIC INTO GROUND. SILT FENCE SHALL BE MARKED WITH SILT FENCE, SAFETY FENCE, HAY BALES, FILTER FABRIC USED SHALL BE TENCATE 140N OR 170N, OR APPROVED EQUIVALENT. SEE SPECIFICATIONS FOR FURTHER INFORMATION.
- WHERE INDICATED ON SEDIMENT AND EROSION CONTROL PLANS USE NEW HAY/STRAW BALES AND REPLACE THEM WHENEVER THEIR CONDITION DETERIORATES BEYOND REASONABLE USABILITY. STAKE BALES SECURELY INTO GROUND AND BUTT TIGHTLY TOGETHER TO PREVENT UNDERCUTTING AND BYPASSING.
- INSTALL TEMPORARY DIVERSION DITCHES, PLUNGE POOLS, SEDIMENT BASINS, SEDIMENT TRAPS, CONCRETE WASH PITS AND DEWATERING PITS AS SHOWN AND AS NECESSARY DURING VARIOUS PHASES OF CONSTRUCTION TO CONTROL RUNOFF UNTIL UPHILL AREAS ARE DETERMINED TO BE STABILIZED BY THE AUTHORITY HAVING JURISDICTION. LOCATION OF TEMPORARY SEDIMENT BASINS WILL REQUIRE REVIEW AND APPROVAL BY THE CIVIL ENGINEER AND AUTHORITY HAVING JURISDICTION.
- DIRECT ALL DEWATERING PUMP DISCHARGE TO A SEDIMENT CONTROL DEVICE SUCH AS TEMPORARY PITS, SEDIMENT TRAP, SEDIMENT BASIN OR GRASS FILTERS WITHIN THE APPROVED LIMIT OF DISTURBANCE. DISCHARGE TO STORM DRAINAGE SYSTEM OR SURFACE WATERS FROM SEDIMENT CONTROLS SHALL BE CLEAR.
- SWEEP AFFECTED PORTIONS OF OFF SITE ROADS ONE OR MORE TIMES A DAY (OR LESS FREQUENTLY IF TRACKING IS NOT A PROBLEM) DURING CONSTRUCTION. OTHER DUST CONTROL MEASURES TO BE USED AS NECESSARY INCLUDE WATERING DOWN DISTURBED AREAS, USING CALCIUM CHLORIDE, AND COVERING LOADS ON DUMP TRUCKS.
- PERIODICALLY CHECK ACCUMULATED SEDIMENT LEVELS IN THE SEDIMENT BASINS AND SEDIMENT TRAPS DURING CONSTRUCTION AND CLEAN ACCUMULATED SILT WHEN NECESSARY OR WHEN ONE FOOT OF SEDIMENT HAS ACCUMULATED OR PER SPECIFIC CLEANOUT MARKER ELEVATION. CLEAN ACCUMULATED SEDIMENT FROM CATCH BASIN SUMPS AS NECESSARY AND AS DIRECTED BY THE CIVIL ENGINEER OR OWNER'S CONSTRUCTION REPRESENTATIVE. REMOVE ACCUMULATED SEDIMENT FROM BEHIND HAY/STRAW BALES AND SILT FENCE WHEN LEVEL REACHES HALF THE HEIGHT OF THE BALE OR ONE FOOT AT SILT FENCE. DISPOSE OF SEDIMENT LEGALLY EITHER ON OR OFF SITE.
- IMMEDIATELY UPON DISCOVERING UNFORESEEN CIRCUMSTANCES POSING THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION, THE OPERATOR SHALL IMPLEMENT APPROPRIATE BEST MANAGEMENT PRACTICES TO ELIMINATE THE POTENTIAL FOR ACCELERATED EROSION AND/OR SEDIMENT POLLUTION.
- ALL PUMPING OF SEDIMENT LADEN WATER SHALL BE THROUGH A SEDIMENT CONTROL BMP, SUCH AS A PUMPED WATER FILTER BAG OR EQUIVALENT SEDIMENT REMOVAL FACILITY, OVER UNDISTURBED VEGETATED AREAS.
- ALL EXCAVATED MATERIAL SHALL BE PLACED ON THE HIGH SIDE OF UTILITY AND STORM PIPE TRENCHES SO AS TO ALLOW THE TRENCH TO INTERCEPT ALL SILT LADEN RUNOFF.
- CONTRACTOR SHALL ONLY EXCAVATE AS MUCH UTILITY AND STORM PIPE TRENCH WORK AS CAN BE COMPLETED, BACKFILLED AND STABILIZED IN ONE DAY SO AS TO LIMIT THE AMOUNT OF OPEN, DISTURBED TRENCHING.
- ANY STOCKPILES OF STRIPPED MATERIALS ARE TO BE PERIODICALLY SPRAYED WITH WATER OR A CRUSTING AGENT TO STABILIZE POTENTIALLY WIND-BLOWN MATERIAL. HAUL ROADS BOTH INTO AND AROUND THE SITE ARE TO BE SPRAYED AS NEEDED TO SUPPRESS DUST. TRUCKS HAULING IMPORT FILL MATERIAL ARE TO BE TARPED TO AID IN THE CONTROL OF AIRBORNE DUST. DURING HIGH WIND EVENTS (20 TO 30 MPH SUSTAINED) CONSTRUCTION ACTIVITY SHALL BE LIMITED OR CEASED IF DUST CANNOT BE CONTROLLED BY WETTING.
- BLOCK END OF STORM SEWERS IN EXPOSED TRENCHES WITH BOARDS AND SANDBAGS AT THE END OF EACH WORKING DAY WHEN RAIN IS EXPECTED.
- AN AREA SHALL BE CONSIDERED TO HAVE ACHIEVED FINAL STABILIZATION WHEN IT HAS A MINIMUM OF 70% UNIFORM PERENNIAL VEGETATIVE COVER OR OTHER PERMANENT NON-VEGETATIVE COVER WITH A DENSITY SUFFICIENT TO RESIST ACCELERATED SURFACE EROSION AND SUBSURFACE CHARACTERISTICS SUFFICIENT TO RESIST SLIDING OR OTHER MOVEMENTS UNLESS OTHERWISE DETERMINED BY THE AUTHORITY HAVING JURISDICTION.
- MAINTAIN ALL PERMANENT AND TEMPORARY EROSION AND SEDIMENT CONTROL DEVICES IN EFFECTIVE CONDITION THROUGHOUT THE CONSTRUCTION PERIOD. UPON COMPLETION OF WORK SWEEP PARKING LOT AND REMOVE ALL TEMPORARY EROSION AND SEDIMENT CONTROLS WHEN AUTHORIZED BY AUTHORITY HAVING JURISDICTION. FILE NOT (NOTICE OF TERMINATION) WITH AUTHORITY HAVING JURISDICTION RESPONSIBLE FOR REGULATING STORM WATER DISCHARGES FROM CONSTRUCTION ACTIVITIES PER NPDES.



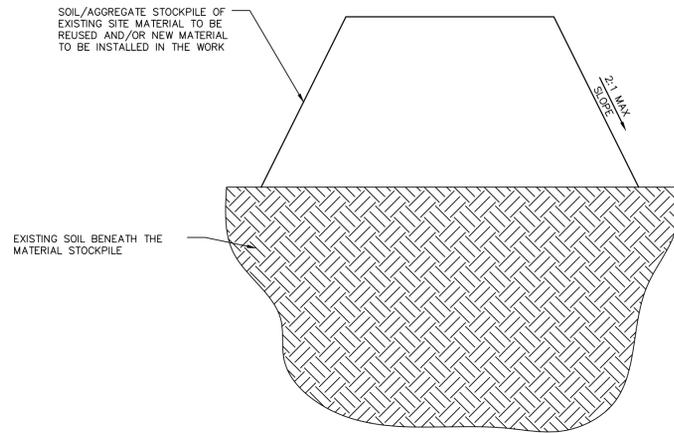
355 Research Parkway
 Meriden, CT 06450
 (203) 630-1406
 (203) 630-2615 Fax

PROPOSED DEVELOPMENT
 100 INDUSTRIAL PARK ROAD
 HINGHAM, MASSACHUSETTS

REVISIONS	No.	Date	Desc.
Designed			P.G.M.
Drawn			P.G.M.
Reviewed			
Scale			NONE
Project No.			1901517
Date			03/06/2020
CAD File:			EC190151701
Title			SEDIMENT AND EROSION CONTROL NOTES
Sheet No.			

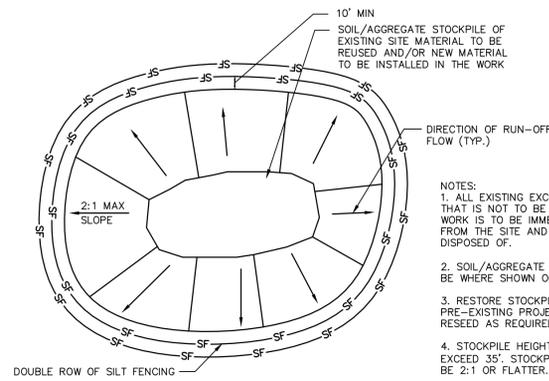
FOR PERMITTING PURPOSES ONLY
 NOT RELEASED FOR CONSTRUCTION

EC-3



MATERIALS STOCKPILE DETAIL

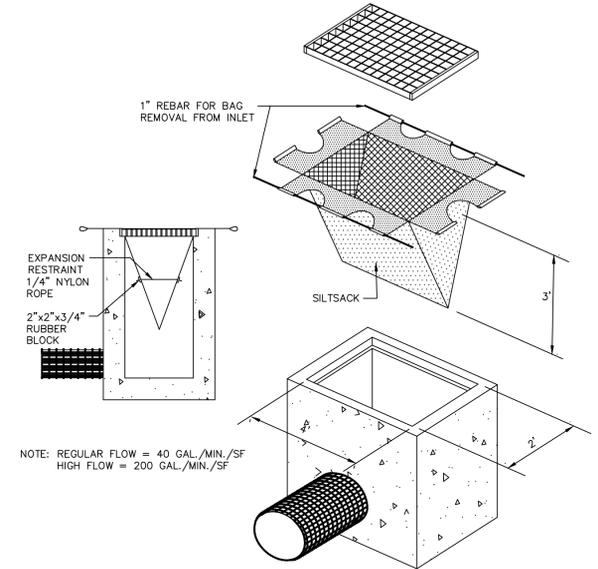
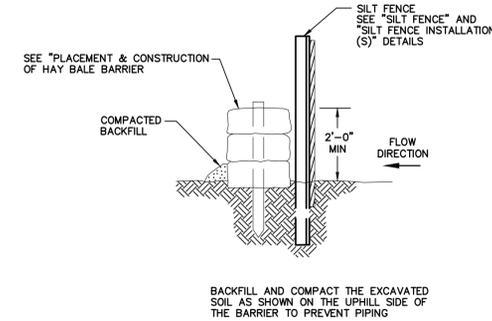
N.T.S. BLEC-006



- NOTES:
1. ALL EXISTING EXCAVATED MATERIAL THAT IS NOT TO BE REUSED IN THE WORK IS TO BE IMMEDIATELY REMOVED FROM THE SITE AND PROPERLY DISPOSED OF.
 2. SOIL/AGGREGATE STOCKPILE SITES TO BE WHERE SHOWN ON THE DRAWINGS.
 3. RESTORE STOCKPILE SITES TO PRE-EXISTING PROJECT CONDITION AND RESEED AS REQUIRED.
 4. STOCKPILE HEIGHTS MUST NOT EXCEED 35'. STOCKPILE SLOPES MUST BE 2:1 OR FLATTER.

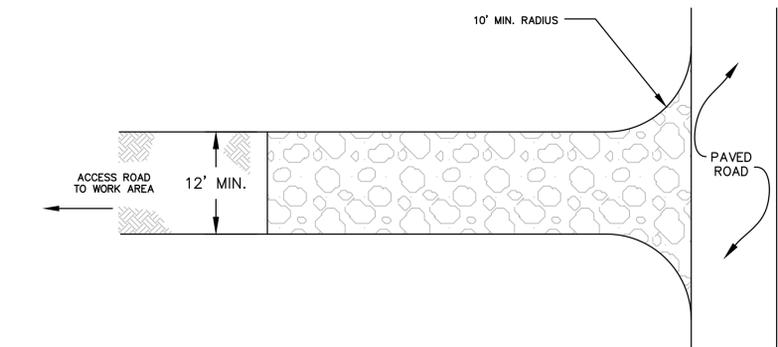
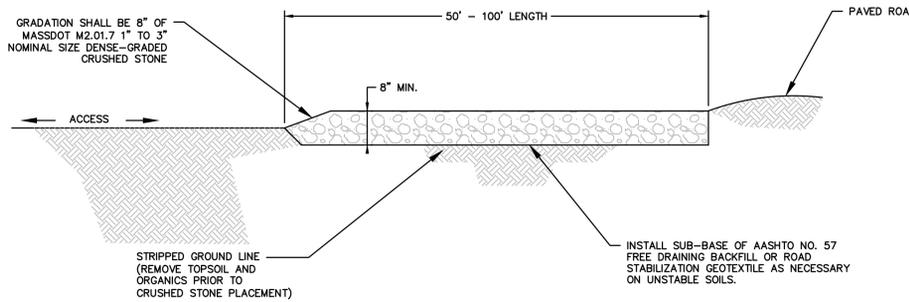
SILT FENCE WITH HAY BALE BACKING

N.T.S.



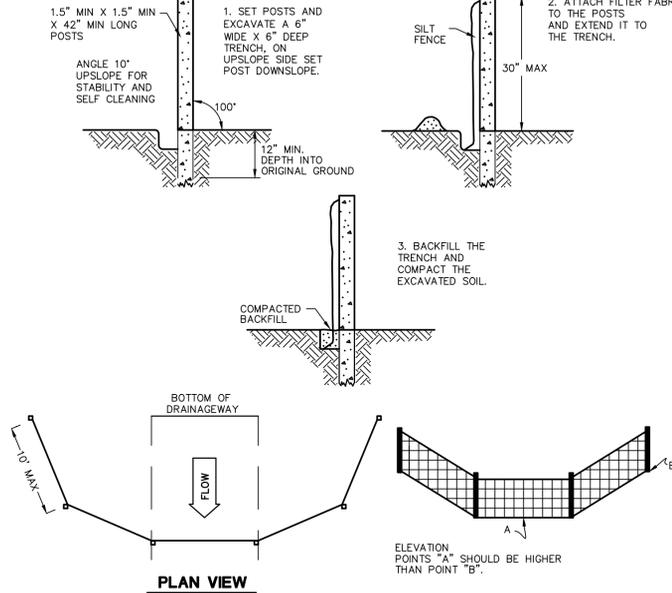
SILTSACK DETAIL

N.T.S. BLEC-005



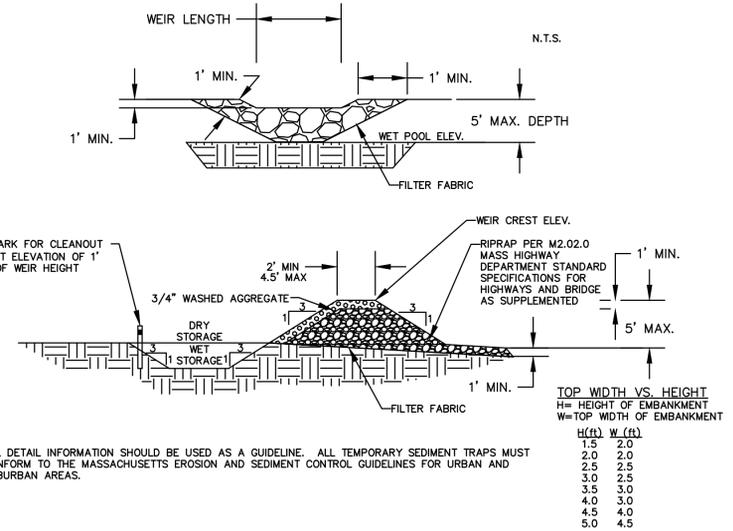
TYPICAL CONSTRUCTION ENTRANCE

N.T.S.



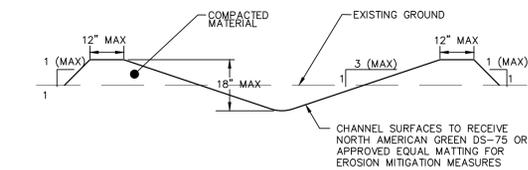
SILT FENCE BARRIER

N.T.S.



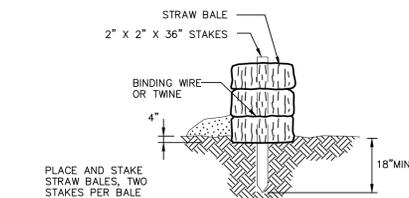
TEMPORARY SEDIMENT TRAP

N.T.S. BLEC-002



NON-ENGINEERED TEMPORARY DIVERSION SWALE DETAIL

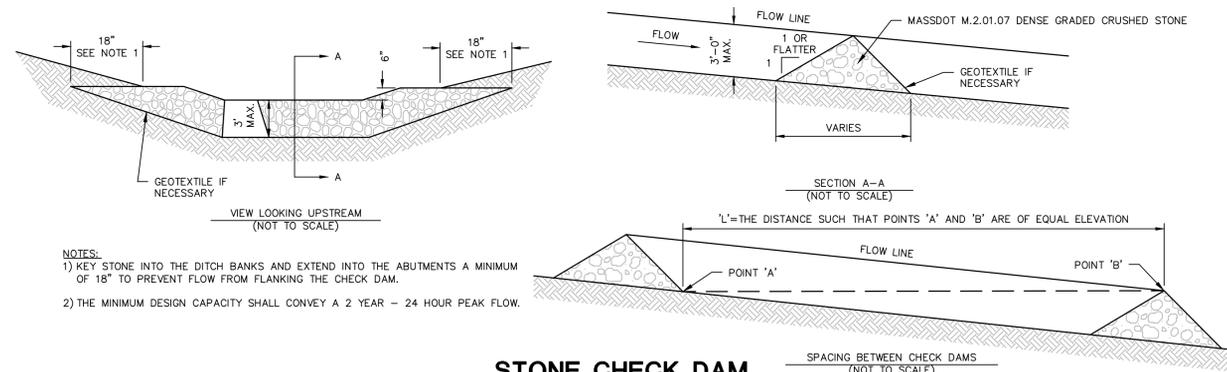
N.T.S.



- STRAW BALE BARRIERS SHOULD NOT BE USED FOR MORE THAN 3 MONTHS
- SEDIMENT MUST BE REMOVED WHEN ACCUMULATIONS REACH 1/3 THE ABOVE GROUND HEIGHT OF THE BARRIER.
- ANY SECTION OF STRAW BALE BARRIER WHICH HAS BEEN UNDERMINED OR TOPPED MUST BE IMMEDIATELY REPLACED WITH A ROCK FILTER OUTLET.

STRAW BALE DETAIL

BLEC-007

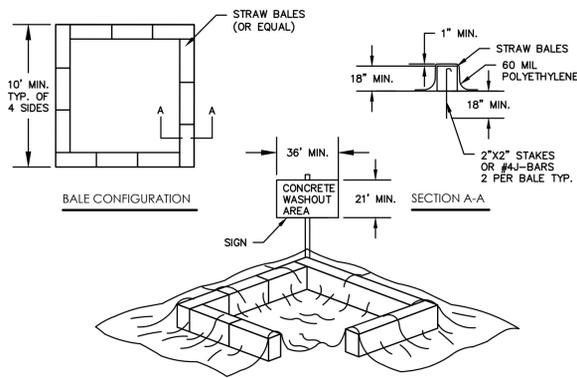


STONE CHECK DAM INSTALLATION IN DRAINAGeways

N.T.S.

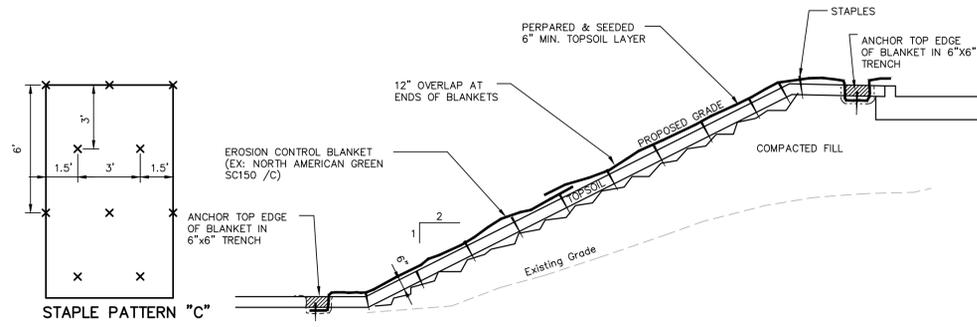
SEE SHEET EC-3 FOR SEDIMENT AND EROSION CONTROL NOTES

**FOR PERMITTING PURPOSES ONLY
NOT RELEASED FOR CONSTRUCTION**



CONCRETE WASH PIT

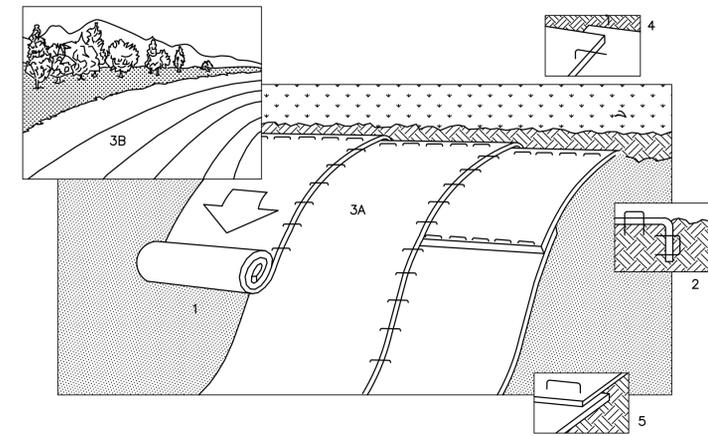
N.T.S.



BLANKET ON FILL SLOPE

N.T.S.

BLEC-009



1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING APPLICATION OF LIME, FERTILIZER, AND SEED.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN 6" DEEP X 6" WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
3. ROLL THE BLANKETS (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE.
4. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH APPROXIMATELY 2" OVERLAP.
5. WHEN BLANKETS MUST BE SPICED DOWN THE SLOPE, PLACE BLANKETS END OVER END (SHINGLE STYLE) WITH APPROXIMATELY 4" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART.

SLOPE STABILIZATION DETAIL

N.T.S.

BLEC-010

SEE SHEET EC-3 FOR SEDIMENT AND EROSION CONTROL NOTES

**FOR PERMITTING PURPOSES ONLY
NOT RELEASED FOR CONSTRUCTION**

REVISIONS	No.	Date	Desc.

Designed	P.G.M.
Drawn	P.G.M.
Reviewed	
Scale	NONE
Project No.	1901517
Date	03/06/2020
CAD File:	EC190151701
Title	SEDIMENT AND EROSION CONTROL DETAILS
Sheet No.	

JEB GROUP
 P.O. BOX E-62
 BOSTON, MA 02127

100 INDUSTRIAL PARK ROAD
 HINGHAM, MA 02043

- NOTES:
1. THE TOPOGRAPHY, SITE DETAIL, AND SURFACE IMPROVEMENTS DEPICTED HERON WERE OBTAINED FROM A PARTIAL FIELD SURVEY CONDUCTED BETWEEN JULY 1 AND SEPTEMBER 9 2016 BY CHA-COMPANIES.
 2. AS BUILT INFORMATION PREPARED BY CHA-COMPANIES.
 3. THE ELEVATIONS DEPICTED HERON ARE BASED ON THE U.S.G.S VERTICAL DATUM 83.
 4. NATURAL RESOURCE DELINEATION WAS CONDUCTED BY DAVID BURKE AND BEALS ASSOCIATES, INC. ON MAY 20, 2016 AND SURVEY LOCATED BY CHA-COMPANIES BETWEEN JULY 1 AND SEPTEMBER 9 2016.
 5. NATURAL RESOURCE BOUNDARIES HAVE BEEN DEPICTED FOR POTENTIAL DEVELOPMENT PARCEL ONLY.



PERMIT DOCUMENTS

PROJECT NUMBER: C-286

SEPTEMBER 26, 2016

REVISIONS:
 1 UPDATE PER SITE WALK 10.12.2016

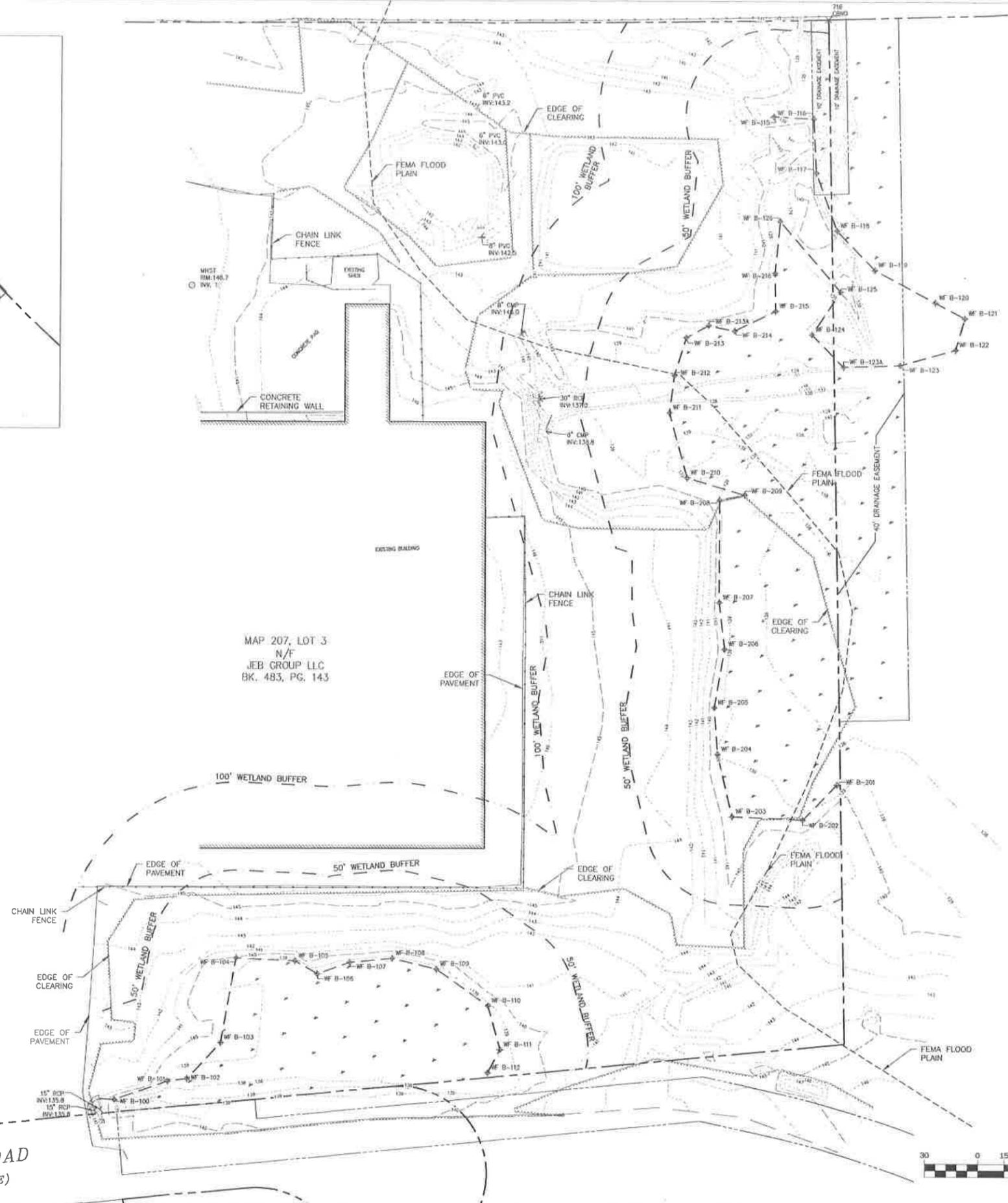
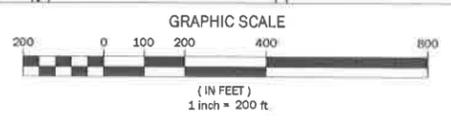
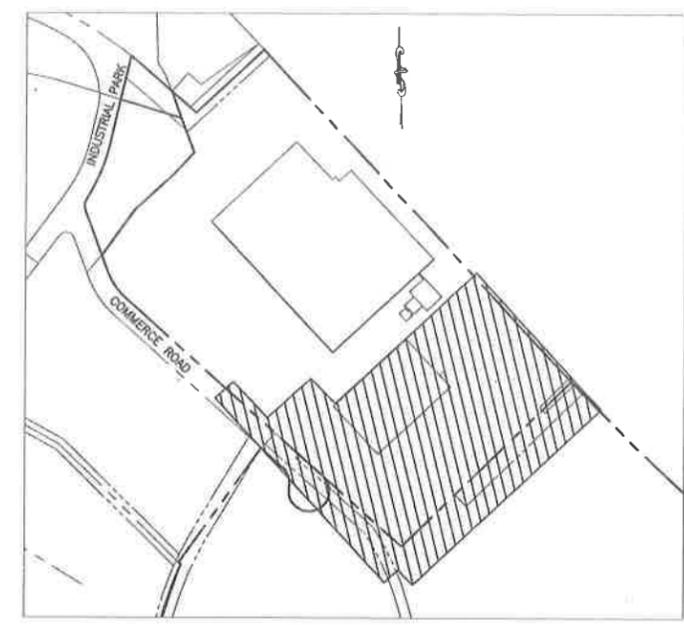
SCALE: 1"=30'

DRAWING NAME:

RESOURCE AREA DELINEATION PLAN

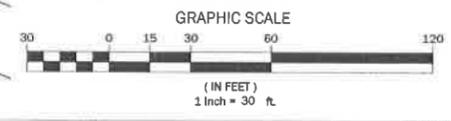
DRAWING NUMBER:

1 OF 1



MAP 207, LOT 3
 N/F
 JEB GROUP LLC
 BK. 483, PG. 143

COMMERCE ROAD
 (PUBLIC - 50' WIDE)



APPENDIX F

**STORMWATER SYSTEM
OPERATION AND MAINTENANCE MANUAL**

Site Operations and Maintenance Plan

For the Proposed:

Commercial Development

Located at:

**100 Industrial Park Road
Hingham, Massachusetts**

Prepared for Submission to:

**Town of Hingham Conservation Commission
Town of Hingham Planning Board**

March 6, 2020

Prepared for:

JEB Group LLC
PO Box E-62
Boston, MA 02127

Prepared by:



BL Companies

355 Research Parkway
Meriden, Connecticut 06450
Phone: (203) 630-1406
Fax: (203) 630-2615

BL Project Number: 1901517

Table of Contents

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General Overview

The subject property is approximately 17.05 acres with two existing easements at the western portion of the property, one consisting of approximately 1.17 acres, the other of approximately 0.25 acres. The parcel is currently developed with two existing buildings, driveways, parking, and some wooded areas that have remained undeveloped. There are existing wetlands to the east of the site in which is currently undeveloped. The proposed redevelopment includes a renovation of the +/- 149,000 square foot (SF) building on the western portion of the site with associated modifications to the parking, drainage, and utilities necessary to support modifications for a new tenant. The project also proposes to demolish the existing building to the southeast for additional parking that is required by the new tenant. The overall existing drainage onsite will be improved through the use of Best Management Practices (BMPs) for water quality and runoff management through detention and outlet control.

A storm water management system will be constructed to control stormwater runoff quantity from the property and improve the runoff quality. The enhanced quality of the stormwater runoff is accomplished through the use of water quality units, underground detention systems, catch basins with deep sumps, hooded catch basin outlets, vegetated slopes, bioretention areas and operations and maintenance criteria for the proposed drainage system.

The following Operations and Maintenance Plan was prepared specifically for this site development in Hingham, Massachusetts. The proposed stormwater management system is designed to be in compliance with the Town of Hingham regulations and the 2008 Massachusetts Stormwater Handbook.

Purpose & Goals

The purpose of this plan is ensuring that the site is operated in accordance with all approvals and permits. The primary goal is to inform the property owner about how the system operates and what maintenance items are necessary to protect downstream wetlands and watercourses. The secondary goal is to provide a practical, efficient means of maintenance planning and record keeping to verify permit compliance.

Responsible Parties

The property owner will be responsible for implementing the Plan on the entire property. The party may retain a management company to oversee the maintenance of the site.

List of Permits & Special Conditions

The site will receive a number of permits, which may contain special conditions that require compliance by the owners and maintenance contractors. These permits may include the following:

Town of Hingham:

Site Plan Permit

Special Permit A3

Conservation Commission Approval

Maintenance Logs and Checklists

The property owner will keep a record of all maintenance procedures performed, date of inspection/ cleanings, etc. Copies of receipts, disposal tickets, inspection reports and maintenance records shall be kept on site in the facility manager's office once it is established. Maintenance logs and inspection forms shall be provided to the Town of Hingham upon request.

Employee Training

The site will have an employee training program, with annual updates, to ensure that the employees charged with maintaining the site do so in accordance with the approved permit conditions. All subcontractors (Vactor, landscaping, snowplowing, etc.) will be informed of requirements and responsibilities.

Spill Control

The owner should have a spill control program. The program should be updated annually and incorporated into the employee training program.

Storm Water Management

System Components

The storm water management system has several components that are shown on the Site Grading and Drainage Plan drawings (GD-0, GD-1, GD-2), and they perform various functions in treating storm water runoff:

Catch Basins are inlets, which trap road sand and floatable debris prior to draining through the storm sewer system. The proposed catch basins (CBs) are equipped with sumps with depths 4' below the outlet pipe, and hoods over the outlet pipes.

Hydrodynamic separators are underground concrete manholes which trap road sand, fine sediment, metals, oils, grease, and floatable debris that wash off the parking lots via storm sewers prior to discharge into the Underground Detention Systems.

Catch Basins and Manholes

The property owner is responsible for cleaning the catch basins and manholes on the property. A Massachusetts Licensed hauler shall clean the sumps, and dispose of removed sand legally. The road sand may be reused for winter sanding, but may not be stored on-site. As part of the hauling contract, the hauler shall notify the property owner in writing where the material is being disposed.

Each catch basin shall be inspected every four months, with one inspection occurring during the month of April. Any debris occurring within one foot from the bottom of each sump shall be removed by Vacuum "Vactor" type of maintenance equipment. At a minimum all catch basins and manholes shall be cleaned out annually.

During the inspection of each of the catch basin sumps, the hoods (where provided) on each of the outlet pipes shall also be observed. In the event that a hood is damaged or off the hanger, it shall be reset or repaired.

Hydrodynamic Separator

The hydrodynamic separator manhole will be cleaned periodically during construction, and at the end of construction once the landscaped areas are fully stabilized, by the Contractor.

Post construction, the property owner is responsible for cleaning and maintaining the hydrodynamic separator. For the first year of operation following construction, inspect the unit once each month for the months of January, February, March and April, and once every six months thereafter, with one inspection occurring during the month of April. A graduated measuring device (stadia rod) shall be inserted into each grit chamber and measurements of any accumulations shall be recorded. Accumulated sediment shall be pumped out when levels reach specific limits in accordance with the manufacturer's recommendations for the specific unit. Accumulated sediment and/or oils/floatables shall be removed by vacuum "Vactor" type of maintenance equipment and disposed of legally off-site.

A detailed maintenance logbook shall be kept for each unit. Information is to include, but not be limited to, the date of inspection, record depth of floatables and solids, depth of accumulated sediment, and volume of sediment removed. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

Underground Detention System

The underground detention systems shall be inspected at the same time that catch basins and manholes are inspected. Each of the inspection ports provided shall be opened and visually checked from the surface. The system shall be kept free of accumulated sand or debris that may act to negatively impact the infiltration process. The underground detention system qualifies as a Confined Space under OSHA regulations, and any maintenance involving entry into the system should comply with OSHA Confined Space Entry Regulations. Accumulated sediment and debris shall be removed by vacuum “Vactor” type of equipment, or manually.

Bioretention System

The bioretention systems shall be checked for and cleaned of trash, excessive sediment, other debris and erosion. Maintain the bioretention systems plantings. A detailed maintenance logbook shall be kept with information including, but not be limited to, the date of inspection, record of grit depth, condition of vegetation, observation of any floatables, and date of cleaning performed.

The bioretention systems shall be inspected every six months in the months of April and October. The inspection shall follow the maintenance list below. The bioretention systems shall be inspected, maintained and cleaned periodically (if required) during construction, and at the end of construction once the vegetation is fully stabilized. For the first year of operation following construction, inspect the raingardens each month for the months of March, April, August and October.

Any accumulations found to be occurring within one foot of the inlet orifice in the detention structure shall be removed and properly disposed off-site. Also, any floating material discovered during inspections shall be removed from the bioretention systems.

Regular inspection/maintenance for the bioretention systems includes the following items:

- removing debris and excess sediment
- checking that the vegetated buffer and pea gravel diaphragm is clear, maintained and functioning properly
- checking that the pipes are clear and the outlet is functioning properly
- checking that the spillway is clear and functioning properly
- checking that the downstream outlet channel is clear, maintained and not eroding
- removing invasive plant species from the system

Site Maintenance

Parking Lots

Parking lots, driveways and sidewalks shall be swept regularly by the property owner to clean trash and other debris. The property owner will sweep parking lots on its property in the spring to remove winter accumulations of road sand.

Landscaping

The property owner will maintain landscaped areas. Normally the landscaping maintenance will consist of pruning, mulching, planting, mowing lawns, raking leaves, etc. Use of fertilizers and pesticides will be controlled and limited to minimal amounts necessary for healthy landscape maintenance.

The lawn areas, once established, will be maintained at a typical height of 2½"-3". This will allow the grass to be maintained with minimal impact from weeds and/or pests. The low-maintenance slope areas will be maintained as a meadow, buffer enhanced plantings where applicable, or allowed to revert back to natural conditions.

Pesticides will only be used as a control method when a problem has been clearly identified and other natural control methods are not successful. All pesticide applications shall be by licensed applicators, where necessary.

Topsoil, brush, leaves, clippings, woodchips, mulch, and other material shall be stored off site.

Outdoor Storage

There will be no outdoor storage of hazardous chemicals, fertilizer, pesticides, or herbicides anywhere in the site.

Snow Removal & Storage

Snow shall be shoveled and plowed from sidewalks, driveways and parking areas as soon as practical during and after winter storms and stored in snow storage areas on site where practical.

MAINTENANCE SCHEDULE

During the First Year of Operation:		
Task:	Completion Date:	Manager's Initials:
JANUARY:		
Employee Training Program with Spill Program		
*Subsurface Detention System		
FEBRUARY:		
* Subsurface Detention System		
MARCH:		
* Subsurface Detention System		
* Bioretention Systems		
APRIL:		
*Catch Basin/Yard Drain		
* Subsurface Detention System		
*Bioretention System		
Shrub Fertilization		
Lawn Limbing (if necessary)		
AUGUST:		
*Catch Basin/Yard Drain		
* Subsurface Detention System		
*Bioretention System		
OCTOBER:		
* Subsurface Detention System		
*Bioretention System		
Tree and Lawn Fertilization		
DECEMBER:		
*Catch Basin/Yard Drain		
* Subsurface Detention System		

*NOTE: Use appropriate worksheet found in this plan to conduct the inspection.

After the First Year of Operation:		
FOR YEAR _____		
Task:	Completion Date:	Manager's Initials:
JANUARY:		
Employee Training Program with Spill Program		
APRIL:		
*Catch Basin/Yard Drain		
* Subsurface Detention System		
*Bioretention System		
Shrub Fertilization		
Lawn Limbing (if necessary)		
AUGUST:		
*Catch Basin/Yard Drain		
OCTOBER:		
* Subsurface Detention System		
*Bioretention System		
Tree and Lawn Fertilization		
DECEMBER:		
*Catch Basin/Yard Drain		

*NOTE: Use appropriate worksheet found in this plan to conduct the inspection.

CATCH BASIN / CATCH BASIN INSERT INSPECTION LOG

Name of Inspector:

Date:

Catch Basin ID	Condition (circle one)		Debris above 1' within sump? (If yes then catch basin is to be cleaned)		Date of Catch Basin Cleaning (if debris is greater than 1')		Condition of Hood (if applicable)	Comments:
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							

	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							

On-site Procedures for Inspection and Maintenance of Catch Basin Inserts

- Secure traffic and pedestrian traffic with cones, barrels, etc.
- Clean surface area around each catch basin
- Remove grates and set aside
- Clean grates, remove litter and debris that may be trapped within the grate
- Remove by vacator hose the debris that has been trapped in the trough area. Dispose of in accordance with local, state and federal regulatory agency requirements. Most debris that is captured in the trough or sump area will fall into the non-hazardous waste category.
- Visually inspect and check the condition of the trough area.
- Replace grate and lockdown as needed.
- Un-secure traffic control area.
- Complete service report and submit to facility owner.

APPENDIX G

GEOTECHNICAL INFORMATION

Geotechnical Report
Boring Logs
Infiltration Test Results



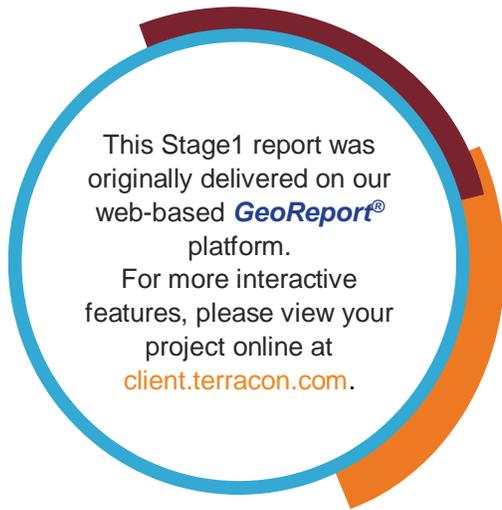
Hingham Warehouse

100 Industrial Park Road
Hingham, MA

BL Companies
Norwood, MA

Terracon Project No. GR195304
September 16, 2019





REPORT TOPICS

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PLANNED CONSTRUCTION	7
PREVIOUS SITE USAGE	8
CONCEPTUAL GEOTECHNICAL MODEL	9
TERRACON EXPLORATION PLAN	11
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LIMITATIONS	14

PREPARED BY:



Marcey J. Fox
 Client Service Manager
marcey.fox@terracon.com

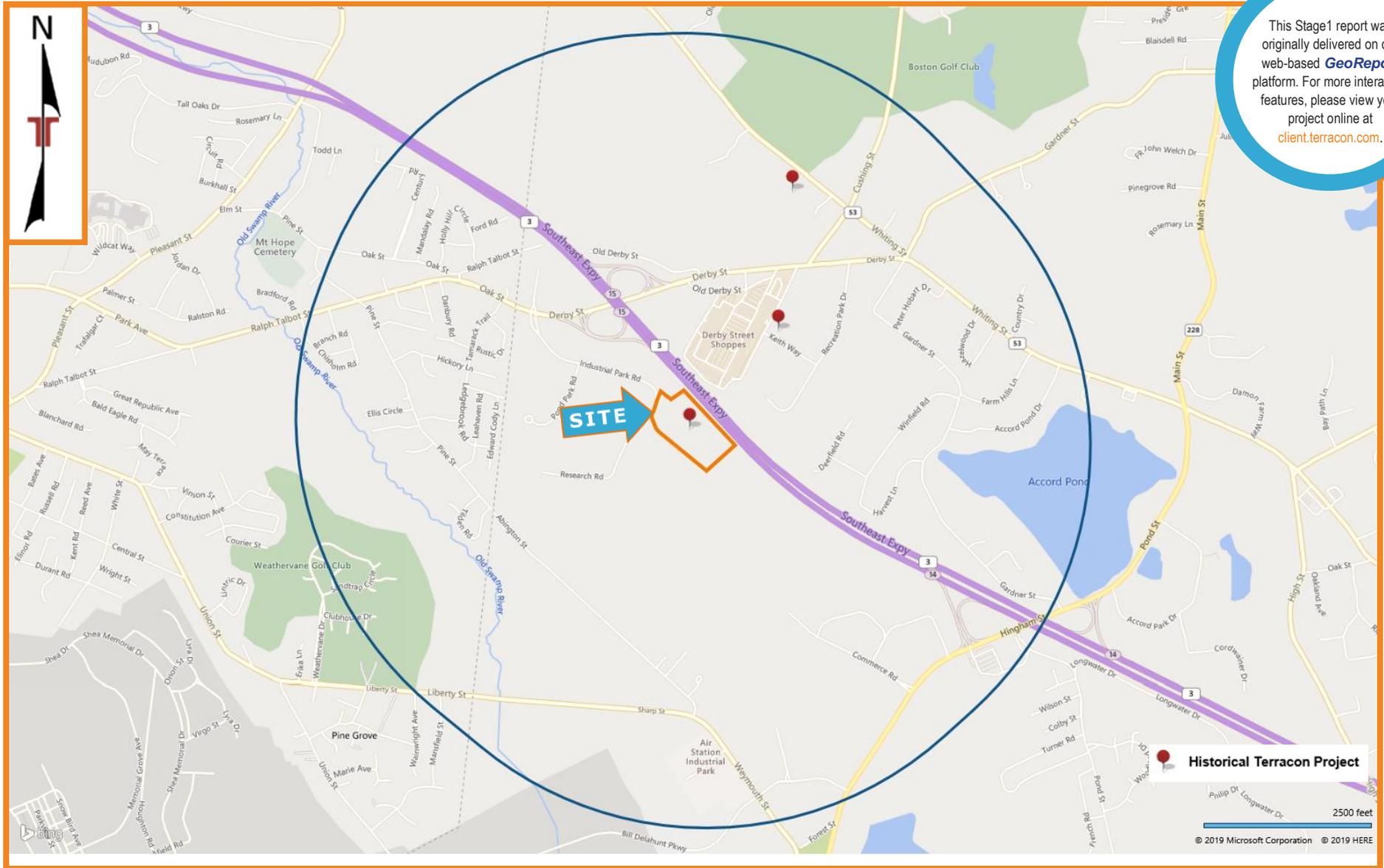
Carl W. Thunberg, P.E.
 Senior Geotechnical Engineer
carl.thunberg@terracon.com

Reviewed by Terracon’s authorized geotechnical project reviewer Steven D. Thorne.

The engineering opinion included with this signature/stamp, dated September 16, 2019, is our recommended exploration plan only. Opinions of the expected conditions and foundation or construction considerations, and **any related opinions are preliminary and cannot be considered an engineer’s work product until confirmed by the TERRACON EXPLORATION PLAN.**

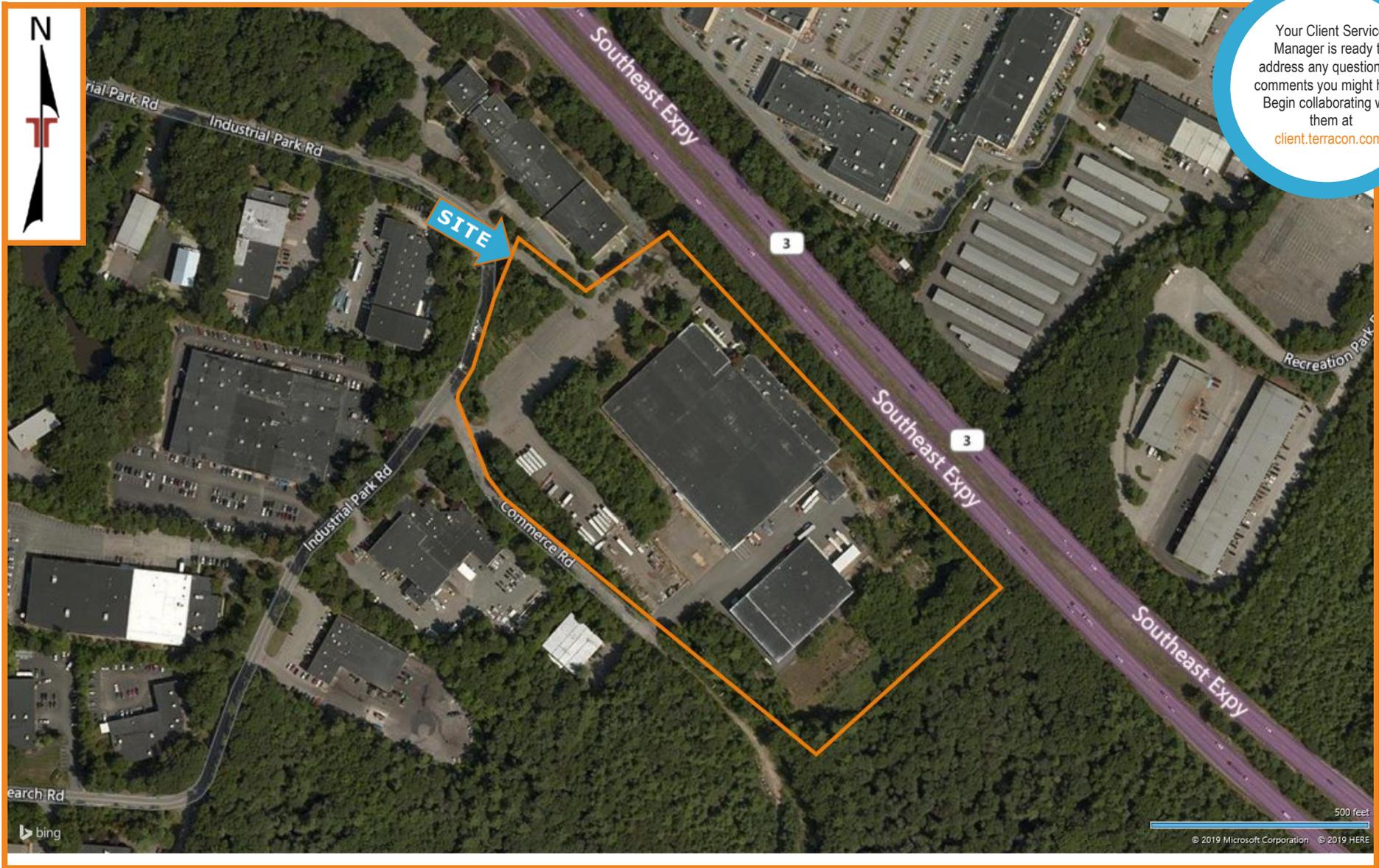
SITE CHARACTERISTICS

NEARBY TERRACON GEOTECHNICAL DATA



See **INFORMATION SOURCES** for a detailed list of sources used to generate this figure.

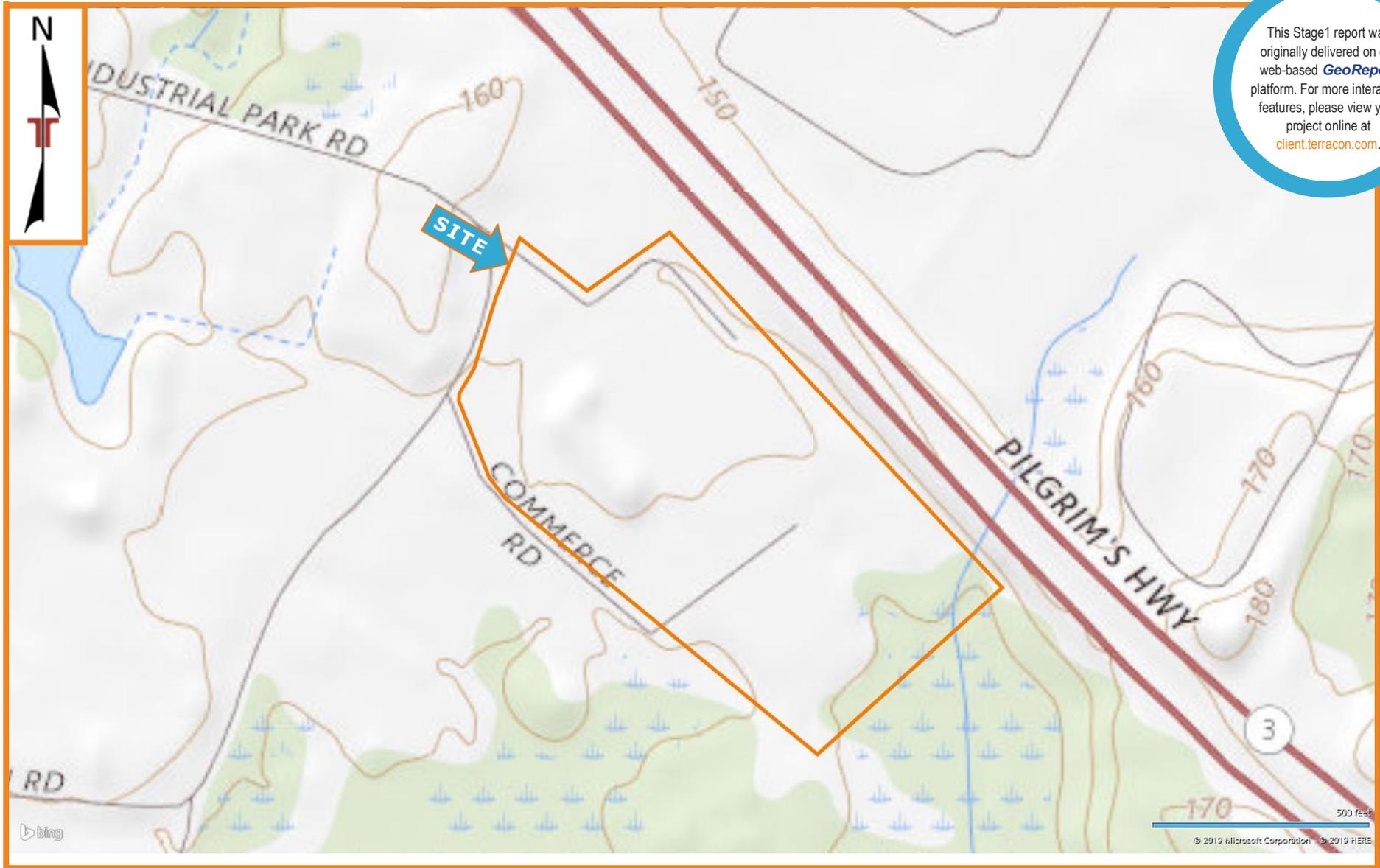
SITE AERIAL



Your Client Service Manager is ready to address any questions or comments you might have. Begin collaborating with them at client.terracon.com.

See **INFORMATION SOURCES** for a detailed list of sources used to generate this figure.

SITE TOPOGRAPHY



See **INFORMATION SOURCES** for a detailed list of sources used to generate this figure.

SITE GEOLOGY



For a wider variety of maps and details, make sure to view your Stage1 online at client.terracon.com.

See **INFORMATION SOURCES** for a detailed list of sources used to generate this figure.

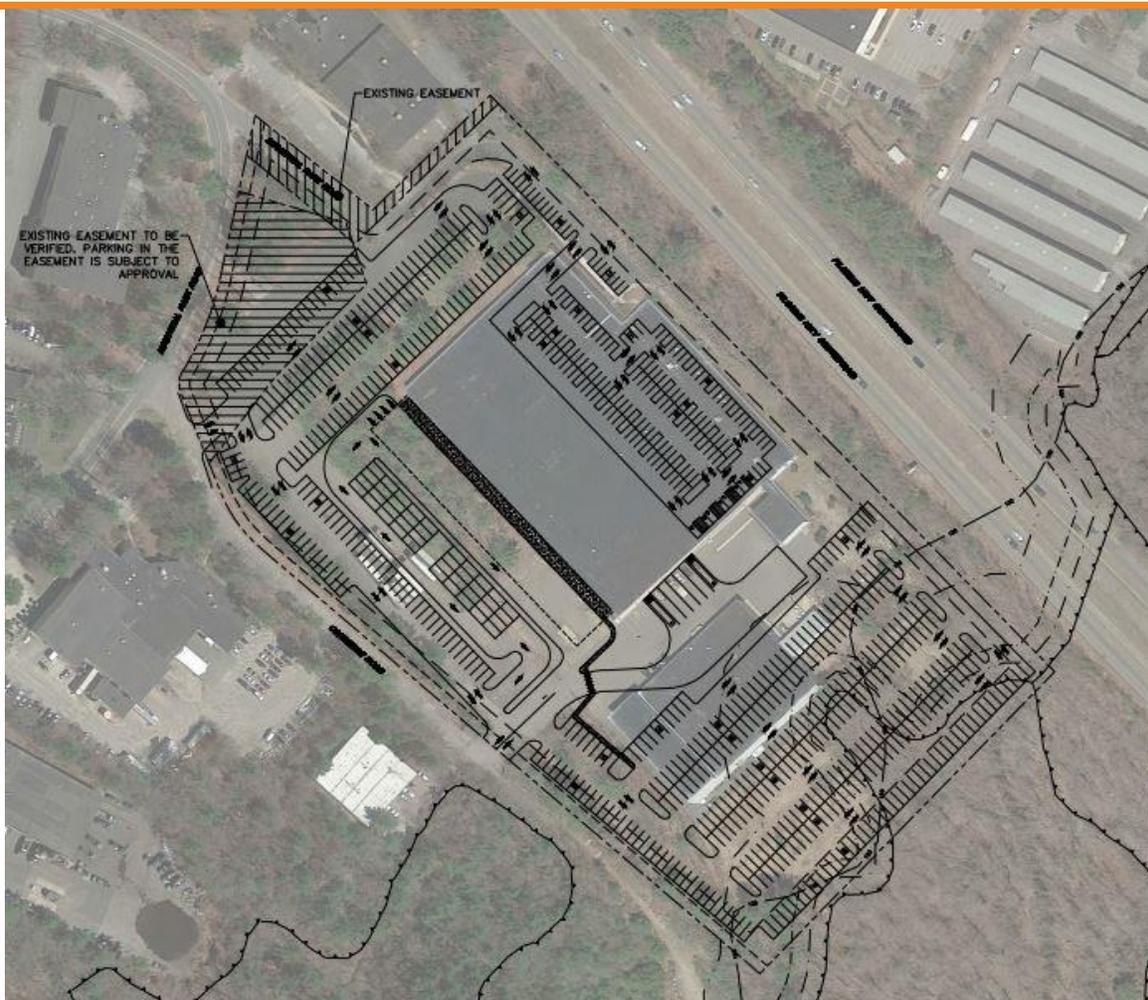
PLANNED CONSTRUCTION

INFORMATION PROVIDED

- Sketch Plan Sheet No. SK-1 (9/10/2019) was furnished to us from BL Companies.

PROJECT DESCRIPTION

- The project is located at 100 Industrial Park Road in, Hingham, MA.
- The site covers approximately 17-acres; and is currently occupied by a warehouse facility. We understand the existing warehouse will remain and will be renovated to include parking inside a portion of the building. Expansion of the exterior existing parking areas are also planned.
- We anticipate that both rigid (concrete) and flexible (asphalt) pavement sections will be considered for the new pavement areas. Anticipated traffic loading and design period are as follows:
 - 30,000 18-kip EALs for standard-duty parking lots
 - 100,000 18-kip EALs for heavy-duty driveways and van access lanes
 - The pavement design period is 15 years
- If the above information is not accurate, please let us know and we can revise accordingly.



PREVIOUS SITE USAGE

HISTORICAL AERIAL IMAGES

Terracon reviewed the following readily available historical aerial images available from Google Earth Pro™ to develop a limited history of previous site usage.

- Aerial Images: 20 images from 1995 to 2018 were reviewed.

HISTORICAL AERIAL IMAGES SUMMARY

- 1995-2018: Two warehouse buildings occupy the majority of the site. Paved drive and parking areas are noted.

HISTORICAL AERIAL IMAGERY USAGE

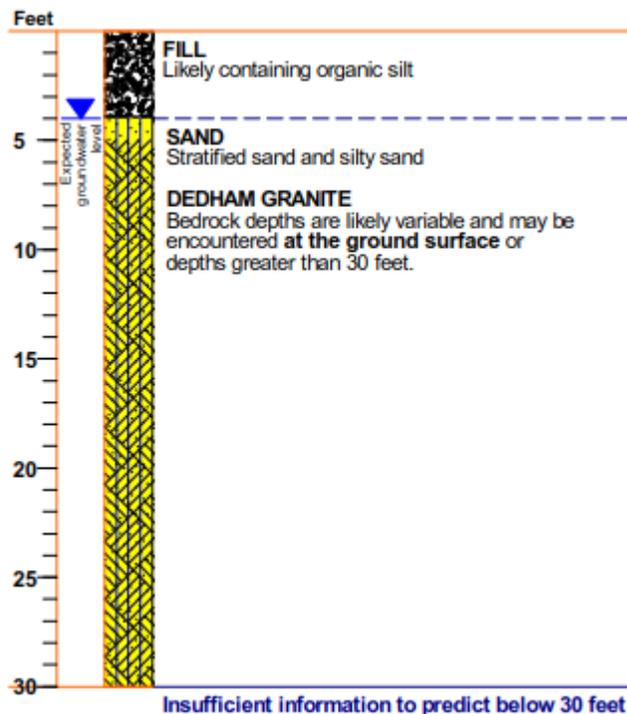
The use of these readily available aerial imagery resources, while helpful to understand previous site usage, should not be considered suitable for detecting any prior site usage that may have affected the site subsurface conditions. These images are widely spaced in time, and a more comprehensive review of aerial imagery and/or site interviews would be required to better understand previous site usage.

CONCEPTUAL GEOTECHNICAL MODEL

The following opinion of expected geotechnical conditions must be validated with a geotechnical engineering evaluation, fieldwork, and testing. See **LIMITATIONS** for additional information. This discussion is preliminary in nature and not for design purposes. In no case should the information or opinions provided in this report be utilized for final design.

AREA REPRESENTED: Entire site

EXPECTED LITHOLOGY



CONFIDENCE

The project geotechnical engineer has assigned confidence estimates for the datasets below. For information regarding the confidence levels below, see **CONFIDENCE ESTIMATE**.

LOCAL EXPERIENCE: MODERATE

PUBLIC DATA: HIGH

HISTORICAL DATA: MODERATE

OVERALL CONFIDENCE: MODERATE

DESIGN CONCEPTS

- The site is located within an industrial park with a history of prior development. Urban fill may be encountered during construction and the possibility of encountering abandoned structures during construction cannot be eliminated.
- The site development sketch provided suggests renovation of the existing building south of the main building and approximately half of the main building to include parking inside the existing building, followed by expansion of existing parking facilities. At this time, no information is yet available whether new foundations are planned.
- This area is usually a Seismic Site Class D.
- Site pavements may be constructed with "typical" pavement sections using standard DOT specified materials, with a recommended total granular subbase/base thickness of at least 12 inches to mitigate frost effects.

CONSTRUCTION & SITE CONSIDERATIONS

- Urban fill is considered unsuitable for direct or indirect support of foundations. If encountered, urban fill should be excavated its full depth within the footing zone of influence and replaced with compacted Structural Fill.
- Urban fill may be left in place to support new pavement sections. However, differential settlements of the pavement (several inches or so) may be possible over time. As a result, periodic shimming maintenance may be necessary in the future to correct the differential settlement. If the risks, of increased maintenance are not acceptable, then it would be necessary to remove the existing fill and replace it with controlled layers of Structural Fill.
- Shallow groundwater may be present at the site. If encountered, temporary construction dewatering will be required. Filtered sumps and pumps are typically used for granular soils encountered in the site vicinity.
- Surface sands are typically compacted with vibratory rollers. Generally, at least two to three feet of separation between compaction surface and groundwater level is required to avoid pumping.
- Bedrock depth in Hingham is highly variable and may be shallow. Rock excavation may potentially be required for new foundations, if planned.
- Hazardous building materials (e.g. asbestos, lead-based paint, PCBs, etc.) may potentially be encountered during demolition or interior renovations. Terracon offers hazardous building material assessment services and would be pleased to submit a proposal for performing a demolition/pre-construction hazardous materials assessment.

TERRACON EXPLORATION PLAN

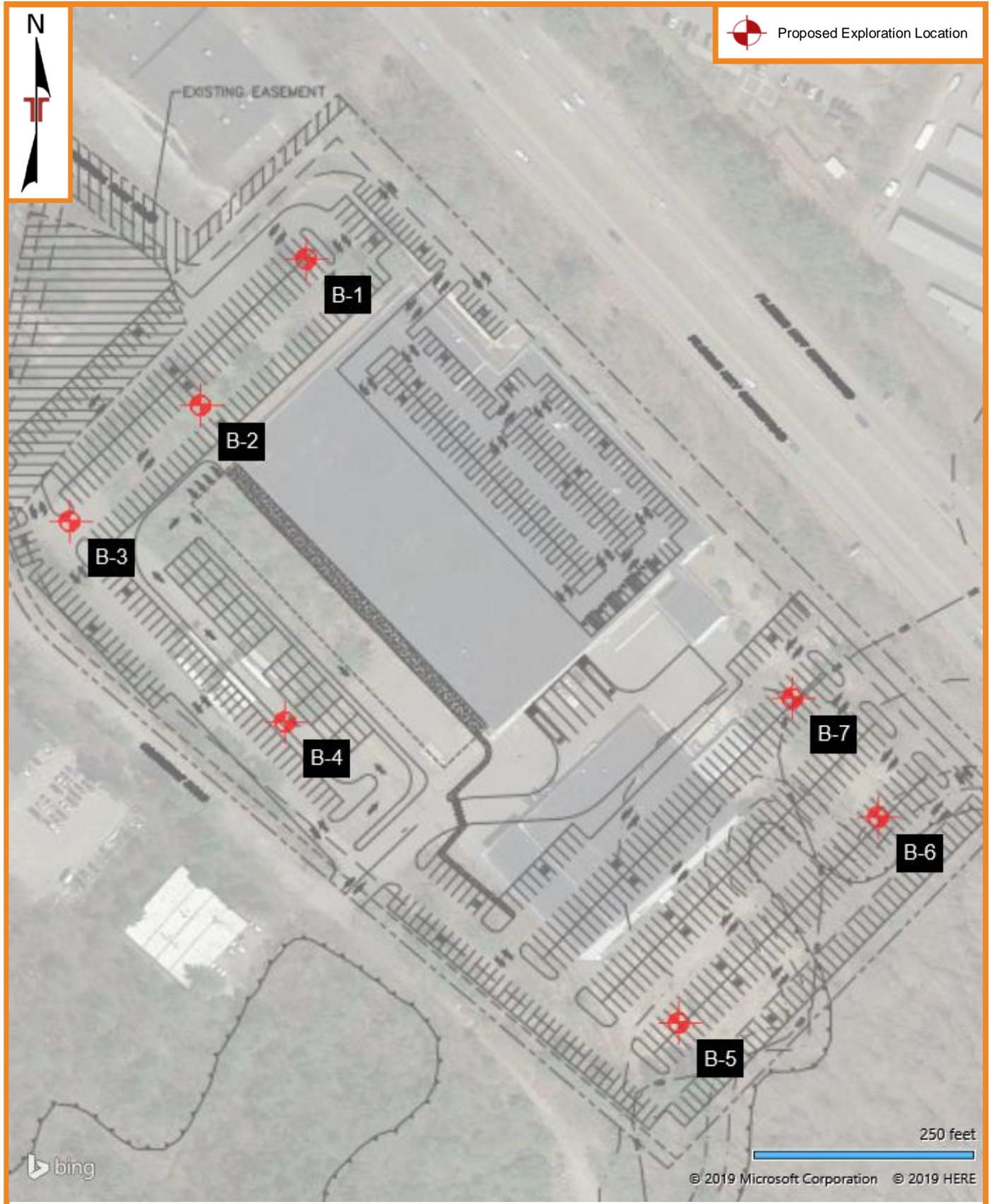
- In order to characterize the subsurface conditions, we recommend exploratory borings and a geophysical survey of the site. Exploratory Standard Penetration Test (SPT) borings will provide the necessary sampling and testing to provide design parameter recommendations.
- Test pits may be warranted to determine existing foundation geometry. This information may assist the structural engineer design interior renovations. Geophysical methods such as Ground Penetrating Radar (GPR) may be warranted to identify subsurface utilities prior to mobilizing drilling equipment or a backhoe.
- GPR can be used to further characterize the subsurface conditions to identifying areas of shallow bedrock.
- Extent of new foundations is unknown at this time. Number and depth of building borings will need to be determined once new foundations are identified. Explorations for the pavement expansion areas will likely include seven borings advanced to depths of approximately 10 feet

Soil laboratory testing may include:

- Gradation analysis
- Proctor Compaction
- California Bearing Ratio

- We recommend completing a Phase I ESA for the site if one has not already been performed.

TERRACON EXPLORATION PLAN (CONTINUED)



See [INFORMATION SOURCES](#) for a detailed list of sources used to generate this figure.

INFORMATION SOURCES

TERRACON HISTORICAL PROJECTS

Terracon has approximately 3 geotechnical projects within 1-mile of your project site. Of those, the local practitioner reviewed select exploration projects to gain a better understanding of potential subsurface conditions. The geotechnical project locations are illustrated on the [GeoReport](#) platform, and on the **SITE LOCATION MAP**.

PUBLIC DATA SOURCES



TOPOGRAPHY
GEOLOGY



Soil Survey Geographic U.S. Database

DEPTH TO BEDROCK
DEPTH TO WATER
FLOOD FREQUENCY
SOIL HYDRO GROUP
SOIL PARENT MATERIAL

OTHER
BING MAPS
GOOGLE MAPS
GOOGLE EARTH PRO™ (Historical Aerial Images)

METHOD

The **CONCEPTUAL GEOTECHNICAL MODEL** developed for the subject site provides expected subsurface (lithology and groundwater) conditions as well as site preparation and foundation options based upon the expected subsurface conditions and our understanding of the planned construction.

It is based upon Terracon's review of information from selected sources within the public domain, historical subsurface exploration and testing data in the vicinity of the project site and the experience of Terracon's local practitioners.

If sufficient site development plans are available, a work plan required to confirm the Conceptual Geotechnical Model is included. The work plan is intended to be executed by Terracon to confirm our Conceptual Geotechnical Model. The work plan may not be sufficient in scope for other geotechnical engineers.

CONFIDENCE ESTIMATE

Terracon has assigned confidence estimates for the datasets based on upon the engineer's local practice in the vicinity of your site. The engineer assigned a subjective confidence opinion of low, moderate, or high for each of the following categories:

- Local Experience
- Public Data
- Historical Project Data

Using a weighted averaging approach, we derived an overall confidence interval for all the combined information sources. Low confidence implies that the level of available data and/or consistency is such that little confidence can be placed in the Conceptual Geotechnical Model. Conversely, a high confidence ranking implies that sufficient data and consistency exists to derive a high confidence in the statement of expected conditions.

Regardless of the confidence ranking, actual conditions may vary significantly from the predicted conditions, and the expected conditions must be confirmed with site-specific exploration data, and significant variations from the expected conditions are possible.

The **CONCEPTUAL GEOTECHNICAL MODEL** is preliminary in nature and not for design purposes. Any opinions regarding the subsurface conditions for this project may not represent actual conditions encountered during project exploration, or construction. In no case should the information or opinions provided in this Stage1 be utilized for final design.

LIMITATIONS

The sources of publicly available information as provided in this Stage1 are identified in the Project Map Viewer and referenced in **INFORMATION SOURCES**. Terracon makes no warranty as to accuracy of any public information, as displayed in the viewer.

Confirmation of opinions stated in this document is essential. Confirmation should include performing a site-specific geotechnical evaluation consisting of exploratory soil borings and/or related exploration methods consistent with the guidelines set forth in the **TERRACON EXPLORATION PLAN**.

This Stage1 **GeoReport** addresses a preliminary, unverified opinion of geotechnical conditions only. The report does not include either specifically, or by implication, any environmental assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions.

Furthermore, given the limitations described above, and based on the preliminary nature of this report, all parties are advised that any decisions or actions taken by any party based on the information contained herein, including decisions with financial implications are done solely at the risk of that party. By providing this information in this preliminary form, Terracon expressly disclaims any duties or obligations associated with the usage of this information for decision-making purposes.

In the event that changes to the nature, design, or location of the project as outlined in this report are planned, the preliminary conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing. In the event the project moves into the design phase, Terracon should be retained to develop and complete a scope of work that includes site specific explorations to confirm or to modify this preliminary report.

Terracon and BL Companies recognize that we have entered into an agreement that may contain certain confidential or non-disclosure obligations relating to our services. BL Companies recognizes, however, that while Terracon will not violate any such obligations, none of these create an exclusivity obligation to Terracon relating to the service or data in question. Terracon has the unfettered ability to provide similar services to any other party and use any public or previously available data for the service of others, even if included as part of this report.

The review of historical aerial imagery is limited to the images available from Google Earth Pro™. Terracon does not represent the imagery reviewed to be a complete historical record of previous site usage.



BORING LOG

Project: 100 Industrial Park Way
 Location: Hingham, Massachusetts
 Nobis Project No.: 96170.03

Boring No.: B-1
 Boring Location: See Boring Location Plan
 Checked by: B. Waterman
 Date Start: January 3, 2020
 Date Finish: January 3, 2020

Contractor: New England Boring Contractors Rig Type / Model: Truck / Diedrich D-120 Ground Surface Elev.: (+/-) 149
 Driller: N. Stutterd Hammer Type: Automatic Hammer
 Nobis Rep.: K. Kocia Hammer Hoist: Automatic Datum: NAVD 88

Type	Drilling Method	Sampler	Groundwater Observations					
			Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
	Hollow Stem Auger	Split-Spoon	01/03/20	08:20	8.0	8.5	10.5	5 min
Size ID (in.)	2.25	1-3/8						
Advancement	Augered	140-lb Hammer						

Depth (ft.)	SAMPLE INFORMATION				Ground Water	LITHOLOGY		SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.		Graphic	Stratum Elev. / Depth (ft.)		
1	S-1	21	0.5-2.5	6		148.8 / 0.3 ASPHALT 148.5 / 0.5 BASE COARSE FILL 148.1 / 0.9	Approximately 3.0-inches of asphalt. Base coarse consisted of fine to coarse SAND, little fine to coarse Gravel, trace Silt; approximately 3-inches in thickness.		
2				9			S-1A (3"): Medium dense, black to brown, fine to medium SAND, little Silt, several asphalt particles/fragments. Moist. [USDA Classification: SANDY LOAM]. S-1B (18"): Medium dense, brown, fine to coarse SAND, some Silt, little fine Gravel. Moist. [USDA Classification: SANDY LOAM].		
3	S-2	21	2.5-4.5	11			S-2: Medium dense, brown to tan, fine SAND, some Silt. Moist. Faint redoximorphic staining present. [USDA Classification: SANDY LOAM]; [Laboratory Analysis From Auger Cuttings - Results Pending].		
4				10					
5	S-3	15	4.5-6.5	10			S-3: Medium dense, tan to gray, fine SAND, some Silt, very few roots. Moist. Very faint redoximorphic staining present. [USDA Classification: SAND]; [Laboratory Analysis - Sieve & Hydrometer (USCS): Gravel = 0.8%, Sand = 73.7%, Silt & Clay = 25.5%].		
6				6			GLACIAL DRIFT		
7	S-4	23	6.5-8.5	6			S-4: Medium dense, gray to orangish-brown, fine SAND, some Silt. Moist to wet. Several redoximorphic staining pockets present. [USDA Classification: SANDY LOAM].		
8				6					
9	S-5	24	8.5-10.5	6			S-5: Medium dense, gray to brown, fine SAND, some Silt. Wet. Few redoximorphic staining pockets present. [USDA Classification: SANDY LOAM].		
10				5					
11				7					
12				7					
13				8					
14									
15							138.5 / 10.5	Boring terminated at 10.5 feet.	1

Soil	Percentage	Non-Soil	NOTES:
trace	5 - 10	very few	1) Boring backfilled with spoils and one (1) bag of filter sand, topped with cold asphalt patch at ground surface and tamped.
little	10 - 20	few	
some	20 - 35	several	
and	35 - 50	numerous	

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 1/21/20 16:16 - J:\96170.03 PARKING AND SITE DEVELOPMENT - HINGHAM, MA\GEO\TECHNICAL\EXPLORATIONS\96170.03 BORING LOGS.GPJ



BORING LOG

Boring No.: **B-2**
 Boring Location: See Boring Location Plan
 Checked by: B. Waterman
 Date Start: January 3, 2020
 Date Finish: January 3, 2020

Project: 100 Industrial Park Way
 Location: Hingham, Massachusetts
 Nobis Project No.: 96170.03

Contractor: New England Boring Contractors
 Driller: N. Stutterd
 Nobis Rep.: K. Kocia

Rig Type / Model: Truck / Diedrich D-120
 Hammer Type: Automatic Hammer
 Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 142
 Datum: NAVD 88

Type	Drilling Method	Sampler	Groundwater Observations					
			Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
	Hollow Stem Auger	Split-Spoon	01/03/20	09:20	2.5	6/5	8.5	5 min
Size ID (in.)	2.25	1-3/8						
Advancement	Augered	140-lb Hammer						

Depth (ft.)	SAMPLE INFORMATION				Ground Water	LITHOLOGY		SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.		Graphic	Stratum Elev. / Depth (ft.)		
1	S-1	10	0.5-2.5	7	▼	ASPHALT 141.6 / 0.4	Approximately 5.0-inches of asphalt.		
				7		BASE COARSE 141.1 / 0.9	Base coarse consisted of fine to coarse SAND, some fine to coarse Gravel, trace Silt; approximately 6-inches in thickness.		
2				7		FILL 140.5 / 1.5	S-1A (5"): Medium dense, brown to gray, fine to coarse SAND and fine Gravel, trace Silt. Moist. [USDA Classification: VERY GRAVELLY SAND].		
				4			S-1B (5"): Medium dense, brown to dark gray, SILT, some fine to medium Sand. Moist. [USDA Classification: SILT LOAM].		
3	S-2	15	2.5-4.5	3			S-2A (6"): Medium dense, dark brown to gray, SILT, some fine to medium Sand, very few roots and organic fibers. Moist to wet. [USDA Classification: SILT LOAM].		
				7			S-2B (9"): Medium dense, bluish-gray, fine to coarse SAND, some Silt. Wet. [USDA Classification: SANDY LOAM].		
4				10					
				10					
5	S-3	12	4.5-6.5	13		GLACIAL DRIFT	S-3: Dense, brown to gray, fine to medium SAND and Silt. Wet. Several redoximorphic staining pockets present. [USDA Classification: SANDY LOAM]; [Laboratory Analysis - Sieve & Hydrometer (USCS): Gravel = 2.0%, Sand = 49.0%, Silt & Clay = 49.0%]		
				15					
6				15					
				13					
7	S-4	16	6.5-8.5	10			S-4: Medium dense, tan to orangish-brown, SILT and fine to medium Sand, trace Clay. Wet. Several redoximorphic staining pockets present. [USDA Classification: SILT LOAM].		
				11					
8				10					
				11					
9						133.5 / 8.5	Boring terminated at 8.5 feet.	1	
10									
11									
12									
13									
14									
15									

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 spoils and one (1) bag of filter sand, topped with cold asphalt patch at ground surface and tamped.

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BORING LOG

Project: 100 Industrial Park Way
 Location: Hingham, Massachusetts
 Nobis Project No.: 96170.03

Boring No.: B-3
 Boring Location: See Boring Location Plan
 Checked by: B. Waterman
 Date Start: January 3, 2020
 Date Finish: January 3, 2020

Contractor: New England Boring Contractors Rig Type / Model: Truck / Diedrich D-120
 Driller: N. Stutterd Hammer Type: Automatic Hammer
 Nobis Rep.: K. Kocia Hammer Hoist: Automatic Datum: NAVD 88
 Ground Surface Elev.: (+/-) 150

Type	Drilling Method	Sampler	Groundwater Observations					
			Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
	Hollow Stem Auger	Split-Spoon	01/03/20	10:35	5.0	6.3	6.3	5 min
Size ID (in.)	2.25	1-3/8						
Advancement	Augered	140-lb Hammer						

Depth (ft.)	SAMPLE INFORMATION				Ground Water	LITHOLOGY		SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.		Graphic	Stratum Elev. / Depth (ft.)		
1	S-1	16	0.5-2.5	10		149.8 / 0.2 ASPHALT	Approximately 2.0-inches of asphalt.		
				10		149.6 / 0.4 BASE COARSE FILL	Base coarse consisted of fine to coarse SAND, little fine to coarse Gravel, trace Silt; approximately 2-inches in thickness.		
2				9		148.5 / 1.5	S-1A (7"): Medium dense, brown, fine to coarse SAND, trace Silt, very few asphalt particles/fragments. Moist. [USDA Classification: SANDY LOAM].		
				11			S-1B (9"): Medium dense, brown to orangish-brown, fine to coarse SAND and Silt, trace fine Gravel. Moist. End of split spoon sample present with redoximorphic staining. [USDA Classification: SANDY LOAM].		
3	S-2	12	2.5-4.5	12		GLACIAL DRIFT	S-2: Medium dense, brown to pink to gray, SILT and fine to coarse Sand, little fine Gravel. Moist. Weathered bedrock fragments present in soil cuttings and tip of split-spoon. [USDA Classification: SILT LOAM].		
				11					
				10					
				13		145.6 / 4.4			
5	S-3	8	4.5-6.3	12		WEATHERED BEDROCK	S-3: Very dense, orangish-brown to pink to gray, WEATHERED BEDROCK particles/fragments. Moist to wet.		
				50					
				51					
				50 1/4"		143.7 / 6.3			
7							Boring terminated at 6.3 feet on auger refusal.	1	
8									
9									
10									
11									
12									
13									
14									
15									

Soil	Percentage	Non-Soil	NOTES:
trace	5 - 10	very few	1) Boring backfilled with spoils and one (1) bag of filter sand, topped with cold asphalt patch at ground surface and tamped.
little	10 - 20	few	
some	20 - 35	several	
and	35 - 50	numerous	

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BORING LOG

Project: 100 Industrial Park Way
 Location: Hingham, Massachusetts
 Nobis Project No.: 96170.03

Boring No.: B-4
 Boring Location: See Boring Location Plan
 Checked by: B. Waterman
 Date Start: January 3, 2020
 Date Finish: January 3, 2020

Contractor: New England Boring Contractors Rig Type / Model: Truck / Diedrich D-120
 Driller: N. Stutterd Hammer Type: Automatic Hammer
 Nobis Rep.: K. Kocia Hammer Hoist: Automatic Datum: NAVD 88
 Ground Surface Elev.: (+/-) 146

Type	Drilling Method	Sampler	Groundwater Observations					
			Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
	Hollow Stem Auger	Split-Spoon	01/03/20	09:55	Not Encountered	3.5	3.5	10 min
Size ID (in.)	2.25	1-3/8						
Advancement	Augered	140-lb Hammer						

Depth (ft.)	SAMPLE INFORMATION				Ground Water	LITHOLOGY		SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.		Graphic	Stratum Elev. / Depth (ft.)		
1	S-1	19	0.5-2.5	8		145.8 / 0.2 ASPHALT	Approximately 1.9-inches of asphalt.		
				10		BASE COARSE 145.5 / 0.5	Base coarse consisted of fine to coarse SAND, some fine to coarse Gravel, little Silt; approximately 3-inches in thickness.		
2				15		GLACIAL DRIFT	S-1: Medium dense, brown to light gray, fine to coarse SAND, some fine to coarse Gravel, some Silt. Moist. [USDA Classification: GRAVELLY SANDY LOAM].		
				20					
3	S-2	6	2.5-3.3	28		143.0 / 3.0	S-2: Very dense, brown to white, fine to coarse SAND and fine Gravel, little Silt. Moist. Weathered bedrock fragments present in soil cuttings and tip of split-spoon. Approximately 1200 psi of downward pressure performed at 3.5 feet bgs. [USDA Classification: VERY GRAVELLY SANDY LOAM].		
				50/3"		WEATHERED BEDROCK 142.5 / 3.5	Boring terminated at 3.5 feet on auger refusal.		
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

Soil	Percentage	Non-Soil	NOTES:
trace	5 - 10	very few	1) Boring backfilled with spoils, topped with cold asphalt patch at ground surface and tamped.
little	10 - 20	few	
some	20 - 35	several	
and	35 - 50	numerous	

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BORING LOG

Project: 100 Industrial Park Way
 Location: Hingham, Massachusetts
 Nobis Project No.: 96170.03

Boring No.: B-5
 Boring Location: See Boring Location Plan
 Checked by: B. Waterman
 Date Start: January 3, 2020
 Date Finish: January 3, 2020

Contractor: New England Boring Contractors Rig Type / Model: Truck / Diedrich D-120
 Driller: N. Stutterd Hammer Type: Automatic Hammer
 Nobis Rep.: K. Kocia Hammer Hoist: Automatic Datum: NAVD 88
 Ground Surface Elev.: (+/-) 150

Type	Drilling Method	Sampler	Groundwater Observations					
			Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
	Hollow Stem Auger	Split-Spoon	01/03/20	11:40	6.5	6.5	8.5	5 min
Size ID (in.)	2.25	1-3/8						
Advancement	Augered	140-lb Hammer						

Depth (ft.)	SAMPLE INFORMATION				Ground Water	LITHOLOGY		SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.		Graphic	Stratum Elev. / Depth (ft.)		
1	S-1	10	0.5-2.5	9		149.9 / 0.2 ASPHALT BASE COARSE 149.5 / 0.5	Approximately 1.8-inches of asphalt. Base coarse consisted of fine to coarse SAND, little fine to coarse Gravel, little Silt; approximately 3-inches in thickness.		
2				10			S-1: Dense, brown, fine to coarse SAND, some Silt, little fine Gravel. Moist. Strong resistance when advancing augers to 2.5 feet bgs. [USDA Classification: SANDY LOAM].		
				20					
				48					
3	S-2	17	2.5-4.5	18			S-2: Very dense, tan to light gray, fine to coarse SAND and Silt, some fine to coarse Gravel. Moist. Faint redoximorphic staining present. Weathered bedrock fragments present in soil cuttings and tip of split-spoon. [USDA Classification: GRAELLY SANDY LOAM].		
				30					
				38					
				32					
5	S-3	11	4.5-6.3	18		GLACIAL DRIFT	S-3: Very dense, tan to light gray, fine to coarse GRAVEL, some fine to coarse Sand, little Silt. Moist. Weathered bedrock fragments present in soil cuttings and tip of split-spoon. [USDA Classification: VERY GRAVELLY SANDY LOAM]; [Laboratory Analysis - Sieve (USCS): Gravel = 54.7%, Sand = 32.1%, Silt & Clay = 13.2%].		
				45					
				58					
				50/3"					
7	S-4	14	6.5-8.5	25			S-4: Dense, tan to light gray, fine to coarse SAND, some Silt, little fine Gravel. Wet. Faint redoximorphic staining present. Weathered bedrock fragments present in soil cuttings and tip of split-spoon. [USDA Classification: SANDY LOAM].		
				20					
				19					
				20					
9						141.5 / 8.5	Boring terminated at 8.5 feet.	1	
10									
11									
12									
13									
14									
15									

Soil	Percentage	Non-Soil	NOTES:
trace	5 - 10	very few	1) Boring backfilled with spoils and one (1) bag of gravel, topped with cold asphalt patch at ground surface and tamped.
little	10 - 20	few	
some	20 - 35	several	
and	35 - 50	numerous	

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BORING LOG

Project: 100 Industrial Park Way
 Location: Hingham, Massachusetts
 Nobis Project No.: 96170.03

Boring No.: B-6
 Boring Location: See Boring Location Plan
 Checked by: B. Waterman
 Date Start: January 3, 2020
 Date Finish: January 3, 2020

Contractor: New England Boring Contractors Rig Type / Model: Truck / Diedrich D-120 Ground Surface Elev.: (+/-) 145
 Driller: N. Stutterd Hammer Type: Automatic Hammer
 Nobis Rep.: K. Kocia Hammer Hoist: Automatic Datum: NAVD 88

Type	Drilling Method	Sampler	Groundwater Observations					
			Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
	Hollow Stem Auger	Split-Spoon	01/03/20	14:50	3.0	7	9	5 min
Size ID (in.)	2.25	1-3/8						
Advancement	Augered	140-lb Hammer						

Depth (ft.)	SAMPLE INFORMATION				Ground Water	LITHOLOGY		SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.		Graphic	Stratum Elev. / Depth (ft.)		
1						ASPHALT 144.6 / 0.5	Approximately 5.4-inches of asphalt.		
2	S-1	19	1-3	6		BASE COARSE 144.2 / 0.8	Base coarse consisted of fine to coarse SAND, little Silt, trace fine to coarse Gravel; approximately 4-inches in thickness.		
3				5		FILL	S-1: Medium dense, brown to tan, fine to medium SAND, some Silt. Moist. [USDA Classification: SANDY LOAM].		
4				6					
5	S-2	16	3-5	5			S-2: Medium dense, dark brown to tan, fine to coarse SAND, some fine Gravel, some Silt. Wet. Very faint redoximorphic staining present. [USDA Classification: SANDY LOAM].		
6				6					
7				20					
8	S-3	1	5-7	33			S-3: Very dense, gray, One piece of coarse gravel present within split-spoon sample.		
9				30		GLACIAL DRIFT	S-4: Medium dense, brown, fine to medium SAND, little fine Gravel, little Silt, trace Clay, few wood particles/fragments, very few roots. Wet. Very faint redoximorphic staining present. [USDA Classification: SANDY LOAM].		
10				32					
11	S-4	18	7-9	18					
12				10					
13				11					
14				11					
15						140.0 / 5.0	Boring terminated at 9 feet.		
						136.0 / 9.0			

Soil	Percentage	Non-Soil	NOTES:
trace	5 - 10	very few	1) Boring backfilled with spoils, topped with cold asphalt patch at ground surface and tamped.
little	10 - 20	few	
some	20 - 35	several	
and	35 - 50	numerous	

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BORING LOG

Project: 100 Industrial Park Way
 Location: Hingham, Massachusetts
 Nobis Project No.: 96170.03

Boring No.: B-7
 Boring Location: See Boring Location Plan
 Checked by: B. Waterman
 Date Start: January 3, 2020
 Date Finish: January 3, 2020

Contractor: New England Boring Contractors Rig Type / Model: Truck / Diedrich D-120 Ground Surface Elev.: (+/-) 146
 Driller: N. Stutterd Hammer Type: Automatic Hammer
 Nobis Rep.: K. Kocia Hammer Hoist: Automatic Datum: NAVD 88

Type	Drilling Method	Sampler	Groundwater Observations					
			Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
	Hollow Stem Auger	Split-Spoon	01/03/20	13:45	4.5	7	9	5 min
Size ID (in.)	2.25	1-3/8						
Advancement	Augered	140-lb Hammer						

Depth (ft.)	SAMPLE INFORMATION				Ground Water	LITHOLOGY		SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES		
	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.		Graphic	Stratum Elev. / Depth (ft.)				
1					▼	ASPHALT 145.5 / 0.5 145.3 / 0.7 BASE COARSE	Approximately 5.6-inches of asphalt. Base coarse consisted of fine to coarse SAND, some fine to coarse Gravel, trace Silt; approximately 3-inches in thickness.				
2	S-1	17	1-3	15		▼	FILL	S-1: Dense, brown to dark gray, fine to coarse SAND and fine to coarse Gravel, little Silt, very few asphalt particles/fragments. Moist. [USDA Classification: VERY GRAVELLY SANDY LOAM].			
3				22							
4				15							
5	S-2	11	3-5	10						S-2: Medium dense, brown to dark gray, fine to coarse SAND, some Silt, little fine Gravel, very few asphalt particles. Moist to wet. [USDA Classification: SANDY LOAM].	
6				19							
7				7							
8	S-3	11	5-7	3					140.7 / 5.3	S-3: Dense, dark brown to dark gray, fine to coarse GRAVEL and fine to coarse Sand, little Silt. Wet. Very few redoximorphic staining pockets present. [USDA Classification: EXTREMELY GRAVELLY SANDY LOAM].	
9				16							
10				33							
11	S-4	21	7-9	40			S-4: Dense, dark brown, Organic SILT, some fine to coarse Sand, trace fine Gravel, trace Clay, few wood particles/fragments, very few roots. Wet. [USDA Classification: SILT LOAM].				
12				23		GLACIAL DRIFT WITH ORGANICS					
13				16							
14				15							
15							Boring terminated at 9 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 spoils, topped with cold asphalt patch at ground surface and tamped.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 1/21/20 16:16 - J:\96170.03 PARKING AND SITE DEVELOPMENT - HINGHAM, MA\GEO\TECHNICAL\EXPLORATIONS\96170.03 BORING LOGS.GPJ



BORING LOG

Project: 100 Industrial Park Way
 Location: Hingham, Massachusetts
 Nobis Project No.: 96170.03

Boring No.: B-8
 Boring Location: See Boring Location Plan
 Checked by: B. Waterman
 Date Start: January 3, 2020
 Date Finish: January 3, 2020

Contractor: New England Boring Contractors Rig Type / Model: Truck / Diedrich D-120 Ground Surface Elev.: (+/-) 147
 Driller: N. Stutterd Hammer Type: Automatic Hammer
 Nobis Rep.: K. Kocia Hammer Hoist: Automatic Datum: NAVD 88

Type	Drilling Method	Sampler	Groundwater Observations					
			Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
	Hollow Stem Auger	Split-Spoon	01/03/20	12:30	6.8	8.5	10.5	5 min
Size ID (in.)	2.25	1-3/8						
Advancement	Augered	140-lb Hammer						

Depth (ft.)	SAMPLE INFORMATION				Ground Water	LITHOLOGY		SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
	Type & No.	Rec (in.)	Depth (ft.)	Blows/6 in.		Stratum Elev. / Depth (ft.)			
1	S-1	17	0.5-2.5	13		ASPHALT 146.7 / 0.4	Approximately 3.5 to 4.2-inches of asphalt.		
				14		BASE COARS 146.3 / 0.7	Base coarse consisted of fine to coarse SAND, little fine to coarse Gravel, little Silt; approximately 4-inches in thickness.		
2				11		FILL	S-1: Medium dense, brown, fine to coarse SAND, little Silt, trace fine Gravel, very few brick and asphalt particles/fragments. Moist. [USDA Classification: SANDY LOAM].		
				8					
3	S-2	16	2.5-4.5	8		144.0 / 3.0	S-2A (4"): Medium dense, brown to gray, fine to coarse SAND, trace Silt, few asphalt particles. Moist. [USDA Classification: SAND].		
				7			S-2B (12"): Medium dense, tan to gray, fine to medium SAND, trace Silt. Moist. Very faint redoximorphic staining present. [USDA Classification: SAND]; [Laboratory Analysis on Auger Cuttings - Results Pending].		
4				6					
				6					
5	S-3	13	4.5-6.5	4			S-3: Medium dense, tan, fine SAND, trace Silt. Moist to wet. Few redoximorphic staining pockets present. [USDA Classification: SAND]; [Laboratory Analysis - Sieve (USCS): Gravel = 0.2%, Sand = 94.3%, Silt & Clay = 5.5%].		
				5					
6				5					
				4					
7	S-4	20	6.5-8.5	5	▼	GLACIAL DRIFT	S-4: Loose, brown, fine to medium SAND, little Silt. Wet. Few redoximorphic staining pockets present. [USDA Classification: LOAMY SAND].		
				3					
8				4					
				4					
9	S-5	21	8.5-10.5	5			S-5: Loose to medium dense, brown, fine to medium SAND, little Silt. Wet. Few redoximorphic staining pockets present. [USDA Classification: LOAMY SAND].		
				5					
10				5					
				5		136.5 / 10.5			
11							Boring terminated at 10.5 feet.	1	
12									
13									
14									
15									

Soil	Percentage	Non-Soil	NOTES:
trace	5 - 10	very few	1) Boring backfilled with spoils, topped with cold asphalt patch at ground surface and tamped.
little	10 - 20	few	
some	20 - 35	several	
and	35 - 50	numerous	

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 1/21/20 16:16 - J:\96170.03 PARKING AND SITE DEVELOPMENT - HINGHAM, MA\GEO\TECHNICAL\EXPLORATIONS\96170.03 BORING LOGS.GPJ

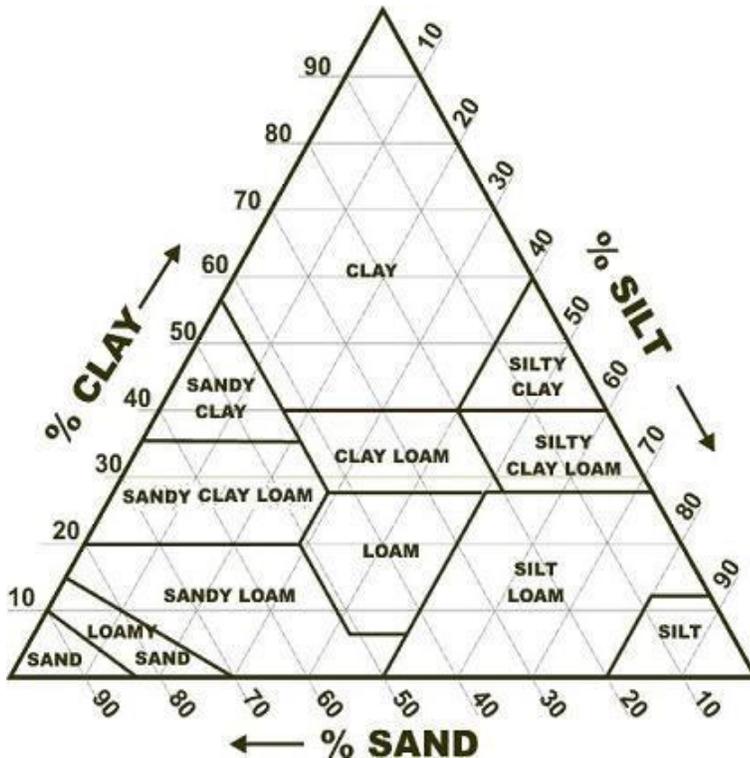
Client: Nobis Engineering, Inc.	Project No: GTX-311163	
Project: 100 Industrial Park Way		
Location: Hingham, MA	Sample Type: jar	Tested By: ckg
Boring ID: B-1	Test Date: 01/17/20	Checked By: emm
Sample ID: S-3	Test Id: 538530	
Depth: 4.5-6.5 ft		
Test Comment: ---		
Visual Description: Moist, dark brownish gray silty sand		
Sample Comment: ---		

USDA Textural Classification

Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
B-1	S-3	4.5-6.5 ft	86	14	0	Sand

Classifications based only on material passing the #10 sieve

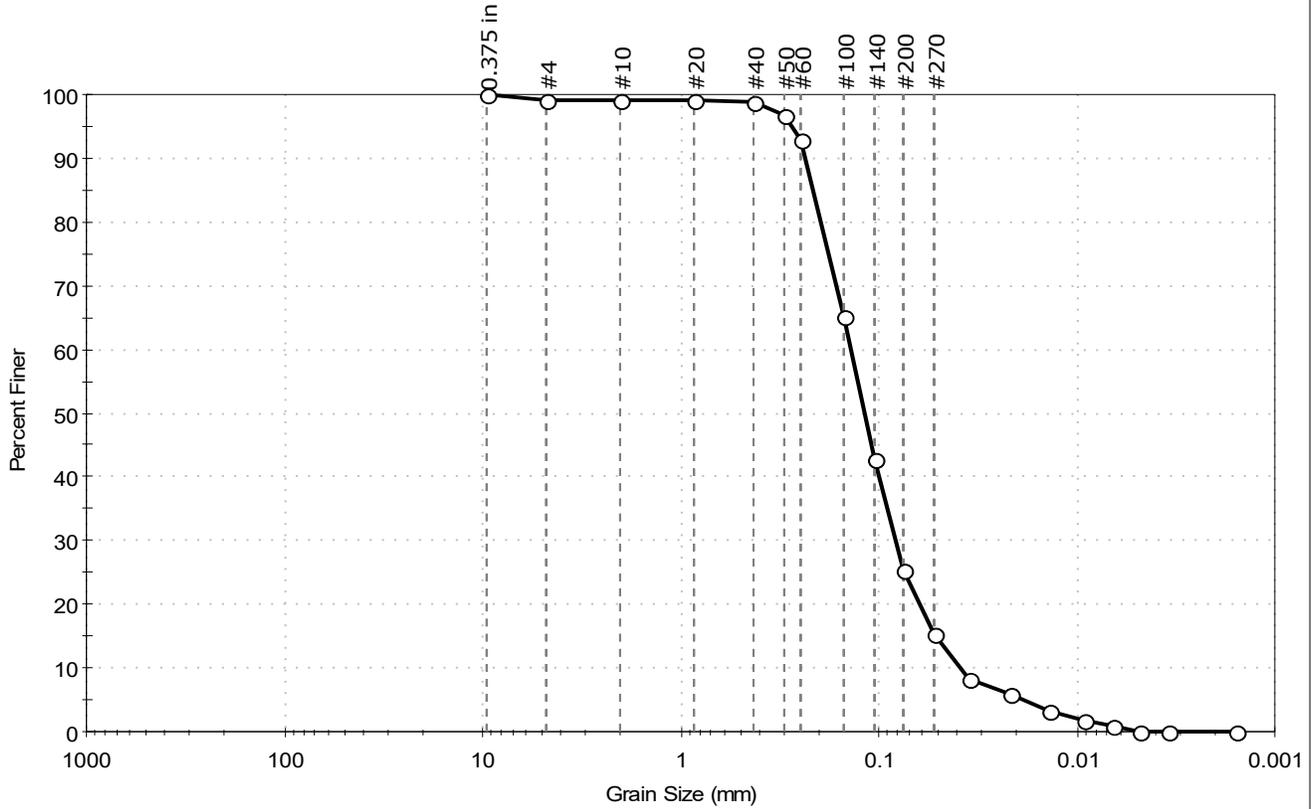
- Sand: material passing 2.0 mm and retained on 0.05 mm diameter
- Silt: material passing 0.05 mm and retained on 0.002 mm diameter
- Clay: material passing 0.002 mm diameter





Client: Nobis Engineering, Inc.
 Project: 100 Industrial Park Way
 Location: Hingham, MA
 Project No: GTX-311163
 Boring ID: B-1
 Sample Type: jar
 Tested By: ckg
 Sample ID: S-3
 Test Date: 01/16/20
 Checked By: emm
 Depth: 4.5-6.5 ft
 Test Id: 538528
 Test Comment: ---
 Visual Description: Moist, dark brownish gray silty sand
 Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.8	73.7	25.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	99		
#10	2.00	99		
#20	0.85	99		
#40	0.42	99		
#50	0.30	97		
#60	0.25	93		
#100	0.15	65		
#140	0.11	43		
#200	0.075	25		
#270	0.053	15		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0353	8		
---	0.0218	6		
---	0.0138	3		
---	0.0091	2		
---	0.0067	1		
---	0.0048	0		
---	0.0034	0		
---	0.0016	0		

Coefficients

D ₈₅ = 0.2156 mm	D ₃₀ = 0.0821 mm
D ₆₀ = 0.1384 mm	D ₁₅ = 0.0519 mm
D ₅₀ = 0.1187 mm	D ₁₀ = 0.0390 mm
C _u = 3.549	C _c = 1.249

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

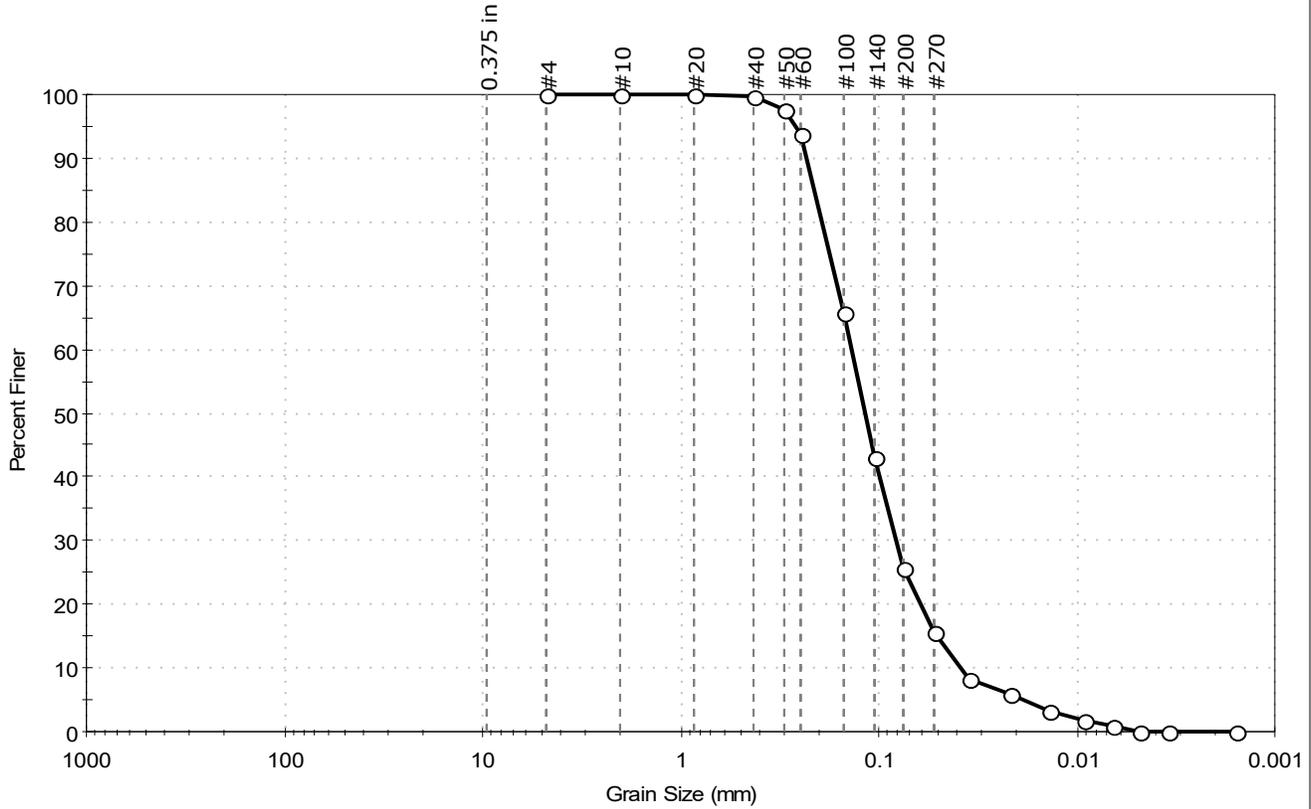
Sample/Test Description

Sand/Gravel Particle Shape : ---
 Sand/Gravel Hardness : ---
 Dispersion Device : Apparatus A - Mech Mixer
 Dispersion Period : 1 minute
 Est. Specific Gravity : 2.65
 Separation of Sample: #270 Sieve



Client: Nobis Engineering, Inc.
 Project: 100 Industrial Park Way
 Location: Hingham, MA
 Project No: GTX-311163
 Boring ID: B-1
 Sample Type: jar
 Tested By: ckg
 Sample ID: S-3
 Test Date: 01/16/20
 Checked By: emm
 Depth: 4.5-6.5 ft
 Test Id: 538528
 Test Comment: Only minus No. 10 sieve for USDA classification
 Visual Description: Moist, dark brownish gray silty sand
 Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	74.3	25.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#50	0.30	98		
#60	0.25	94		
#100	0.15	66		
#140	0.11	43		
#200	0.075	26		
#270	0.053	15		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0353	8		
---	0.0218	6		
---	0.0138	3		
---	0.0091	2		
---	0.0067	1		
---	0.0048	0		
---	0.0034	0		
---	0.0016	0		

Coefficients

D ₈₅ = 0.2128 mm	D ₃₀ = 0.0817 mm
D ₆₀ = 0.1373 mm	D ₁₅ = 0.0515 mm
D ₅₀ = 0.1179 mm	D ₁₀ = 0.0389 mm
C _u = 3.530	C _c = 1.250

Classification

<u>ASTM</u>	N/A
<u>AASHTO</u>	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
 Sand/Gravel Hardness : ---
 Dispersion Device : Apparatus A - Mech Mixer
 Dispersion Period : 1 minute
 Est. Specific Gravity : 2.65
 Separation of Sample: #270 Sieve

Client: Nobis Engineering, Inc.	Project No: GTX-311163	
Project: 100 Industrial Park Way		
Location: Hingham, MA	Sample Type: jar	Tested By: ckg
Boring ID: B-2	Test Date: 01/17/20	Checked By: emm
Sample ID: S-3	Test Id: 538531	
Depth: 4.5-6.5 ft		
Test Comment: ---		
Visual Description: Moist, olive gray silty sand		
Sample Comment: ---		

USDA Textural Classification

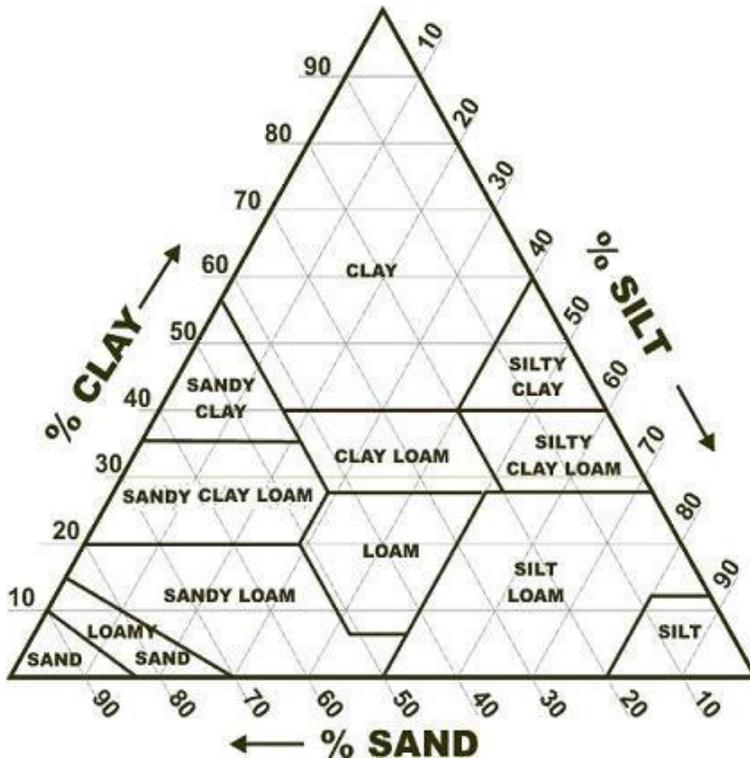
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
B-2	S-3	4.5-6.5 ft	55	42	3	Sandy Loam

Classifications based only on material passing the #10 sieve

Sand: material passing 2.0 mm and retained on 0.05 mm diameter

Silt: material passing 0.05 mm and retained on 0.002 mm diameter

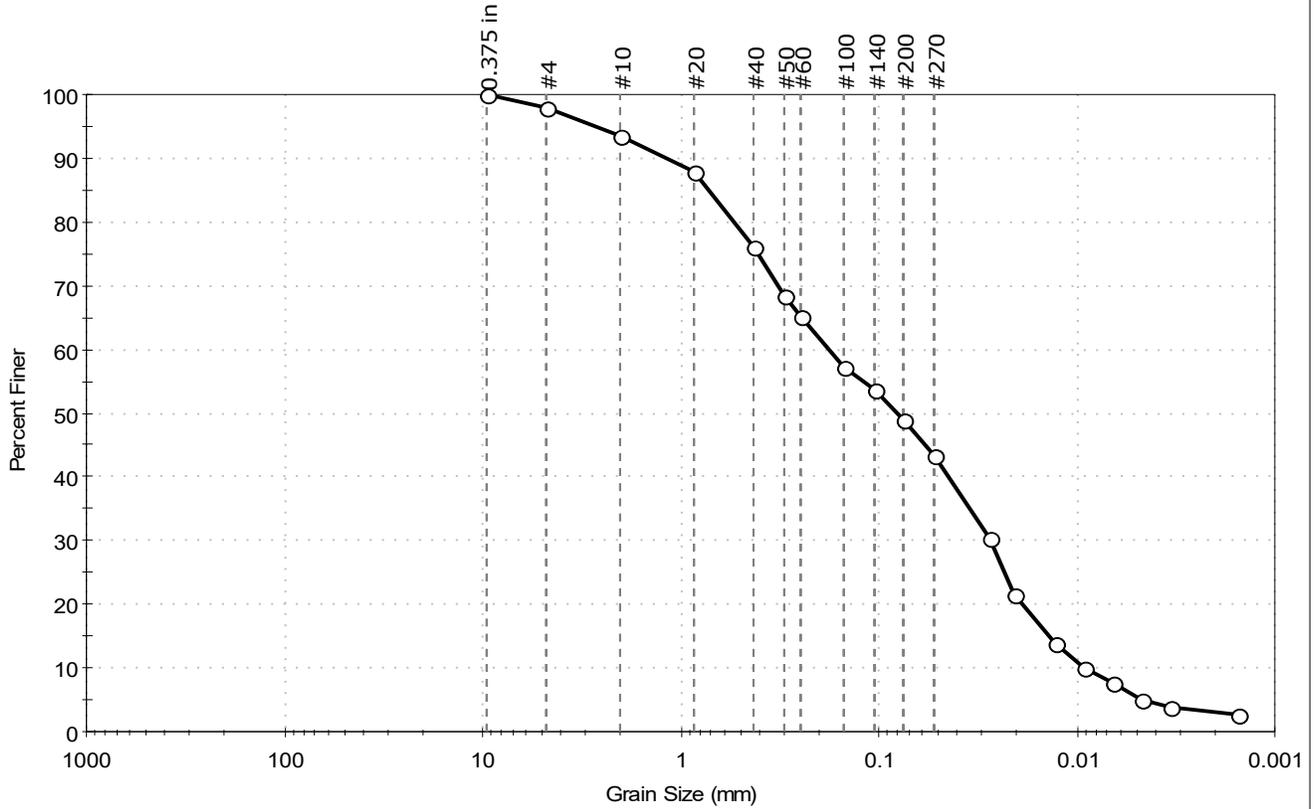
Clay: material passing 0.002 mm diameter





Client: Nobis Engineering, Inc.
 Project: 100 Industrial Park Way
 Location: Hingham, MA
 Project No: GTX-311163
 Boring ID: B-2
 Sample Type: jar
 Tested By: ckg
 Sample ID: S-3
 Test Date: 01/16/20
 Checked By: emm
 Depth: 4.5-6.5 ft
 Test Id: 538529
 Test Comment: ---
 Visual Description: Moist, olive gray silty sand
 Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	2.0	49.0	49.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	94		
#20	0.85	88		
#40	0.42	76		
#50	0.30	69		
#60	0.25	65		
#100	0.15	57		
#140	0.11	54		
#200	0.075	49		
#270	0.053	44		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0276	30		
---	0.0208	22		
---	0.0127	14		
---	0.0091	10		
---	0.0066	8		
---	0.0047	5		
---	0.0034	4		
---	0.0015	3		

Coefficients

D ₈₅ = 0.7133 mm	D ₃₀ = 0.0272 mm
D ₆₀ = 0.1785 mm	D ₁₅ = 0.0136 mm
D ₅₀ = 0.0810 mm	D ₁₀ = 0.0089 mm
C _u = 20.056	C _c = 0.466

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

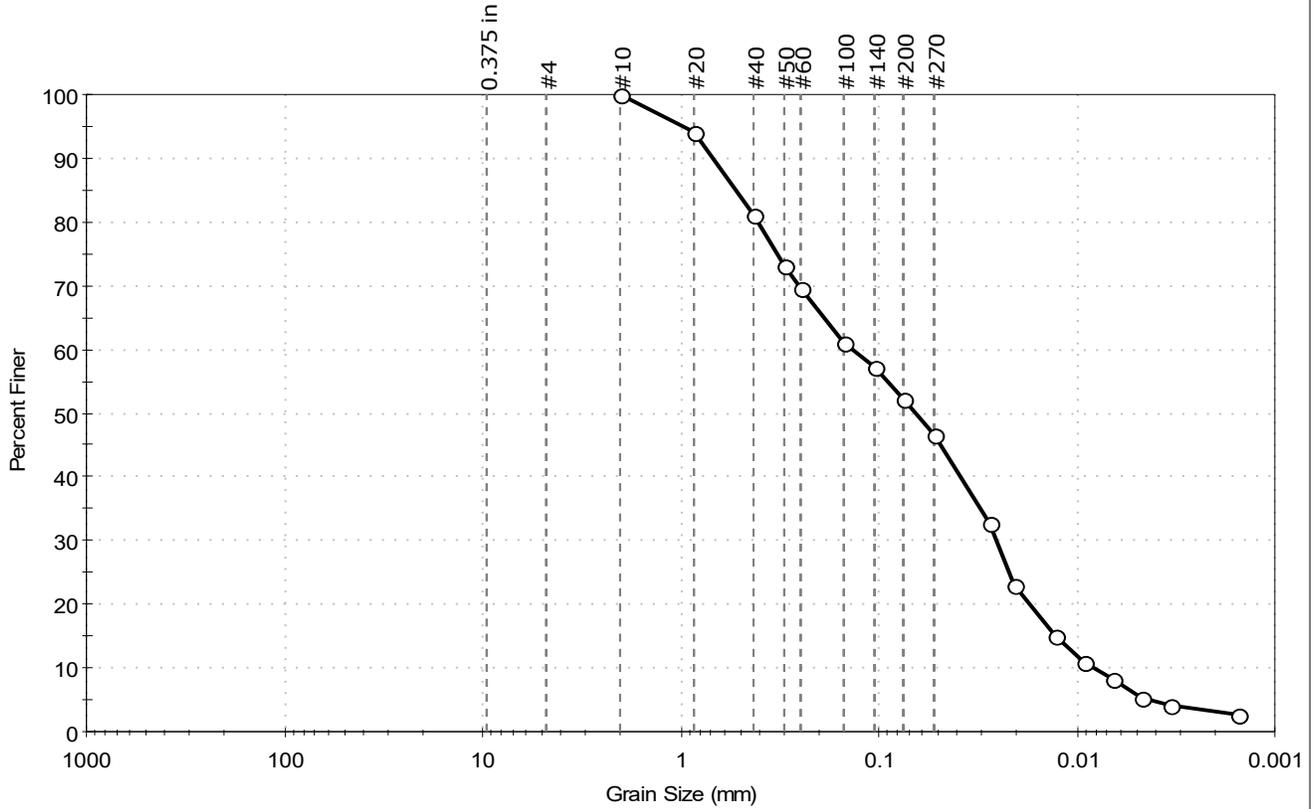
Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve



Client: Nobis Engineering, Inc.
 Project: 100 Industrial Park Way
 Location: Hingham, MA
 Project No: GTX-311163
 Boring ID: B-2
 Sample Type: jar
 Tested By: ckg
 Sample ID: S-3
 Test Date: 01/16/20
 Checked By: emm
 Depth: 4.5-6.5 ft
 Test Id: 538529
 Test Comment: Only minus No. 10 sieve for USDA classification
 Visual Description: Moist, olive gray silty sand
 Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	47.7	52.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#10	2.00	100		
#20	0.85	94		
#40	0.42	81		
#50	0.30	73		
#60	0.25	70		
#100	0.15	61		
#140	0.11	57		
#200	0.075	52		
#270	0.053	46		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0276	33		
---	0.0208	23		
---	0.0127	15		
---	0.0091	11		
---	0.0066	8		
---	0.0047	5		
---	0.0034	4		
---	0.0015	3		

Coefficients

D ₈₅ = 0.5210 mm	D ₃₀ = 0.0255 mm
D ₆₀ = 0.1347 mm	D ₁₅ = 0.0128 mm
D ₅₀ = 0.0654 mm	D ₁₀ = 0.0082 mm
C _u = 16.427	C _c = 0.589

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

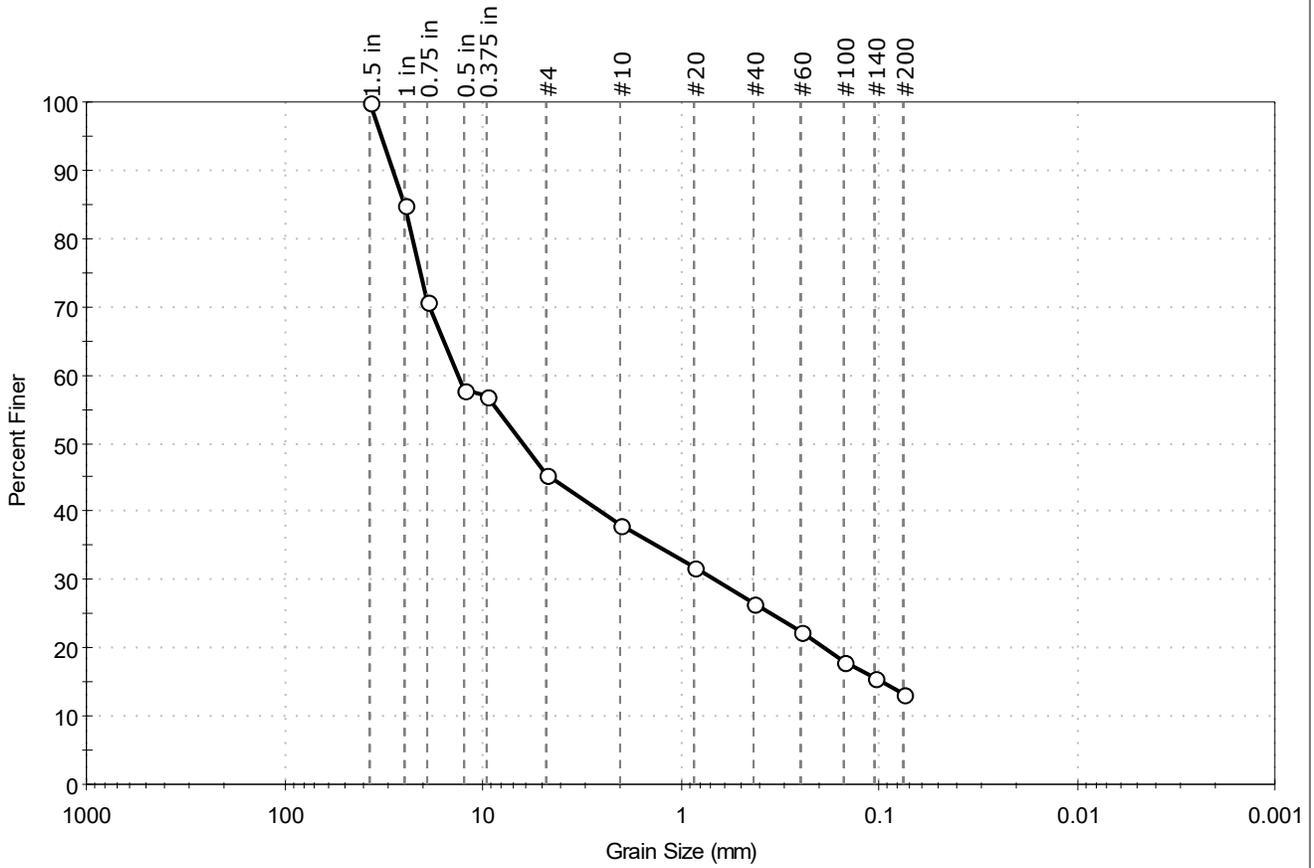
Est. Specific Gravity : 2.65

Separation of Sample: #270 Sieve



Client: Nobis Engineering, Inc.	Project No: GTX-311163
Project: 100 Industrial Park Way	
Location: Hingham, MA	
Boring ID: B-5	Sample Type: jar
Sample ID: S-3	Test Date: 01/16/20
Depth: 4.5-6.5 ft	Test Id: 538532
Test Comment: ---	Tested By: ckg
Visual Description: Moist, pale brown silty gravel with sand	Checked By: emm
Sample Comment: ---	

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	54.7	32.1	13.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	85		
0.75 in	19.00	71		
0.5 in	12.50	58		
0.375 in	9.50	57		
#4	4.75	45		
#10	2.00	38		
#20	0.85	32		
#40	0.42	27		
#60	0.25	22		
#100	0.15	18		
#140	0.11	16		
#200	0.075	13		

<u>Coefficients</u>	
D ₈₅ = 25.0299 mm	D ₃₀ = 0.6610 mm
D ₆₀ = 13.4647 mm	D ₁₅ = 0.0967 mm
D ₅₀ = 6.2927 mm	D ₁₀ = N/A
C _u = N/A	C _c = N/A

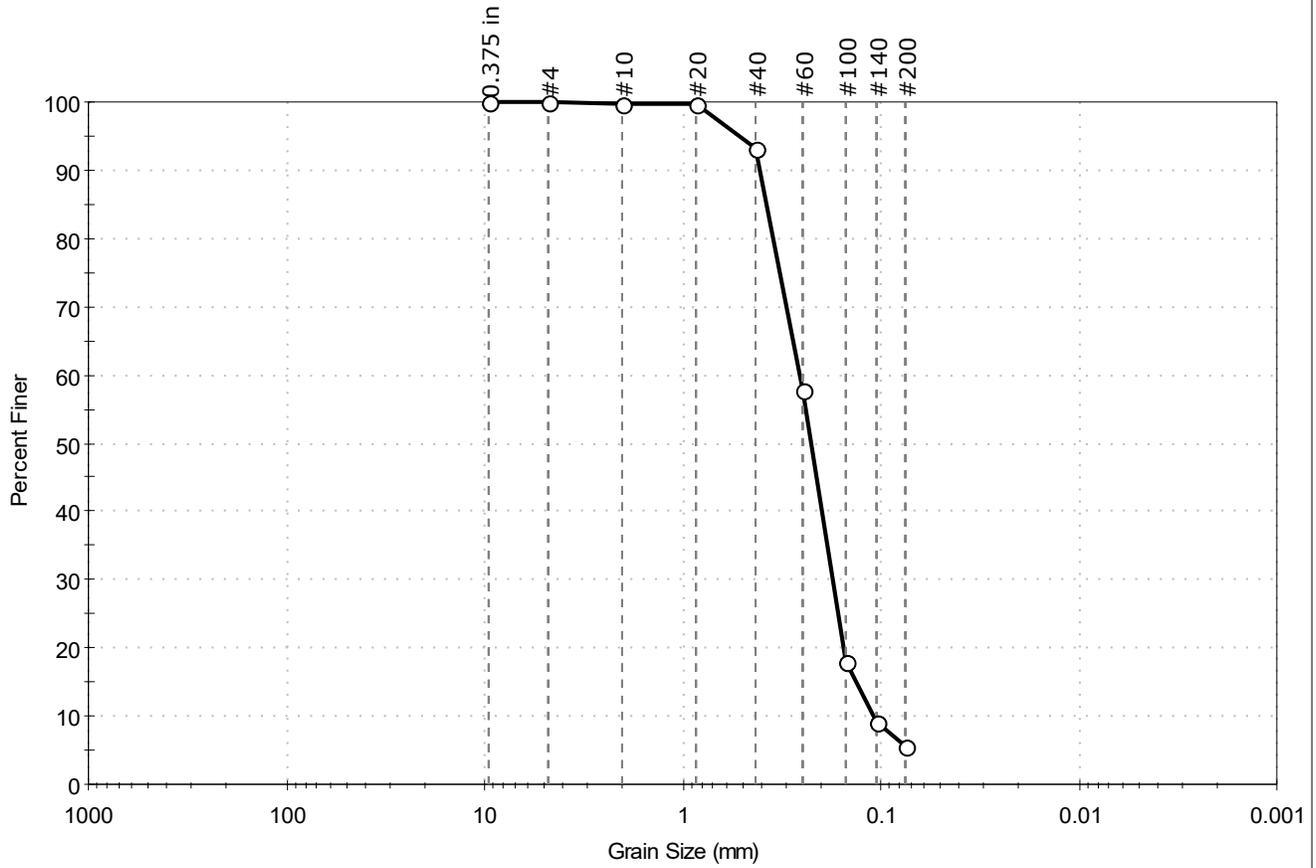
<u>Classification</u>	
ASTM	N/A
AASHTO	Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description
 Sand/Gravel Particle Shape : ANGULAR
 Sand/Gravel Hardness : HARD



Client: Nobis Engineering, Inc.	Project No: GTX-311163
Project: 100 Industrial Park Way	
Location: Hingham, MA	
Boring ID: B-8	Sample Type: jar
Sample ID: S-3	Test Date: 01/16/20
Depth: 4.5-6.5 ft	Test Id: 538533
Tested By: ckg	Checked By: emm
Test Comment: ---	
Visual Description: Moist, brownish gray sand with silt	
Sample Comment: ---	

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.2	94.3	5.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	93		
#60	0.25	58		
#100	0.15	18		
#140	0.11	9		
#200	0.075	5.5		

<u>Coefficients</u>	
D ₈₅ = 0.3753 mm	D ₃₀ = 0.1752 mm
D ₆₀ = 0.2585 mm	D ₁₅ = 0.1339 mm
D ₅₀ = 0.2263 mm	D ₁₀ = 0.1099 mm
C _u = 2.352	C _c = 1.080

<u>Classification</u>	
ASTM	N/A
AASHTO	Fine Sand (A-3 (1))

<u>Sample/Test Description</u>
Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---

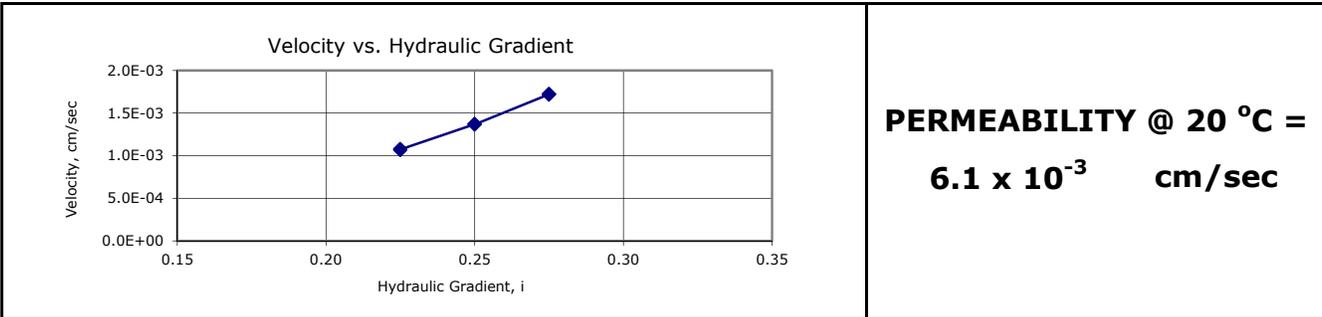


Client:	Nobis Engineering, Inc.		
Project Name:	100 Industrial Park Way		
Project Location:	Hingham, MA		
GTX #:	311163		
Start Date:	01/16/20	Tested By:	jlw
End Date:	01/17/20	Checked By:	emm
Boring #:	B-1		
Sample #:	Auger Cuttings		
Depth:	2-4 ft + -		
Visual Description:	Moist, olive brown silty sand		

Permeability of Granular Soils (Constant Head) by ASTM D2434

Sample Type:	Remolded		
Sample Information:	Maximum Dry Density:	---	pcf
	Optimum Moisture Content:	---	%
	Compaction Test Method:	---	
	Classification (ASTM D2487):	---	
	Assumed Specific Gravity:	2.65	
Sample Preparation / Test Setup:	Test specimen compacted with moderate effort at air-dried moisture content. Material >3/8-inch removed from sample prior to testing (6.1% of sample).		
	Parameter	Initial	Final
	Height, in	4.00	3.90
	Diameter, in	4.00	4.00
	Area, in ²	12.6	12.6
	Volume, in ³	50.3	49.0
	Mass, g	1235	1549
	Bulk Density, pcf	93.6	120.4
	Moisture Content, %	1.2	27.0
	Dry Density, pcf	92.4	94.8
	Degree of Saturation, %	---	96.0
	Void Ratio, e	---	0.75

Date	Reading #	Volume of Flow, cc	Time of Flow, sec	Flow Rate, cc/sec	Gradient	Permeability, cm/sec	Temp., °C	Correction Factor	Permeability @ 20 °C, cm/sec
1/16	1	2.6	30	0.09	0.23	4.7E-03	15.8	1.113	5.3E-03
1/16	2	2.6	30	0.09	0.23	4.8E-03	15.8	1.113	5.3E-03
1/16	3	2.6	30	0.09	0.23	4.8E-03	15.8	1.113	5.3E-03
1/16	4	3.3	30	0.11	0.25	5.5E-03	16.3	1.099	6.0E-03
1/16	5	3.3	30	0.11	0.25	5.5E-03	16.3	1.099	6.0E-03
1/16	6	3.3	30	0.11	0.25	5.5E-03	16.3	1.099	6.0E-03
1/16	7	4.2	30	0.14	0.28	6.3E-03	16.6	1.090	6.8E-03
1/16	8	4.2	30	0.14	0.28	6.2E-03	16.6	1.090	6.8E-03
1/16	9	4.2	30	0.14	0.28	6.3E-03	16.6	1.090	6.8E-03



Note: This standard has been withdrawn by ASTM with no replacement.

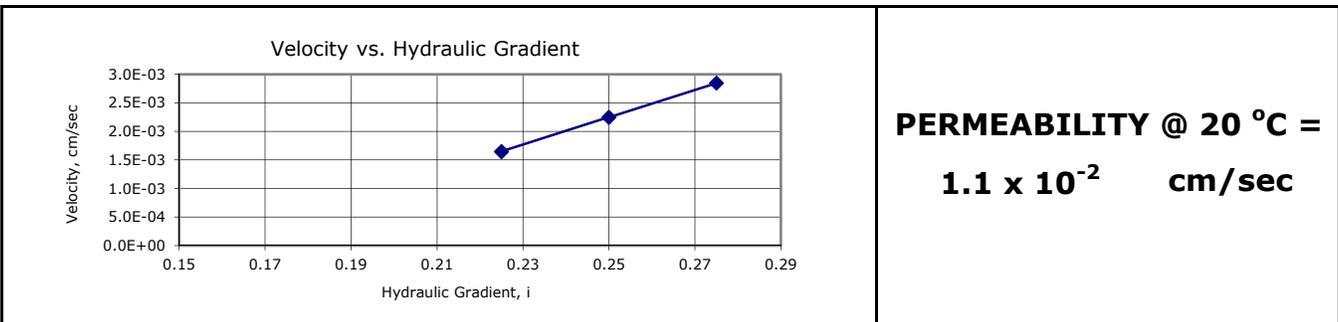


Client:	Nobis Engineering, Inc.		
Project Name:	100 Industrial Park Way		
Project Location:	Hingham, MA		
GTX #:	311163		
Start Date:	01/17/20	Tested By:	jlw
End Date:	01/17/20	Checked By:	emm
Boring #:	B-8		
Sample #:	Auger Cuttings		
Depth:	1-6 ft + -		
Visual Description:	Moist, olive brown silty sand		

Permeability of Granular Soils (Constant Head) by ASTM D2434

Sample Type:	Remolded		
Sample Information:	Maximum Dry Density:	---	pcf
	Optimum Moisture Content:	---	%
	Compaction Test Method:	---	
	Classification (ASTM D2487):	---	
	Assumed Specific Gravity:	2.65	
Sample Preparation / Test Setup:	Test specimen compacted with moderate effort at air-dried moisture content. Material >3/8-inch removed from sample prior to testing (4.0% of sample).		
	Parameter	Initial	Final
	Height, in	4.00	3.90
	Diameter, in	4.00	4.00
	Area, in ²	12.6	12.6
	Volume, in ³	50.3	49.0
	Mass, g	1396	1657
	Bulk Density, pcf	105.8	128.8
	Moisture Content, %	0.3	19.0
	Dry Density, pcf	105.5	108.2
	Degree of Saturation, %	---	95.2
	Void Ratio, e	---	0.53

Date	Reading #	Volume of Flow, cc	Time of Flow, sec	Flow Rate, cc/sec	Gradient	Permeability, cm/sec	Temp., °C	Correction Factor	Permeability @ 20 °C, cm/sec
1/17	1	4.0	30	0.13	0.23	7.3E-03	12.5	1.221	8.9E-03
1/17	2	4.0	30	0.13	0.23	7.3E-03	12.5	1.221	8.9E-03
1/17	3	4.0	30	0.13	0.23	7.3E-03	12.5	1.221	9.0E-03
1/17	4	5.5	30	0.18	0.25	9.0E-03	13.2	1.196	1.1E-02
1/17	5	5.4	30	0.18	0.25	9.0E-03	13.2	1.196	1.1E-02
1/17	6	5.5	30	0.18	0.25	9.0E-03	13.2	1.196	1.1E-02
1/17	7	6.9	30	0.23	0.28	1.0E-02	14.2	1.163	1.2E-02
1/17	8	6.9	30	0.23	0.28	1.0E-02	14.2	1.163	1.2E-02
1/17	9	6.9	30	0.23	0.28	1.0E-02	14.2	1.163	1.2E-02



Note: This standard has been withdrawn by ASTM with no replacement.