

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**

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Cut/Fill Report

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 concrete 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 existing roof leaders. The stormwater runoff from the site parking areas will be conveyed to detention chambers and into a constructed extended detention stormwater wetland pond that will provide the water quality treatment.

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 15.62 acres and has approximately 61.6% 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	102,065	75	34.9%	12.60
EDA-1B	105,544	56	35.9%	16.40
EDA-1C	143,468	98	100.0%	6.00
EDA-1D	3,147	98	100.0%	6.00
EDA-2A	285,147	72	55.3%	9.40
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 impacts are proposed to the existing wetlands located on the subject property. No work is proposed within the FEMA Floodplain Zone A. Proposed impacts to the wetland buffer are due to construction of an extended detention stormwater wetland pond for water quality treatment.

The overall existing drainage onsite will be improved through the use of Best Management Practices (BMPs) for water quality and runoff rate 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 with the addition of a new discharge point (DP-3) at the constructed stormwater wetland forebay. The proposed development has been analyzed as nine sub-drainage areas as illustrated on the enclosed Proposed Drainage Plan (PD-1) located in Appendix E. The proposed analysis includes a total of 15.62 acres and is approximately 77.3% 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 east and southeast 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 1D, under the southeastern parking area. The runoff is pretreated with an isolator row after entering the structure to keep trash and suspended solids out of the system. The stormwater quality structure consists of concrete storage chambers in an interconnected network that will store stormwater runoff as the stormwater release is attenuated through an outlet control structure. The system is designed to drain completely between storm events and is sized up to the 100-year storm event. 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 to the forebay of a constructed extended detention stormwater wetland pond at Design Point 3 (DP-3).

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 southeastern parking area. The runoff is pretreated with an isolator row after entering the structure to keep trash and suspended solids out of the system. The stormwater quality structure consists of concrete storage chambers in an interconnected network that will store stormwater runoff as the stormwater release is attenuated through an outlet control structure. The system is designed to drain completely between storm events and is sized up to the 100-year storm event. 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 to the forebay of a constructed extended detention stormwater wetland pond at DP-3.

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 western parking area. The runoff is pretreated with an isolator row after entering the structure to keep trash and suspended solids out of the system. The stormwater quality structure consists of concrete storage chambers in an interconnected network that will store stormwater runoff as the stormwater release is attenuated through an outlet control structure. The system is designed to drain completely between storm events and is sized up to the 100-year storm event. 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 to the forebay of a constructed extended detention stormwater wetland pond at DP-3.

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 the stormwater runoff flows southerly and westerly, collected by a series of catch basins and is routed to a detention system, Detention Basin 1D, under the southeastern parking area. The runoff is pretreated with an isolator row after entering the structure to keep trash and suspended solids out of the system. The stormwater quality structure consists of concrete storage chambers in an interconnected network that will store stormwater runoff as the stormwater release

is attenuated through an outlet control structure. The system is designed to drain completely between storm events and is sized up to the 100-year storm event. 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 to the forebay of a constructed extended detention stormwater wetland pond at DP-3.

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	52,370	57	0.0%	9.20
PDA-1B	100,339	74	62.5%	27.90
PDA-1C	143,468	98	100.0%	6.00
PDA-1D	56,696	98	99.2%	6.00
PDA-1E	13,771	98	100.0%	6.00
PDA-2A	152,357	94	93.6%	6.00
PDA-2B	90,674	97	99.1%	6.00
PDA-2C	45,499	67	41.7%	6.60
PDA-2D	25,400	73	0.0%	19.20

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)			
Analysis Point	Design Storms		
	2-YEAR	10-YEAR	100-YEAR
DP-1			
Existing	18.91	32.46	56.46
Proposed	18.11	29.88	48.25
DP-2			
Existing	14.18	29.65	56.82
Proposed	5.40	9.20	17.64

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 has an Activity and Use Limitation do to soil contamination, which prohibits stormwater from being recharged into the groundwater, therefore no infiltration if proposed onsite. Calculations have still been provided in Appendix D for the recharge quantities of the drainage areas that would be required otherwise.

Standard 4

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

80% TSS is provided by an extended detention constructed stormwater wetland. With a lined and sealed bottom and groundwater intercepting underdrains. The stormwater wetland pond has a suitably sized forebay, micropool, low-marsh, high-marsh and semi-wet areas sized for the site water quality volume (WQV). Calculations for the WQV required and the volumes provided from the various components of the stormwater wetland system can be found in Appendix D. In addition to this, landscaped islands, catch basins with hoods and deep sumps, underground isolation rows

in the underground detention and street sweeping (not specified) are proposed, but no design credit is calculated or given to these features. Calculations for water quality volume, treatment train efficiency can be found in Appendix D. A long-term Stormwater System Operation and Maintenance Manual for these systems and practices can be found in Appendix F.

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 a lined bottom for the constructed stormwater wetland and a forebay to receive discharge from the site prior to entering the marshes and micropool.

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, however the site is tributary to a surface water supply and portions of the site are located in the Zone A of a surface water supply according to MassGIS. see the MA DEP mapping in Appendix A for more information. The constructed stormwater wetland proposed according to the Massachusetts Stormwater Handbook is highly recommended for use near critical areas (other than cold-water fisheries). The constructed stormwater wetland will not be located within the Zone A area.

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 a partial redevelopment project since there is an overall increase in impervious area post-development. However, in order to be conservative, the WQV calculated to be treated for the site is for the entire site impervious area as practical (except for the existing roof), not just the proposed additional impervious area. Resulting in a significant improvement to the existing stormwater conditions.

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. Compost filter sock support will be staked in front of the silt fence where fencing is proposed 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 devise 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.”

No illicit discharges to the site stormwater management system shall be allowed, aside from the permitted discharges as described in Standard 10 of the 2008 Massachusetts Stormwater Handbook including firefighting water, water line flushing, landscape irrigation water, uncontaminated groundwater, potable water sources, foundation drains, air conditioning

condensation, footing drains, individual resident car washing water, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents.

Stormwater 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 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 with outlet control aid in attenuating peak flows for the most frequent storm events as practical up to the 100-year storm. Stormwater quality is being addressed with a constructed extended detention stormwater wetland pond BMP 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

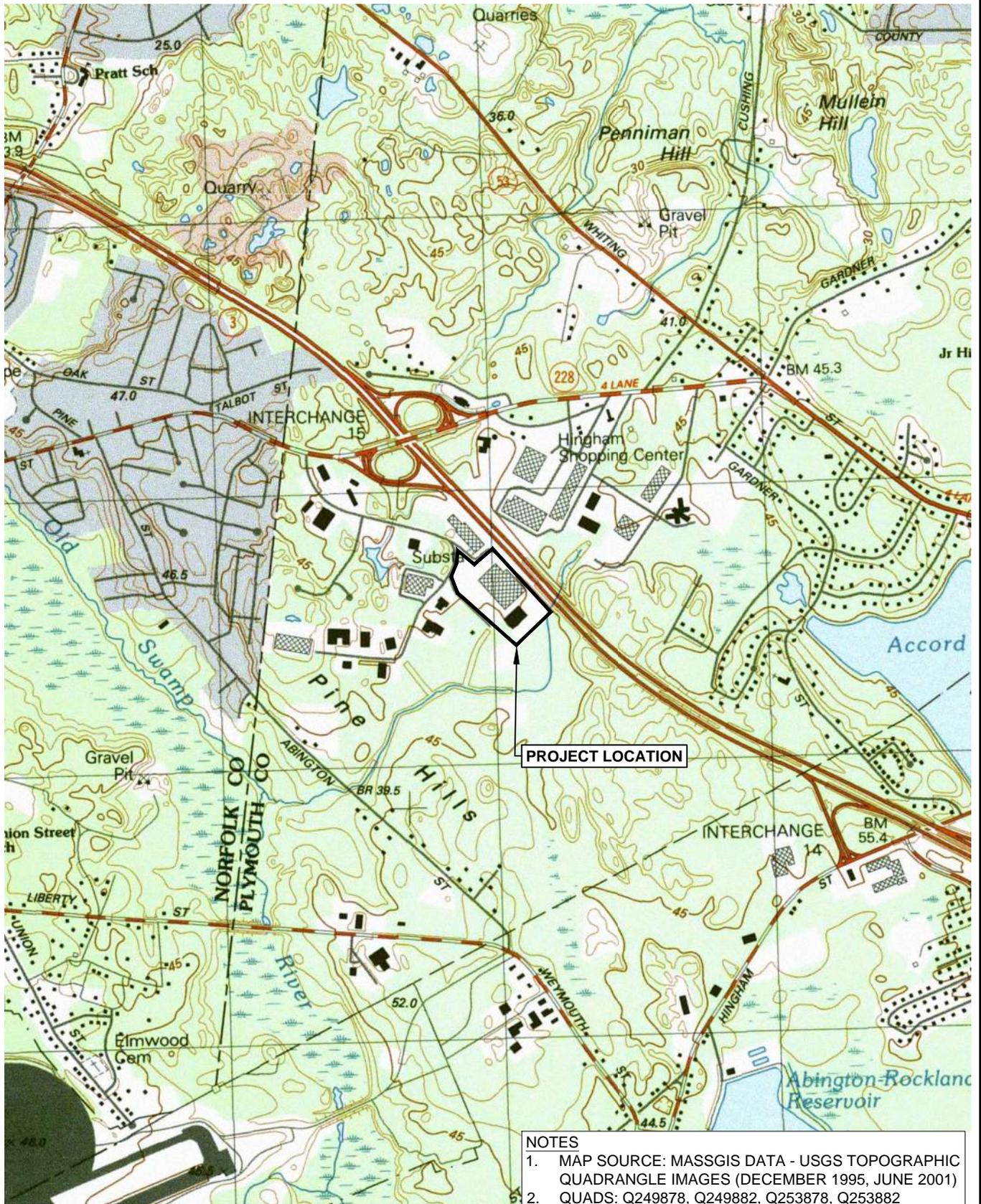
Figure 1: USGS Location Map

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

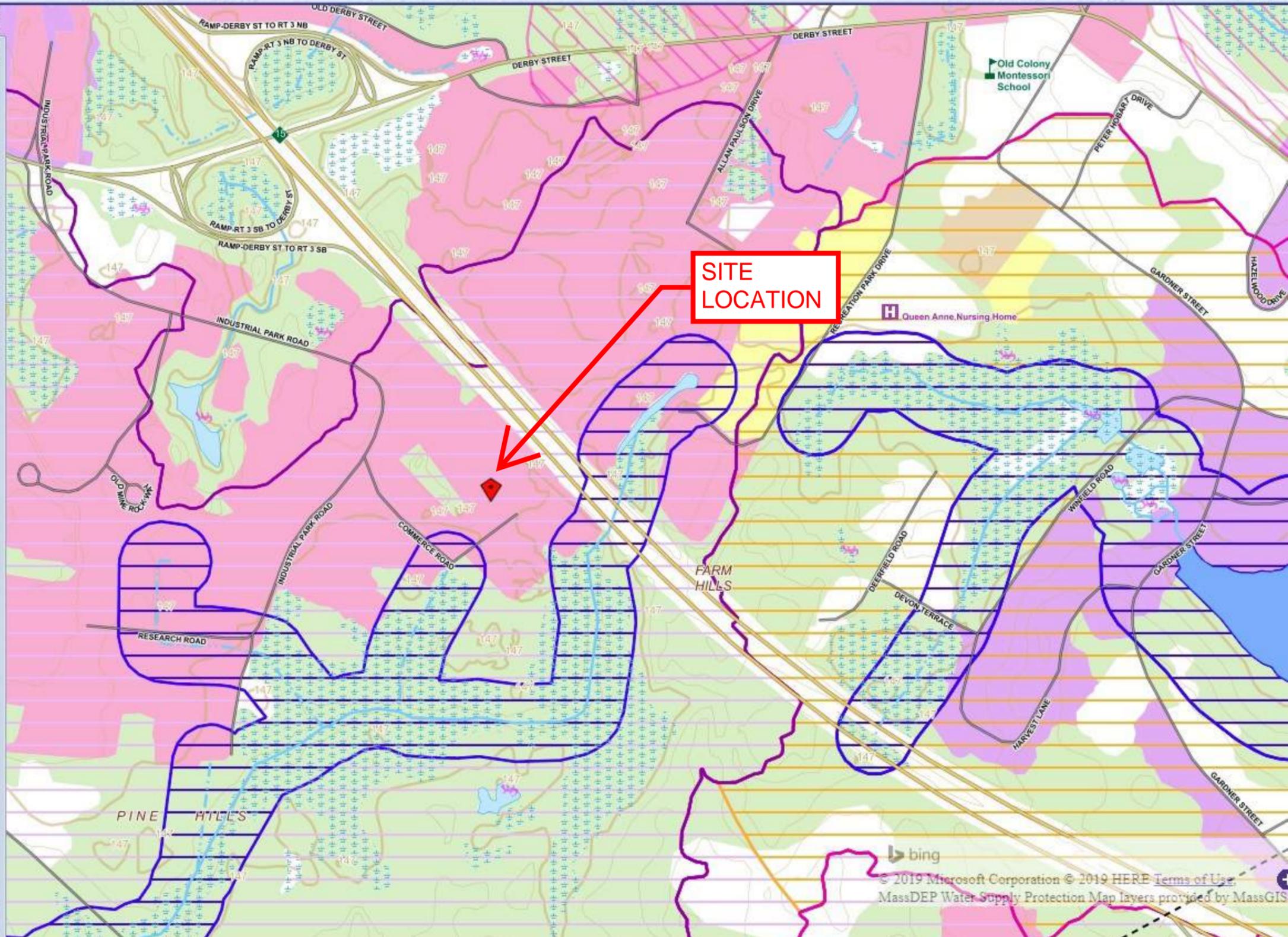


Massachusetts Department of Environmental Protection

Map Legend

	NHESP Potential Vernal Pool		Town and State Boundary		Interim Wellhead Protection Area (IWPA)
	NHESP Certified Vernal Pool		DEP Region Boundary		Approved Wellhead Protection Area (Zone II)
	Community Groundwater Well		Perennial Stream or Shoreline		Solid Waste Landfill
	Community Surface Water Intake		Intermittent Stream		Surface Water Supply Watershed Boundary
	Emergency Surface Water Intake		Intermittent Shoreline		15 Meter Contour Interval
	Non-Community Groundwater Well		Intermittent Shoreline		3 Meter Contour Interval
	School		Manmade Shoreline		Protected Open Space
	Hospital		Ditch or Canal		High and Medium Density Residential
	Long Term Care Residence		Aqueduct		Forested
	Prison		Dam		Commercial, Industrial and Mining
	Pipeline		Channel in Water		Waste Disposal, Junkyard
	Powerline		Open Water		Recreation Area, Golf Course
	MBTA Blue Line		Public Water Supply Reservoir		Agricultural Land, Orchard, Nursery
	MBTA Green Line		Tidal Flat		
	MBTA Orange Line		Inundated Area		
	MBTA Red Line		Fresh Water Wetland		
	Active Rail Lines		Cranberry Bog		
	Major Highway - Limited Access		Salt Water Wetland		
	Major Road - Not Limited Access		Surface Water Supply Protection Area (Zone A)		
	Local Street or Road		Surface Water Supply Protection Area (Zone B)		
			Surface Water Supply Protection Area (Zone C)		

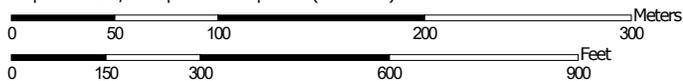
Overview | Map Layers | Legend | Map Help | Contact | Query Results



Hydrologic Soil Group—Plymouth County, Massachusetts



Map Scale: 1:3,640 if printed on A portrait (8.5" x 11") sheet.



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



MAP LEGEND

Area of Interest (AOI)		 C
Area of Interest (AOI)		 C/D
		 D
		 Not rated or not available
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		
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



USGS The National Map: Orthoimagery, Data refreshed April, 2019. 0 250 500 1,000 1,500 2,000 Feet 1:6,000 42°10'12.58"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		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		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Profile Baseline
OTHER FEATURES		Hydrographic Feature

MAP PANELS		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.





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)

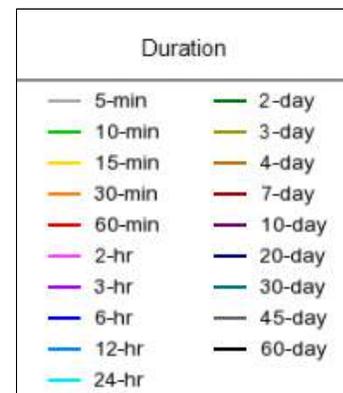
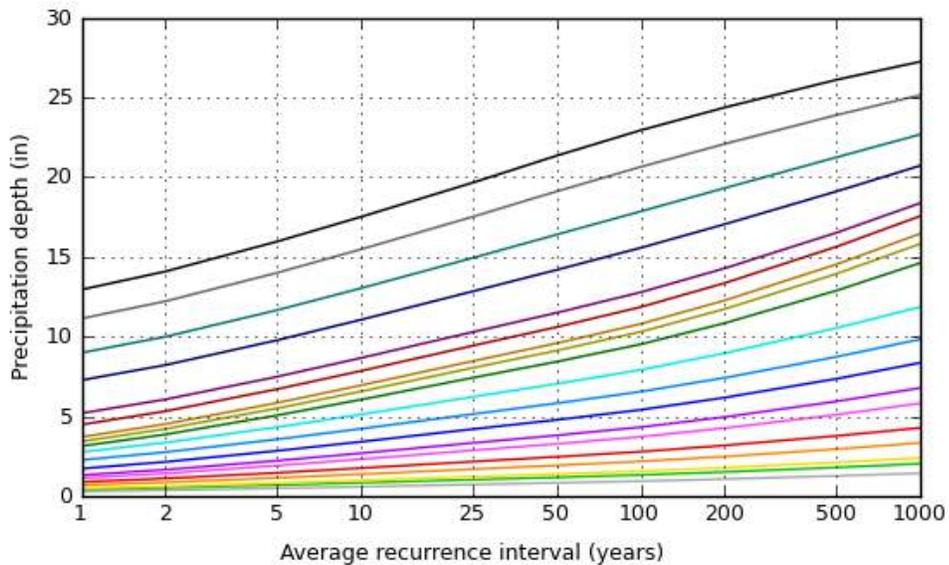
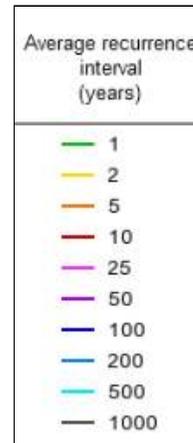
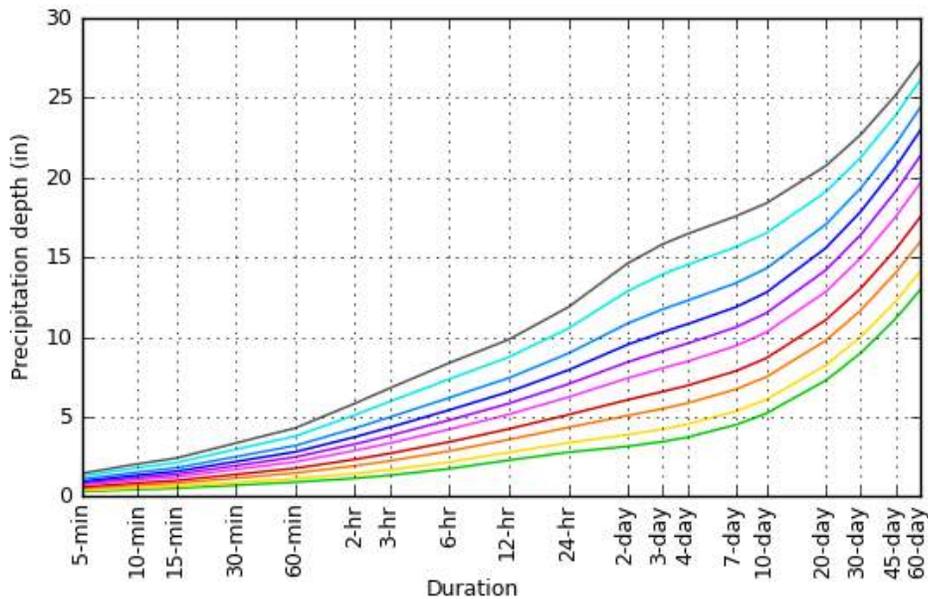
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average 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

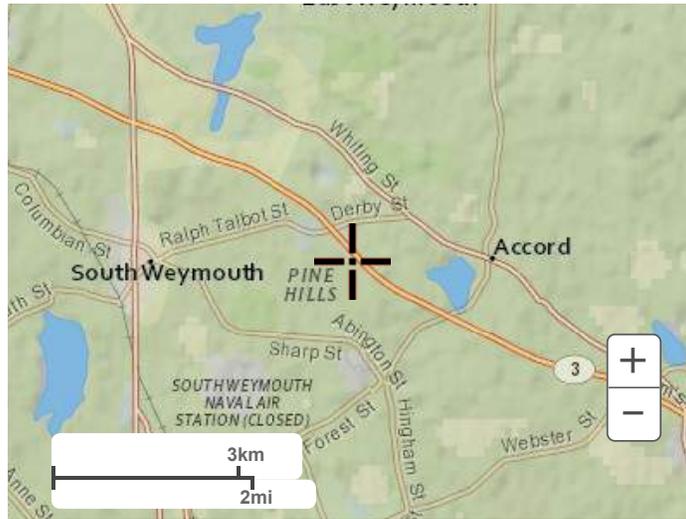
Latitude: 42.1739°, Longitude: -70.9119°



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Maps & aerials

Small scale terrain



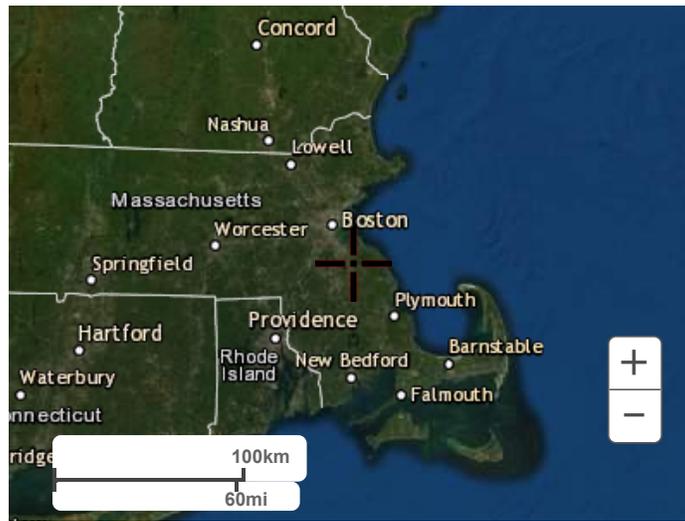
Large scale terrain



Large scale map



Large scale aerial



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[National Weather Service](#)
[National Water Center](#)
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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**
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** 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

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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)

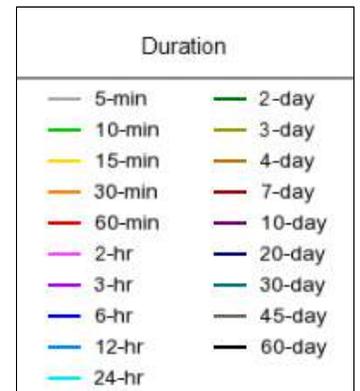
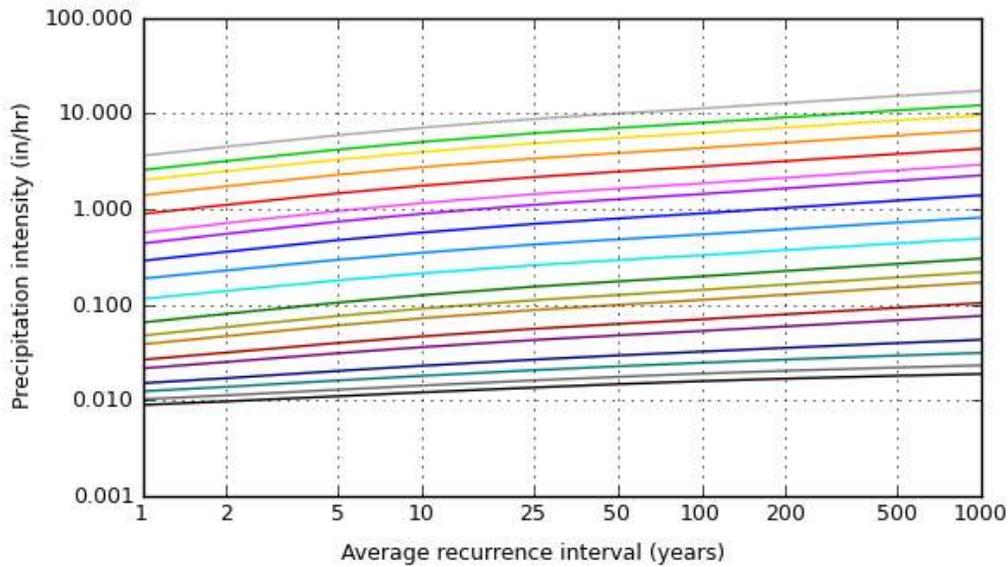
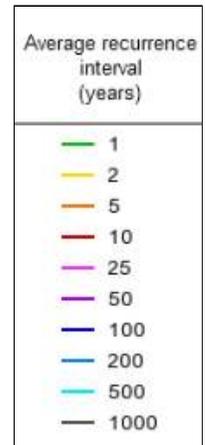
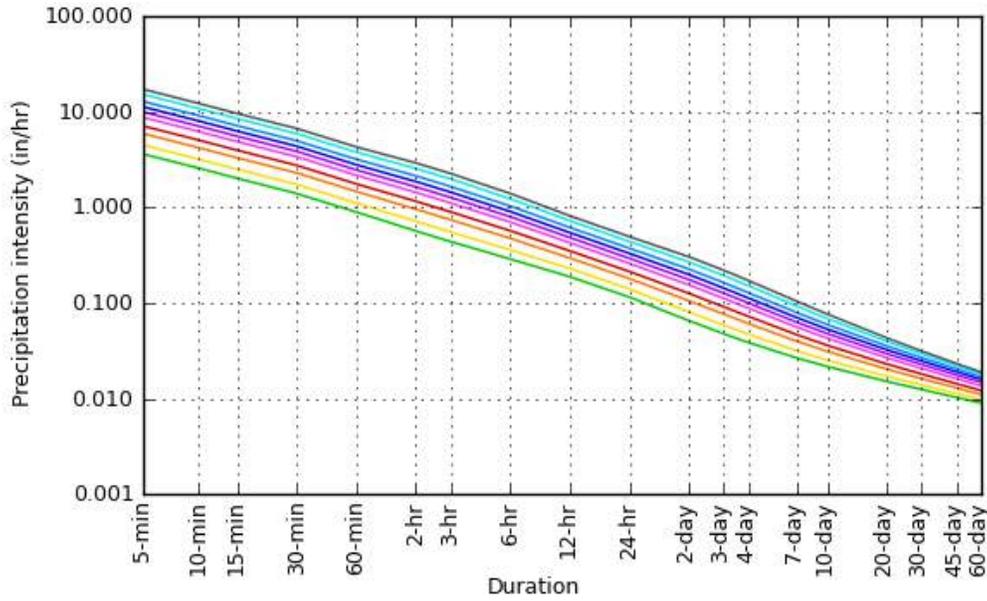
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average 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

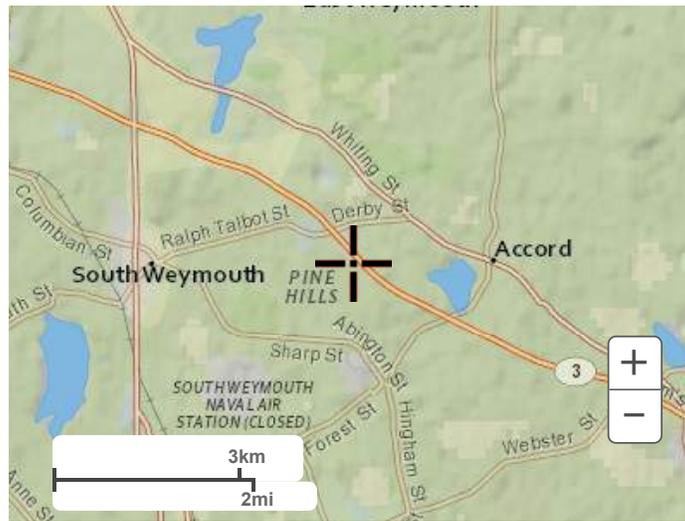
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Maps & arials

Small scale terrain



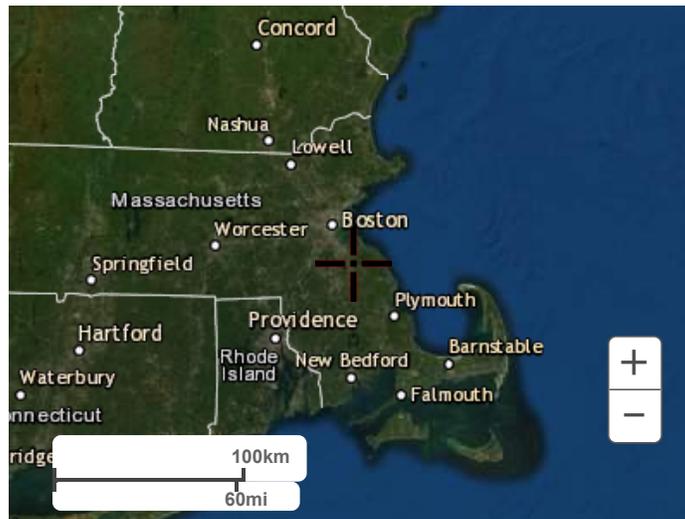
Large scale terrain



Large scale map



Large scale aerial



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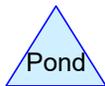
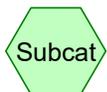
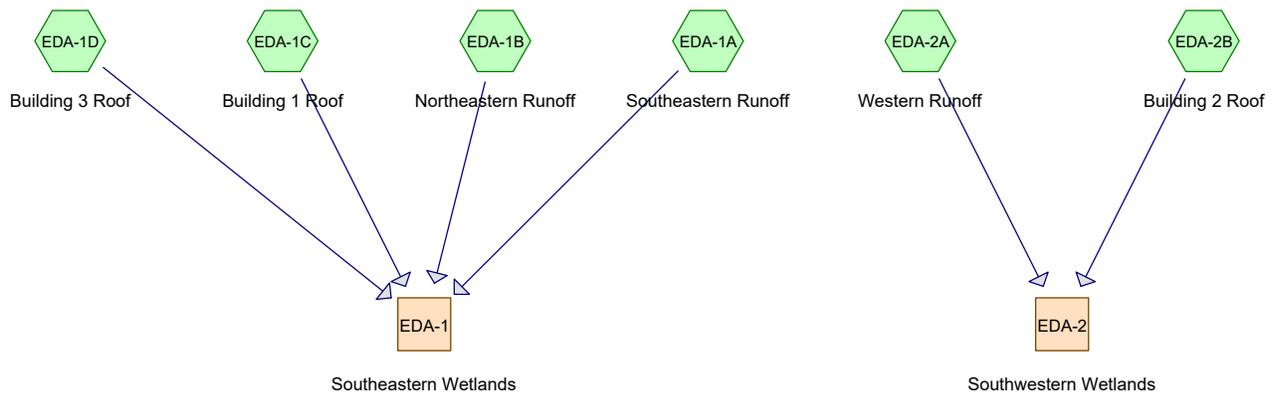
[US Department of Commerce](#)
[National Oceanic and Atmospheric Administration](#)
[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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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
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1901517-HYDRO

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Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
18,546	39	>75% Grass cover, Good, HSG A (EDA-1B, EDA-2A)
20,947	96	Gravel surface, HSG A (EDA-2A)
210,291	98	Paved parking, HSG A (EDA-1A, EDA-1B, EDA-2A)
187,818	98	Unconnected roofs, HSG A (EDA-1C, EDA-1D, EDA-2B)
87,354	30	Woods, Good, HSG A (EDA-2A)
6,943	55	Woods, Good, HSG B (EDA-2A)
18,999	77	Woods, Good, HSG D (EDA-2A)
85,725	32	Woods/grass comb., Good, HSG A (EDA-1A, EDA-1B)
841	58	Woods/grass comb., Good, HSG B (EDA-1A)
43,110	79	Woods/grass comb., Good, HSG D (EDA-1A)
680,574	77	TOTAL AREA

1901517-HYDRO

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Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
610,681	HSG A	EDA-1A, EDA-1B, EDA-1C, EDA-1D, EDA-2A, EDA-2B
7,784	HSG B	EDA-1A, EDA-2A
0	HSG C	
62,109	HSG D	EDA-1A, EDA-2A
0	Other	
680,574		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
18,546	0	0	0	0	18,546	>75% Grass cover, Good
20,947	0	0	0	0	20,947	Gravel surface
210,291	0	0	0	0	210,291	Paved parking
187,818	0	0	0	0	187,818	Unconnected roofs
87,354	6,943	0	18,999	0	113,296	Woods, Good
85,725	841	0	43,110	0	129,676	Woods/grass comb., Good
610,681	7,784	0	62,109	0	680,574	TOTAL AREA

1901517-HYDRO

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

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEDA-1A: Southeastern Runoff Area=102,065 sf 34.86% Impervious Runoff Depth=1.20"
Flow Length=204' Tc=12.6 min CN=75 Runoff=3.89 cfs 10,238 cf

SubcatchmentEDA-1B: Northeastern Runoff Area=105,544 sf 35.86% Impervious Runoff Depth=0.33"
Flow Length=436' Tc=16.4 min CN=56 Runoff=0.50 cfs 2,917 cf

SubcatchmentEDA-1C: Building 1 Roof Runoff Area=143,468 sf 100.00% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=98 Runoff=15.66 cfs 37,384 cf

SubcatchmentEDA-1D: Building 3 Roof Runoff Area=3,147 sf 100.00% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=98 Runoff=0.34 cfs 820 cf

SubcatchmentEDA-2A: Western Runoff Runoff Area=285,147 sf 48.00% Impervious Runoff Depth=1.03"
Flow Length=582' Tc=9.4 min CN=72 Runoff=10.35 cfs 24,485 cf

SubcatchmentEDA-2B: Building 2 Roof Runoff Area=41,203 sf 100.00% Impervious Runoff Depth=3.13"
Tc=6.0 min CN=98 Runoff=4.50 cfs 10,737 cf

Reach EDA-1: Southeastern Wetlands Inflow=18.91 cfs 51,359 cf
Outflow=18.91 cfs 51,359 cf

Reach EDA-2: Southwestern Wetlands Inflow=14.18 cfs 35,221 cf
Outflow=14.18 cfs 35,221 cf

Total Runoff Area = 680,574 sf Runoff Volume = 86,580 cf Average Runoff Depth = 1.53"
41.50% Pervious = 282,465 sf 58.50% Impervious = 398,109 sf

Summary for Subcatchment EDA-1A: Southeastern Runoff

Runoff = 3.89 cfs @ 12.05 hrs, Volume= 10,238 cf, Depth= 1.20"

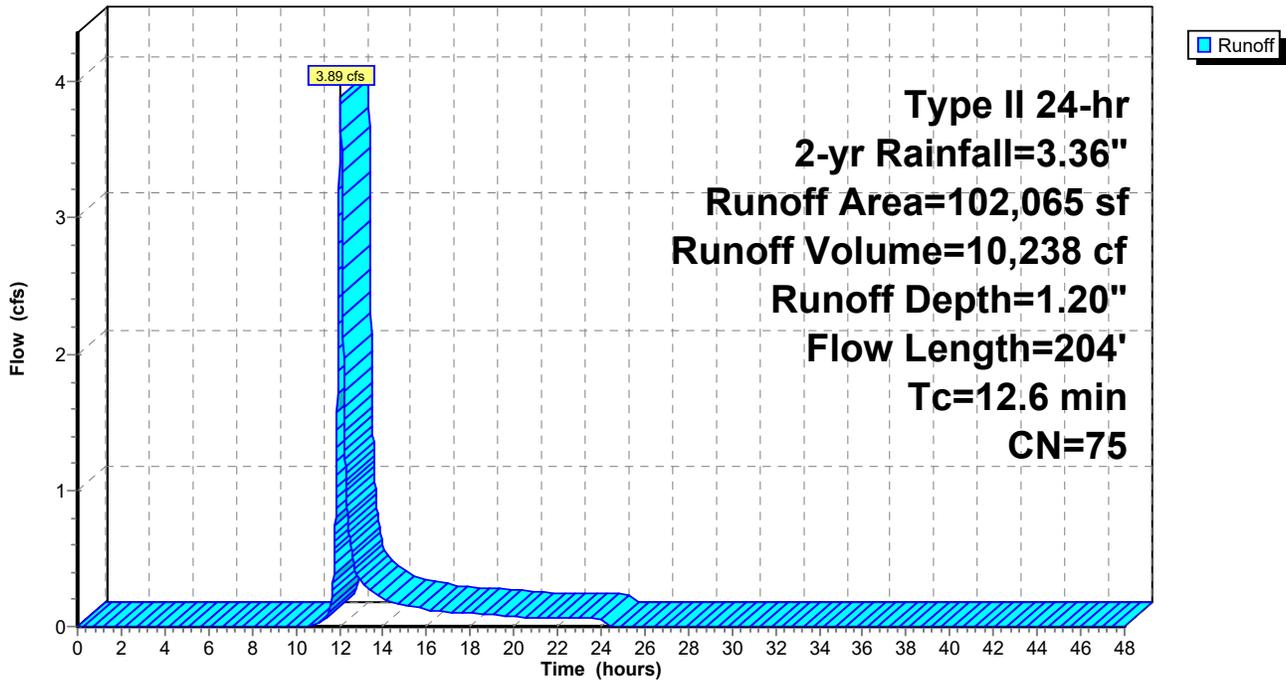
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
35,580	98	Paved parking, HSG A
22,534	32	Woods/grass comb., Good, HSG A
841	58	Woods/grass comb., Good, HSG B
43,110	79	Woods/grass comb., Good, HSG D
102,065	75	Weighted Average
66,485		65.14% Pervious Area
35,580		34.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	50	0.0420	0.09		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
3.7	154	0.0195	0.70		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
12.6	204	Total			

Subcatchment EDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1B: Northeastern Runoff

Runoff = 0.50 cfs @ 12.15 hrs, Volume= 2,917 cf, Depth= 0.33"

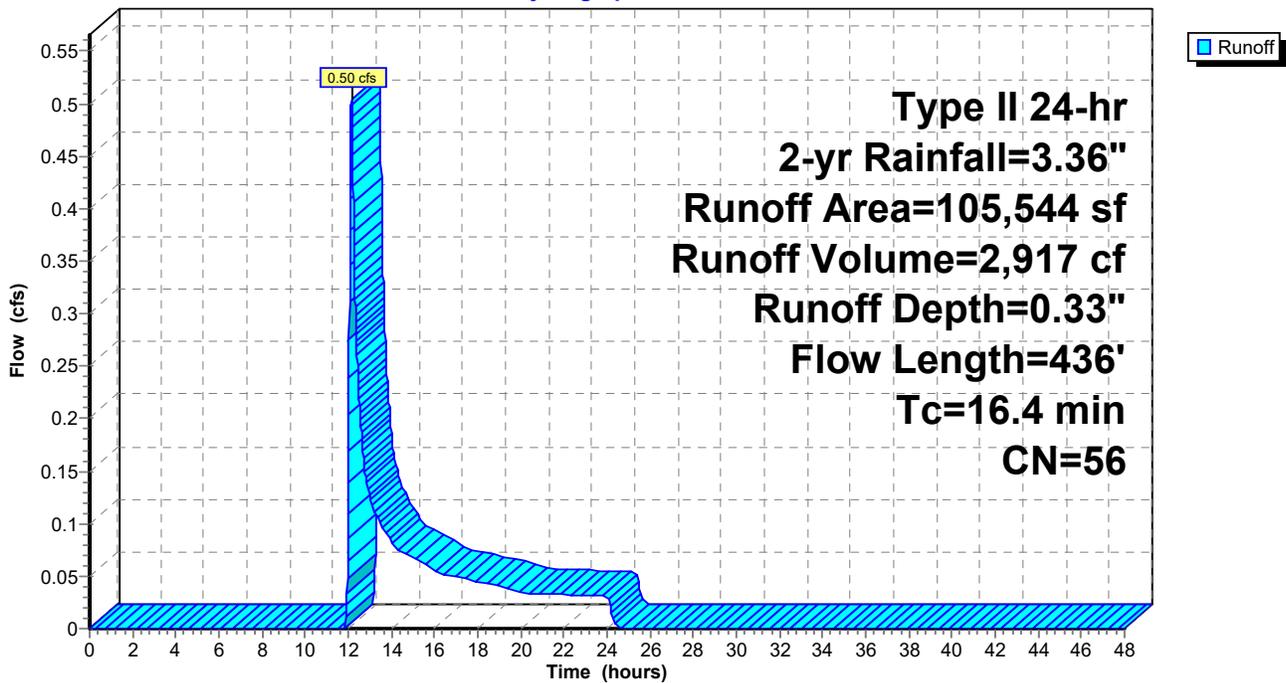
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
37,851	98	Paved parking, HSG A
63,191	32	Woods/grass comb., Good, HSG A
4,502	39	>75% Grass cover, Good, HSG A
105,544	56	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
12.0	50	0.0200	0.07		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
1.4	104	0.0313	1.24		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
3.0	282	0.0060	1.57		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
16.4	436	Total			

Subcatchment EDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1C: Building 1 Roof

Runoff = 15.66 cfs @ 11.97 hrs, Volume= 37,384 cf, Depth= 3.13"

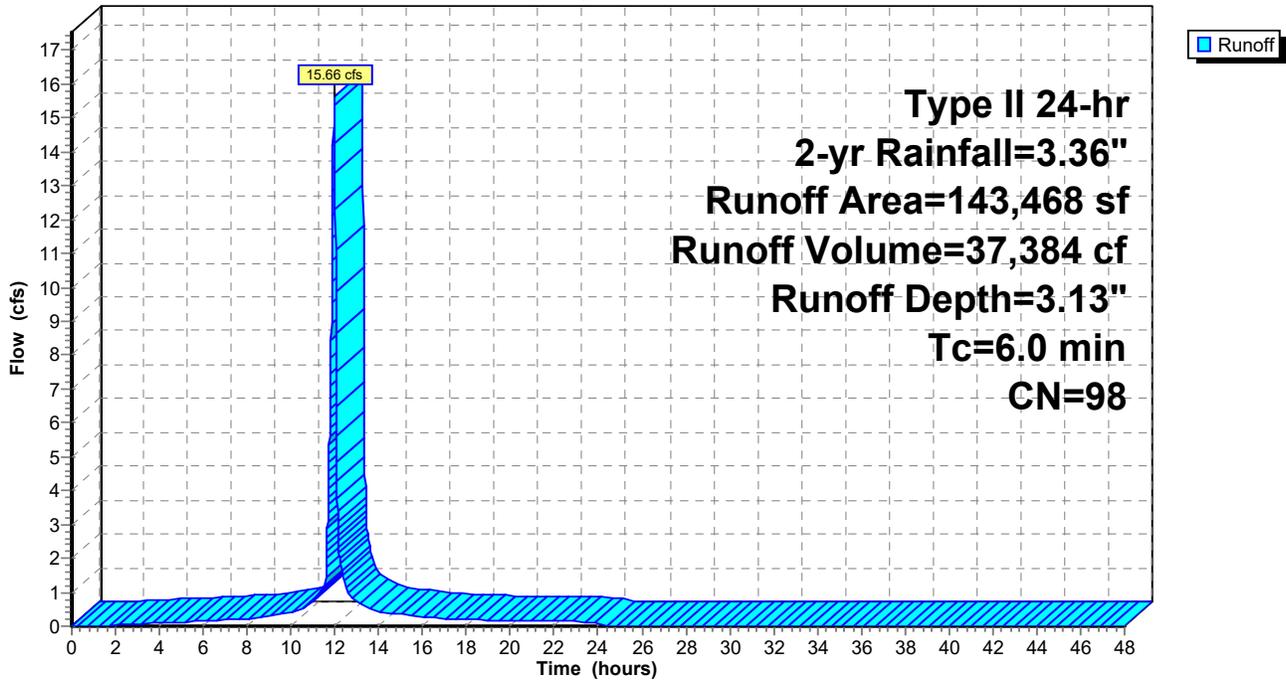
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
143,468	98	Unconnected roofs, HSG A
143,468		100.00% Impervious Area
143,468		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"

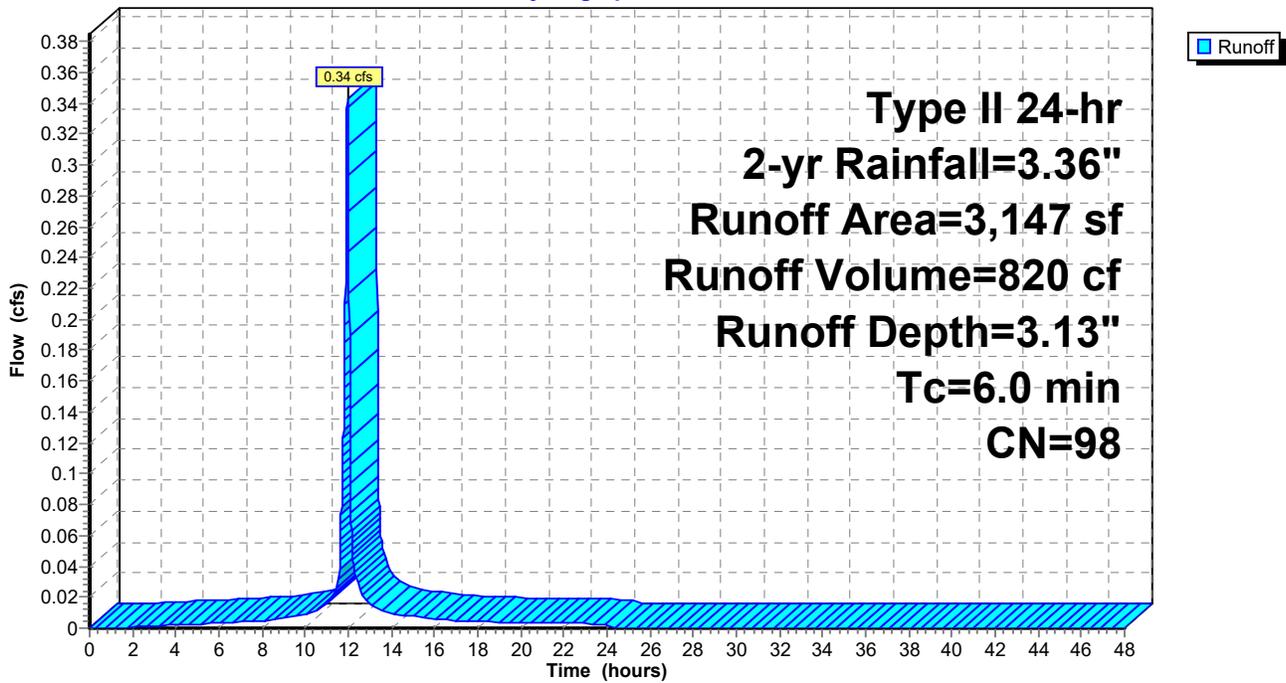
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
3,147	98	Unconnected roofs, HSG A
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 = 10.35 cfs @ 12.02 hrs, Volume= 24,485 cf, Depth= 1.03"

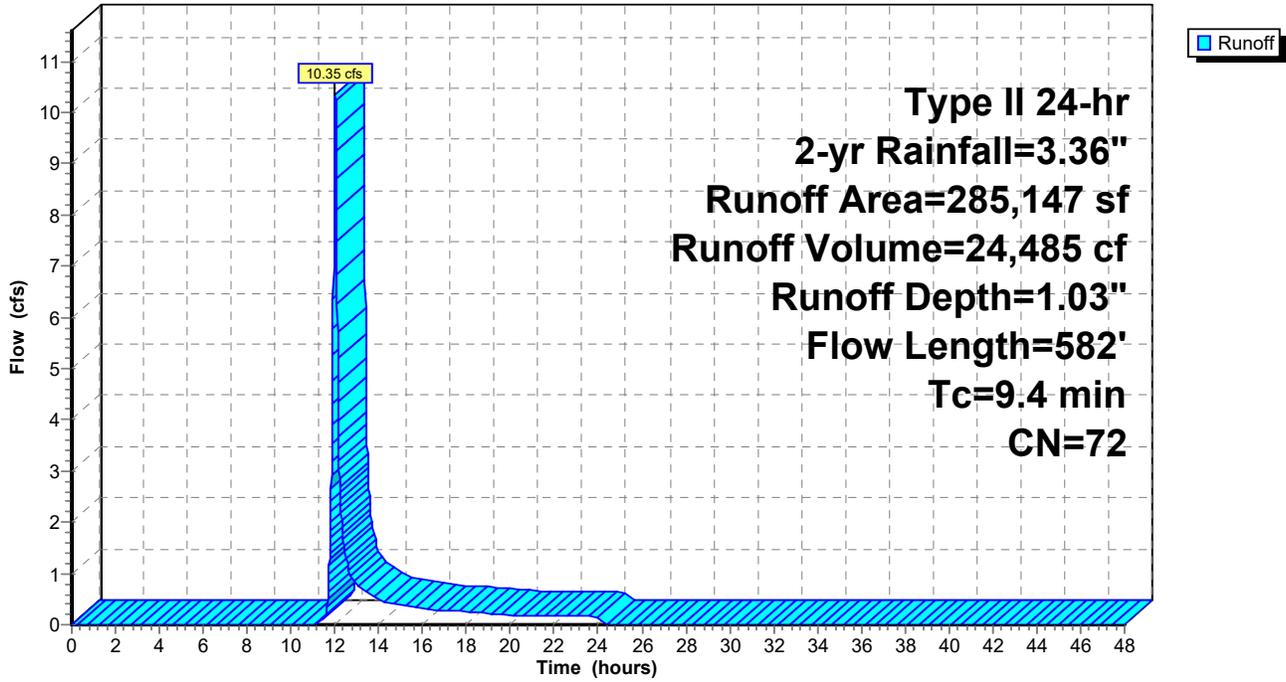
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
136,860	98	Paved parking, HSG A
87,354	30	Woods, Good, HSG A
20,947	96	Gravel surface, HSG A
14,044	39	>75% Grass cover, Good, HSG A
6,943	55	Woods, Good, HSG B
18,999	77	Woods, Good, HSG D
285,147	72	Weighted Average
148,287		52.00% Pervious Area
136,860		48.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1300	0.15		Sheet Flow, Woods Woods: Light underbrush n= 0.400 P2= 3.36"
1.5	124	0.0806	1.42		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
2.2	408	0.0240	3.14		Shallow Concentrated Flow, Paved Paved Kv= 20.3 fps
9.4	582	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"

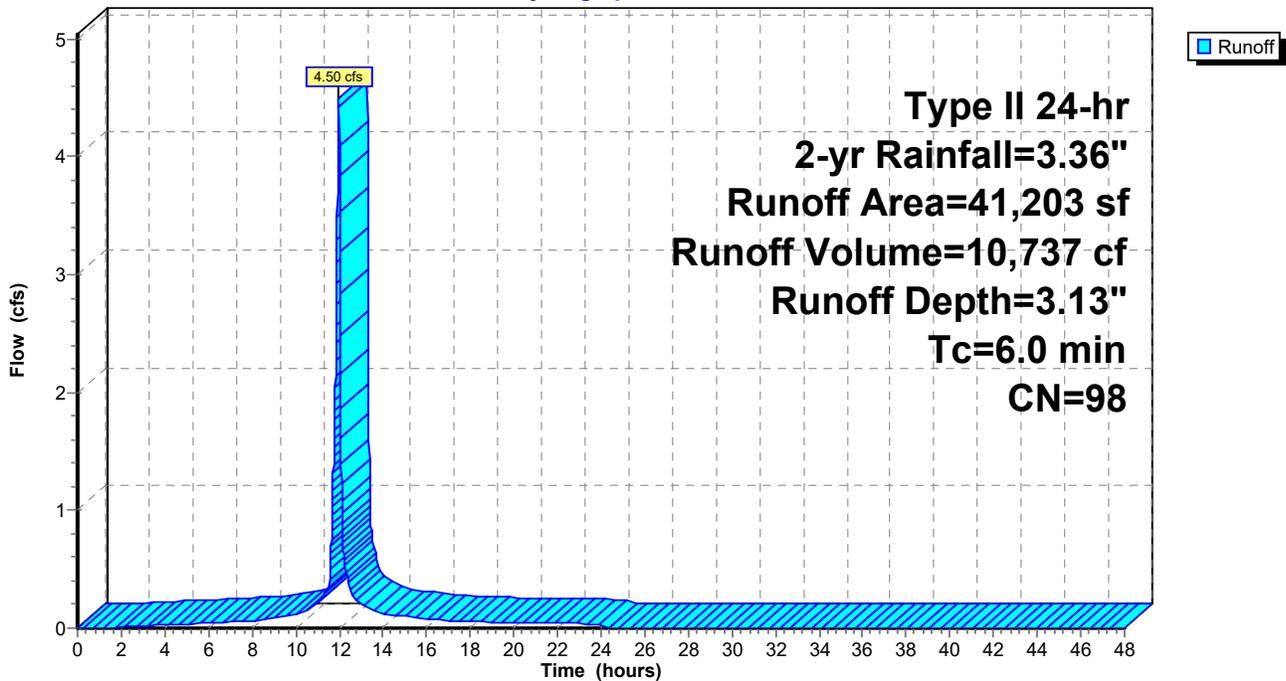
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
41,203	98	Unconnected roofs, HSG A
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

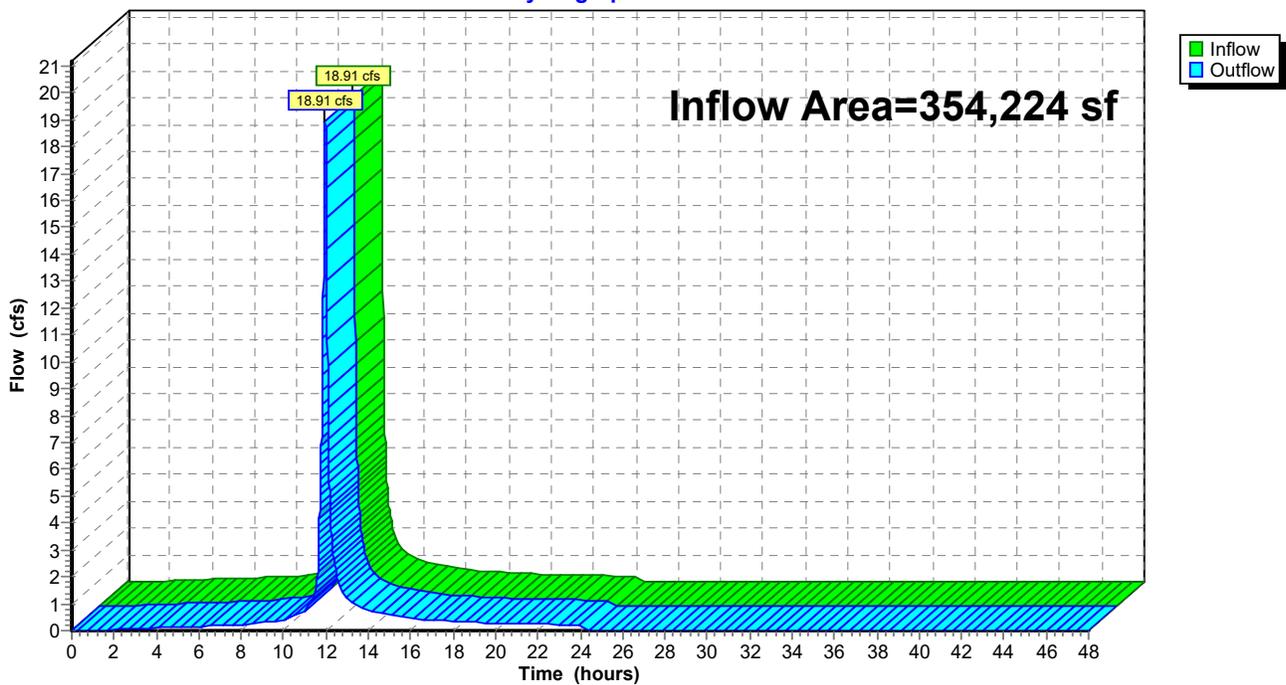
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 354,224 sf, 62.12% Impervious, Inflow Depth = 1.74" for 2-yr event
Inflow = 18.91 cfs @ 11.98 hrs, Volume= 51,359 cf
Outflow = 18.91 cfs @ 11.98 hrs, Volume= 51,359 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

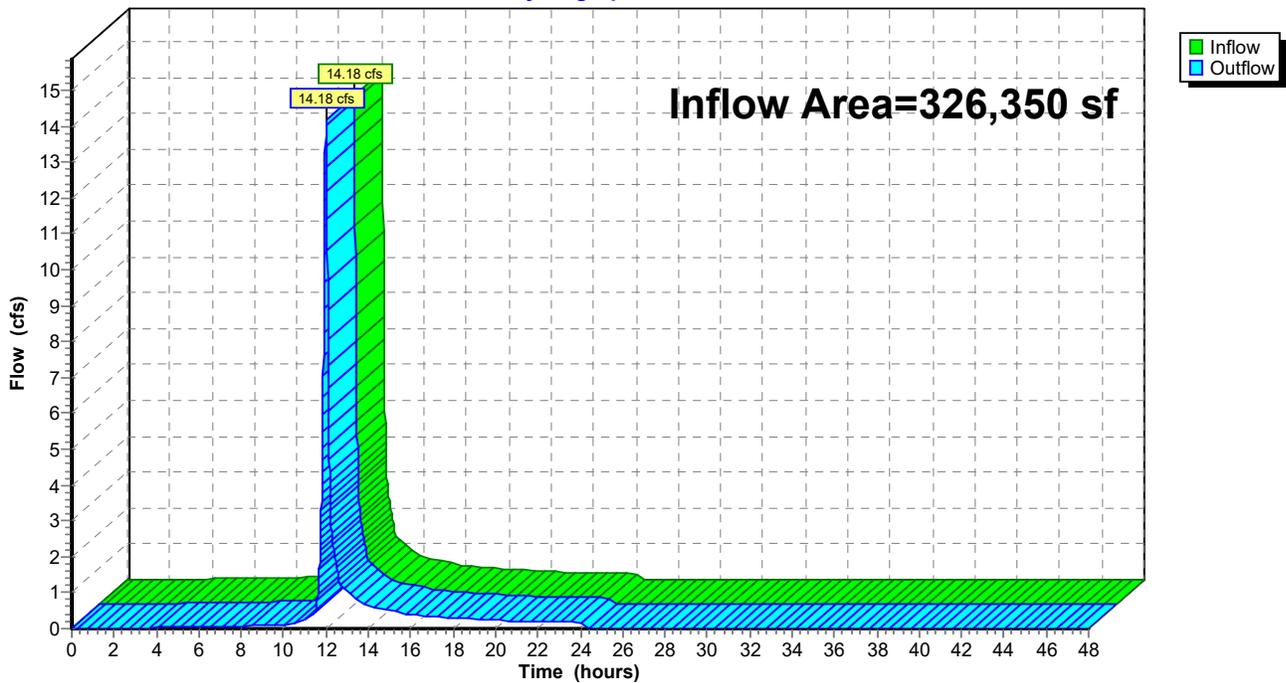
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 326,350 sf, 54.56% Impervious, Inflow Depth = 1.30" for 2-yr event
Inflow = 14.18 cfs @ 12.00 hrs, Volume= 35,221 cf
Outflow = 14.18 cfs @ 12.00 hrs, Volume= 35,221 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 10-yr Rainfall=5.12"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEDA-1A: Southeastern Runoff Area=102,065 sf 34.86% Impervious Runoff Depth=2.55"
Flow Length=204' Tc=12.6 min CN=75 Runoff=8.39 cfs 21,663 cf

SubcatchmentEDA-1B: Northeastern Runoff Area=105,544 sf 35.86% Impervious Runoff Depth=1.10"
Flow Length=436' Tc=16.4 min CN=56 Runoff=2.84 cfs 9,710 cf

SubcatchmentEDA-1C: Building 1 Roof Runoff Area=143,468 sf 100.00% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=98 Runoff=24.01 cfs 58,379 cf

SubcatchmentEDA-1D: Building 3 Roof Runoff Area=3,147 sf 100.00% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=98 Runoff=0.53 cfs 1,281 cf

SubcatchmentEDA-2A: Western Runoff Runoff Area=285,147 sf 48.00% Impervious Runoff Depth=2.29"
Flow Length=582' Tc=9.4 min CN=72 Runoff=23.64 cfs 54,432 cf

SubcatchmentEDA-2B: Building 2 Roof Runoff Area=41,203 sf 100.00% Impervious Runoff Depth=4.88"
Tc=6.0 min CN=98 Runoff=6.89 cfs 16,766 cf

Reach EDA-1: Southeastern Wetlands Inflow=32.46 cfs 91,033 cf
Outflow=32.46 cfs 91,033 cf

Reach EDA-2: Southwestern Wetlands Inflow=29.65 cfs 71,198 cf
Outflow=29.65 cfs 71,198 cf

Total Runoff Area = 680,574 sf Runoff Volume = 162,231 cf Average Runoff Depth = 2.86"
41.50% Pervious = 282,465 sf 58.50% Impervious = 398,109 sf

Summary for Subcatchment EDA-1A: Southeastern Runoff

Runoff = 8.39 cfs @ 12.05 hrs, Volume= 21,663 cf, Depth= 2.55"

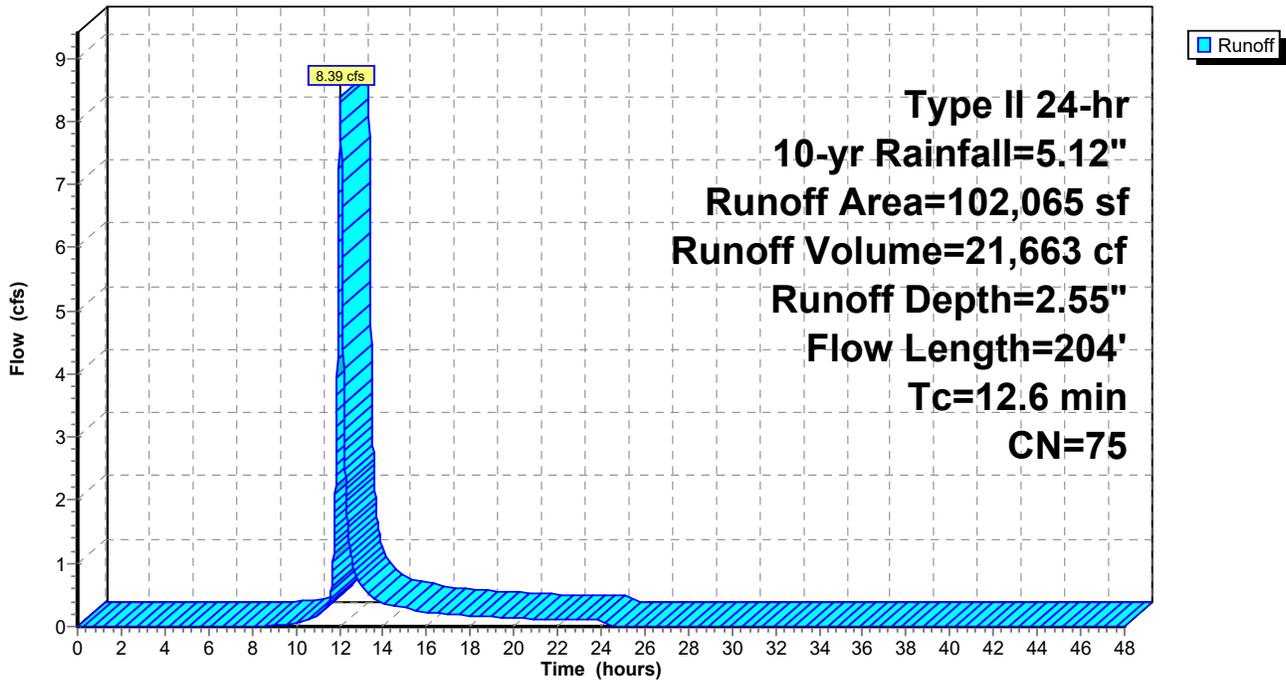
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
35,580	98	Paved parking, HSG A
22,534	32	Woods/grass comb., Good, HSG A
841	58	Woods/grass comb., Good, HSG B
43,110	79	Woods/grass comb., Good, HSG D
102,065	75	Weighted Average
66,485		65.14% Pervious Area
35,580		34.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	50	0.0420	0.09		Sheet Flow, Grass/Woods
					Woods: Light underbrush n= 0.400 P2= 3.36"
3.7	154	0.0195	0.70		Shallow Concentrated Flow, Woods
					Woodland Kv= 5.0 fps
12.6	204	Total			

Subcatchment EDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1B: Northeastern Runoff

Runoff = 2.84 cfs @ 12.11 hrs, Volume= 9,710 cf, Depth= 1.10"

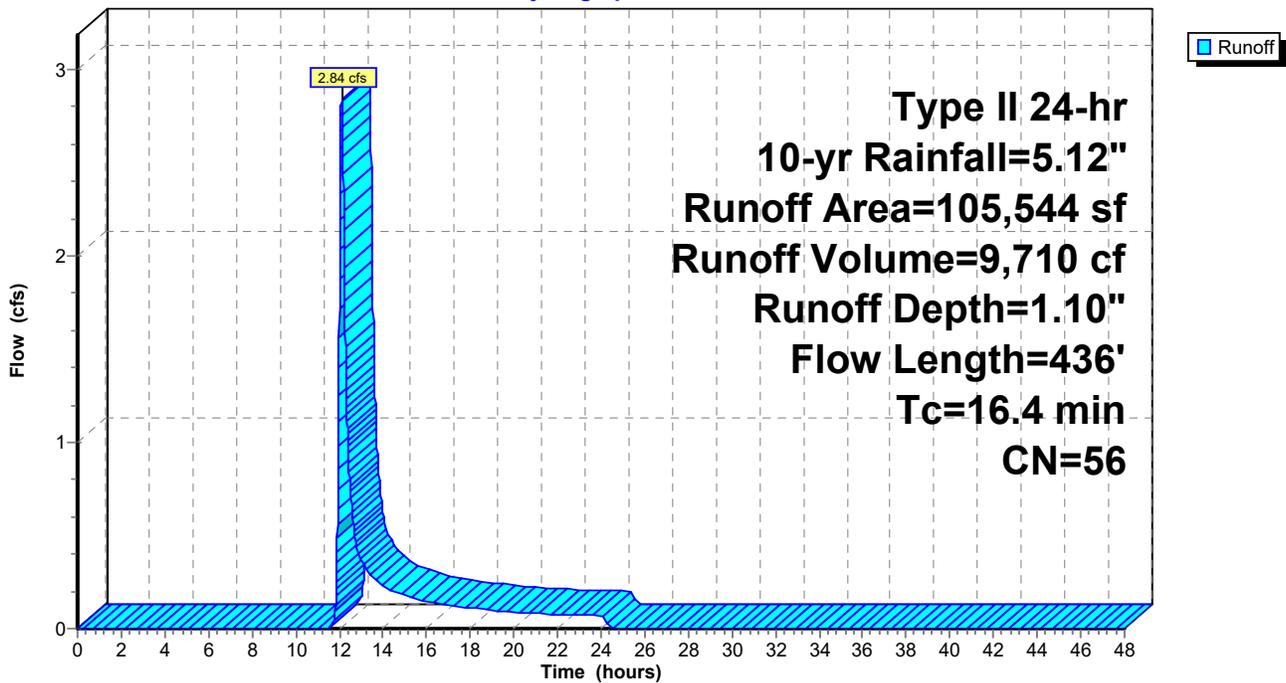
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
37,851	98	Paved parking, HSG A
63,191	32	Woods/grass comb., Good, HSG A
4,502	39	>75% Grass cover, Good, HSG A
105,544	56	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
12.0	50	0.0200	0.07		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
1.4	104	0.0313	1.24		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
3.0	282	0.0060	1.57		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
16.4	436	Total			

Subcatchment EDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment EDA-1C: Building 1 Roof

Runoff = 24.01 cfs @ 11.97 hrs, Volume= 58,379 cf, Depth= 4.88"

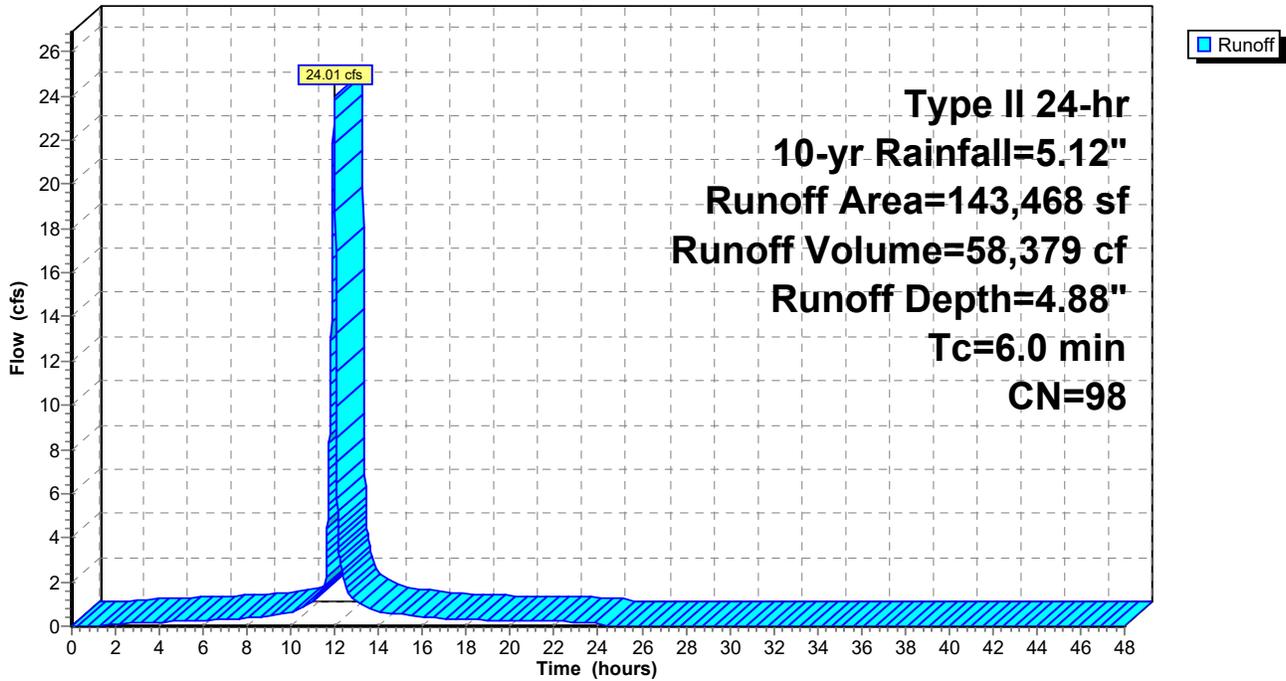
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
143,468	98	Unconnected roofs, HSG A
143,468		100.00% Impervious Area
143,468		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"

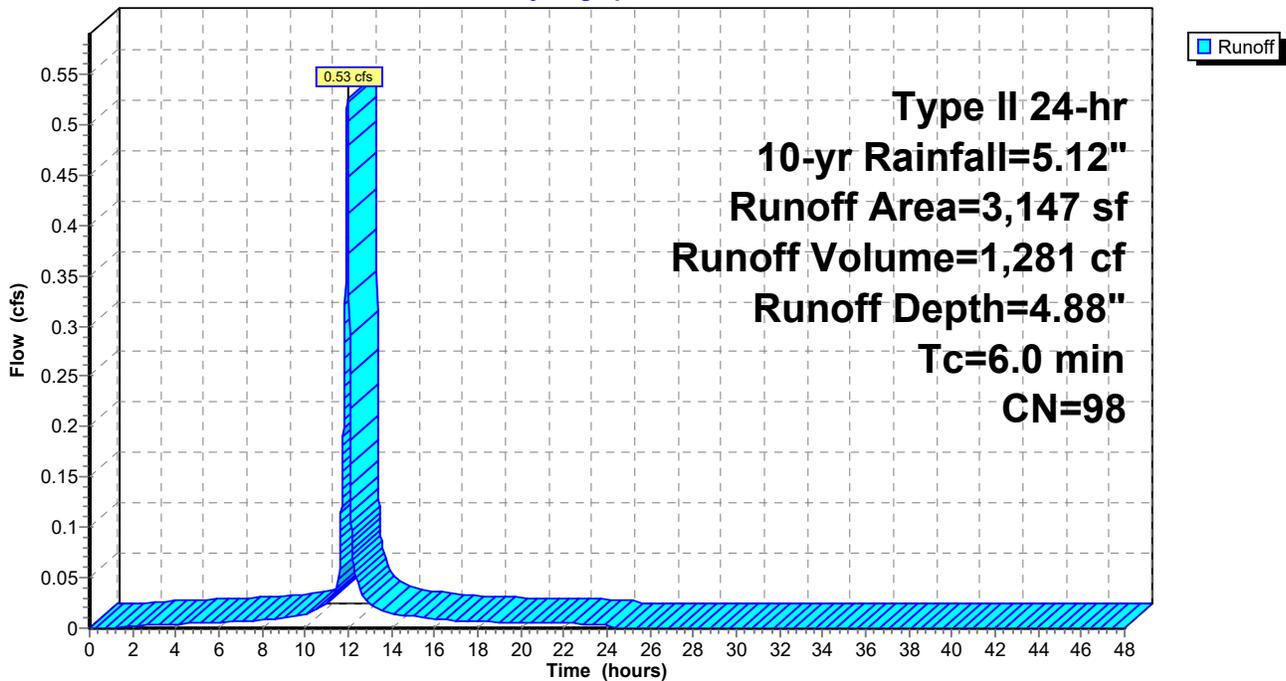
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
3,147	98	Unconnected roofs, HSG A
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 = 23.64 cfs @ 12.01 hrs, Volume= 54,432 cf, Depth= 2.29"

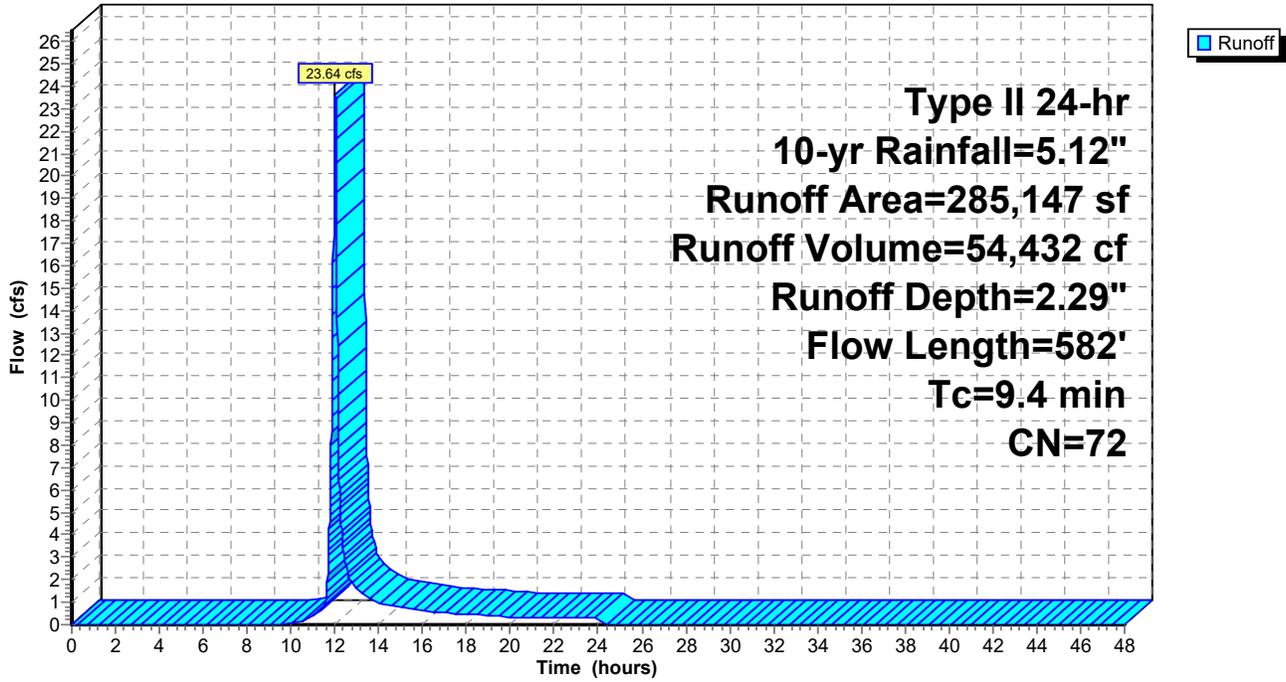
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
136,860	98	Paved parking, HSG A
87,354	30	Woods, Good, HSG A
20,947	96	Gravel surface, HSG A
14,044	39	>75% Grass cover, Good, HSG A
6,943	55	Woods, Good, HSG B
18,999	77	Woods, Good, HSG D
285,147	72	Weighted Average
148,287		52.00% Pervious Area
136,860		48.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1300	0.15		Sheet Flow, Woods Woods: Light underbrush n= 0.400 P2= 3.36"
1.5	124	0.0806	1.42		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
2.2	408	0.0240	3.14		Shallow Concentrated Flow, Paved Paved Kv= 20.3 fps
9.4	582	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"

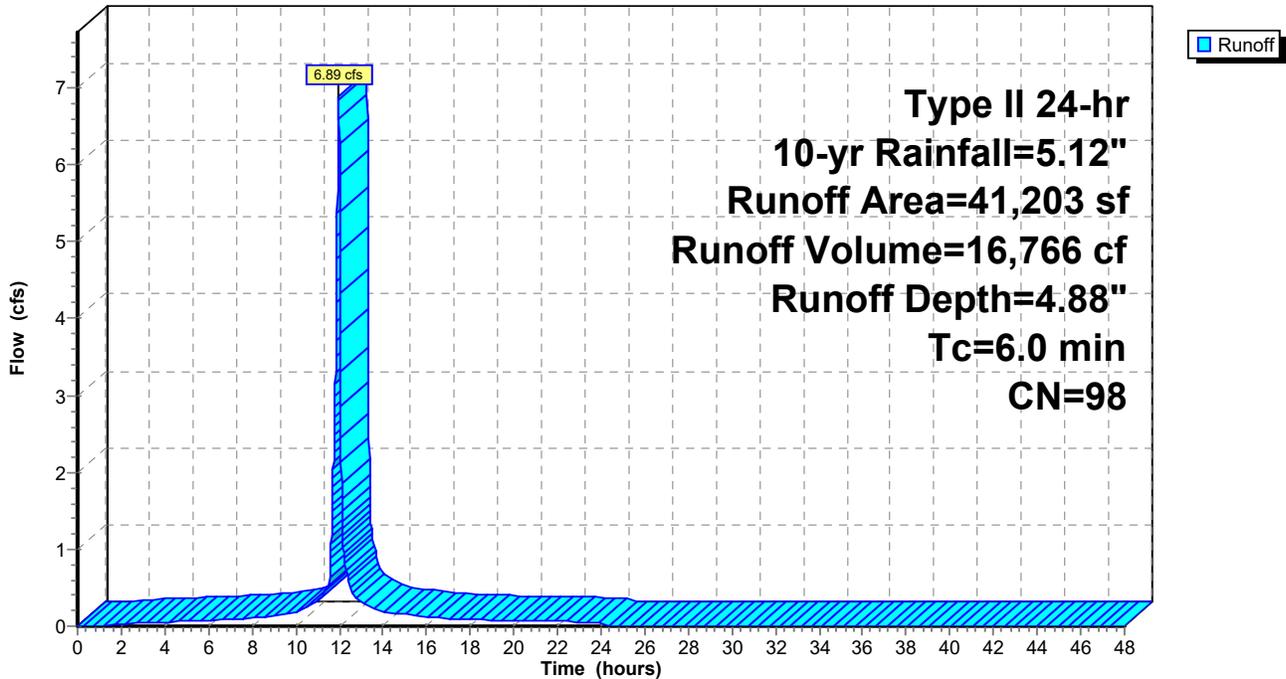
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
41,203	98	Unconnected roofs, HSG A
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

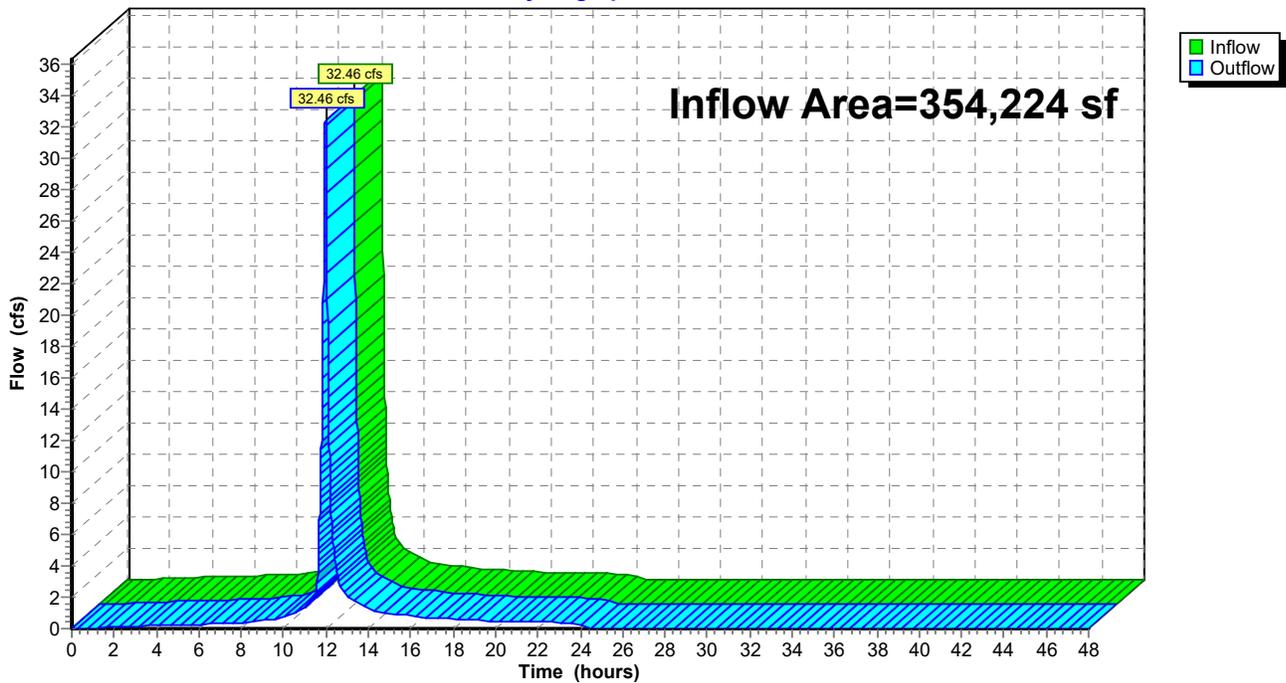
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 354,224 sf, 62.12% Impervious, Inflow Depth = 3.08" for 10-yr event
Inflow = 32.46 cfs @ 11.98 hrs, Volume= 91,033 cf
Outflow = 32.46 cfs @ 11.98 hrs, Volume= 91,033 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

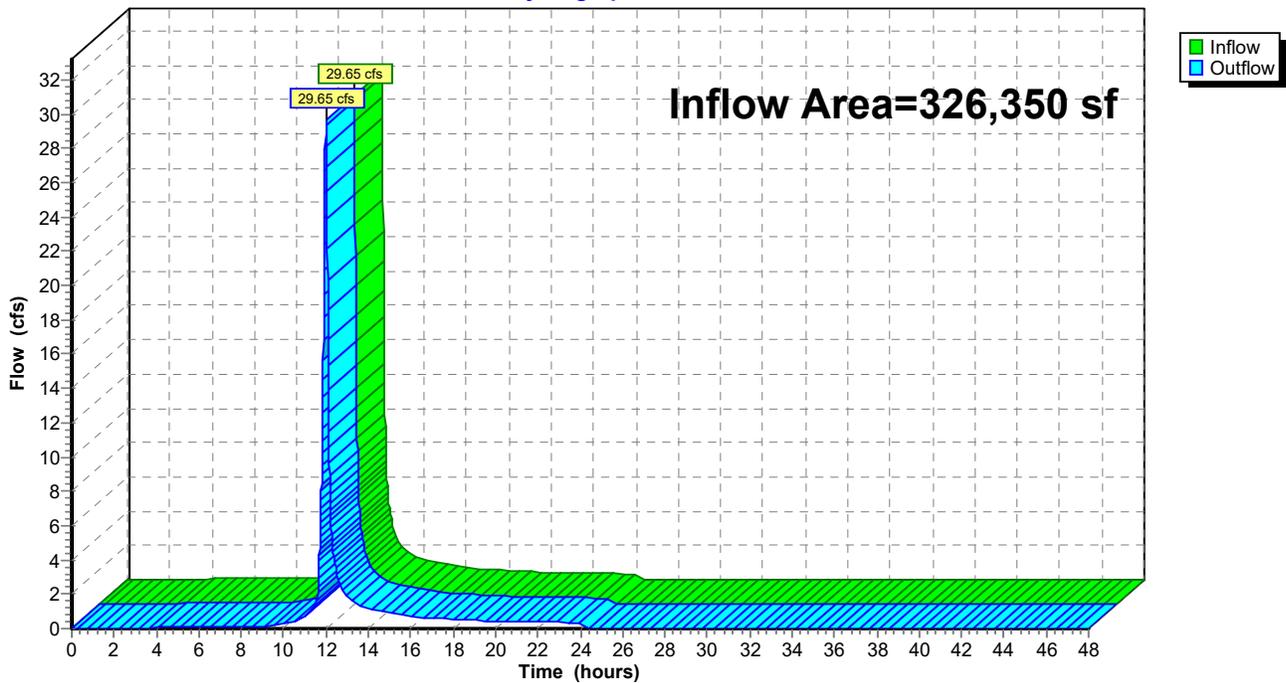
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 326,350 sf, 54.56% Impervious, Inflow Depth = 2.62" for 10-yr event
Inflow = 29.65 cfs @ 12.00 hrs, Volume= 71,198 cf
Outflow = 29.65 cfs @ 12.00 hrs, Volume= 71,198 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



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

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEDA-1A: Southeastern Runoff Area=102,065 sf 34.86% Impervious Runoff Depth=4.97"
Flow Length=204' Tc=12.6 min CN=75 Runoff=16.20 cfs 42,268 cf

SubcatchmentEDA-1B: Northeastern Runoff Area=105,544 sf 35.86% Impervious Runoff Depth=2.84"
Flow Length=436' Tc=16.4 min CN=56 Runoff=8.28 cfs 24,954 cf

SubcatchmentEDA-1C: Building 1 Roof Runoff Area=143,468 sf 100.00% Impervious Runoff Depth=7.68"
Tc=6.0 min CN=98 Runoff=37.24 cfs 91,823 cf

SubcatchmentEDA-1D: Building 3 Roof Runoff Area=3,147 sf 100.00% Impervious Runoff Depth=7.68"
Tc=6.0 min CN=98 Runoff=0.82 cfs 2,014 cf

SubcatchmentEDA-2A: Western Runoff Runoff Area=285,147 sf 48.00% Impervious Runoff Depth=4.62"
Flow Length=582' Tc=9.4 min CN=72 Runoff=47.33 cfs 109,884 cf

SubcatchmentEDA-2B: Building 2 Roof Runoff Area=41,203 sf 100.00% Impervious Runoff Depth=7.68"
Tc=6.0 min CN=98 Runoff=10.70 cfs 26,371 cf

Reach EDA-1: Southeastern Wetlands Inflow=56.46 cfs 161,059 cf
Outflow=56.46 cfs 161,059 cf

Reach EDA-2: Southwestern Wetlands Inflow=56.82 cfs 136,255 cf
Outflow=56.82 cfs 136,255 cf

Total Runoff Area = 680,574 sf Runoff Volume = 297,314 cf Average Runoff Depth = 5.24"
41.50% Pervious = 282,465 sf 58.50% Impervious = 398,109 sf

Summary for Subcatchment EDA-1A: Southeastern Runoff

Runoff = 16.20 cfs @ 12.04 hrs, Volume= 42,268 cf, Depth= 4.97"

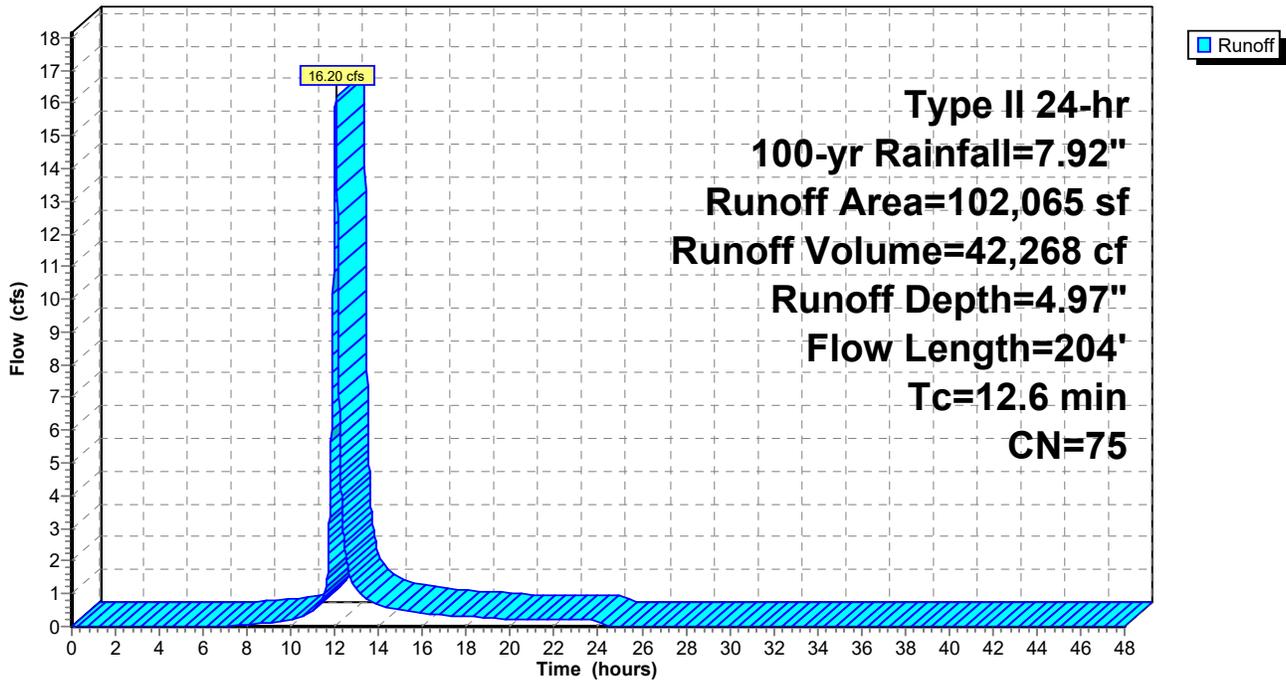
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
35,580	98	Paved parking, HSG A
22,534	32	Woods/grass comb., Good, HSG A
841	58	Woods/grass comb., Good, HSG B
43,110	79	Woods/grass comb., Good, HSG D
102,065	75	Weighted Average
66,485		65.14% Pervious Area
35,580		34.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	50	0.0420	0.09		Sheet Flow, Grass/Woods
					Woods: Light underbrush n= 0.400 P2= 3.36"
3.7	154	0.0195	0.70		Shallow Concentrated Flow, Woods
					Woodland Kv= 5.0 fps
12.6	204	Total			

Subcatchment EDA-1A: Southeastern Runoff

Hydrograph



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

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Summary for Subcatchment EDA-1B: Northeastern Runoff

Runoff = 8.28 cfs @ 12.10 hrs, Volume= 24,954 cf, Depth= 2.84"

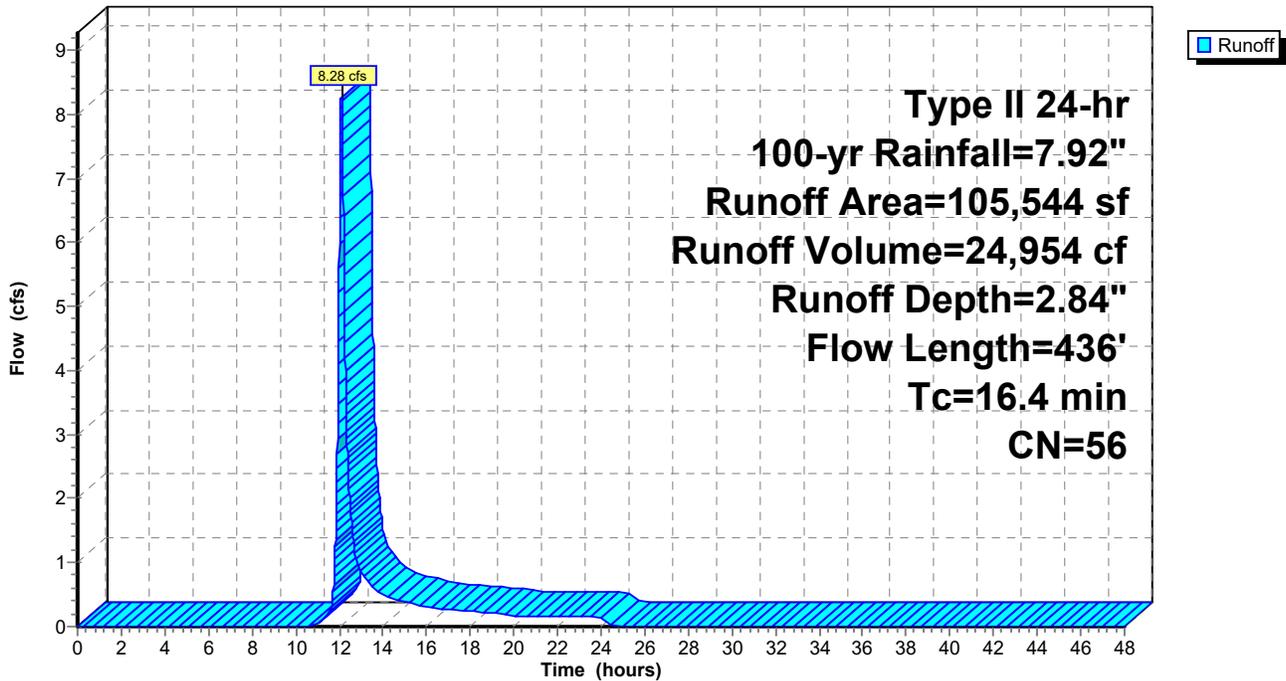
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
37,851	98	Paved parking, HSG A
63,191	32	Woods/grass comb., Good, HSG A
4,502	39	>75% Grass cover, Good, HSG A
105,544	56	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
12.0	50	0.0200	0.07		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
1.4	104	0.0313	1.24		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
3.0	282	0.0060	1.57		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
16.4	436	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"

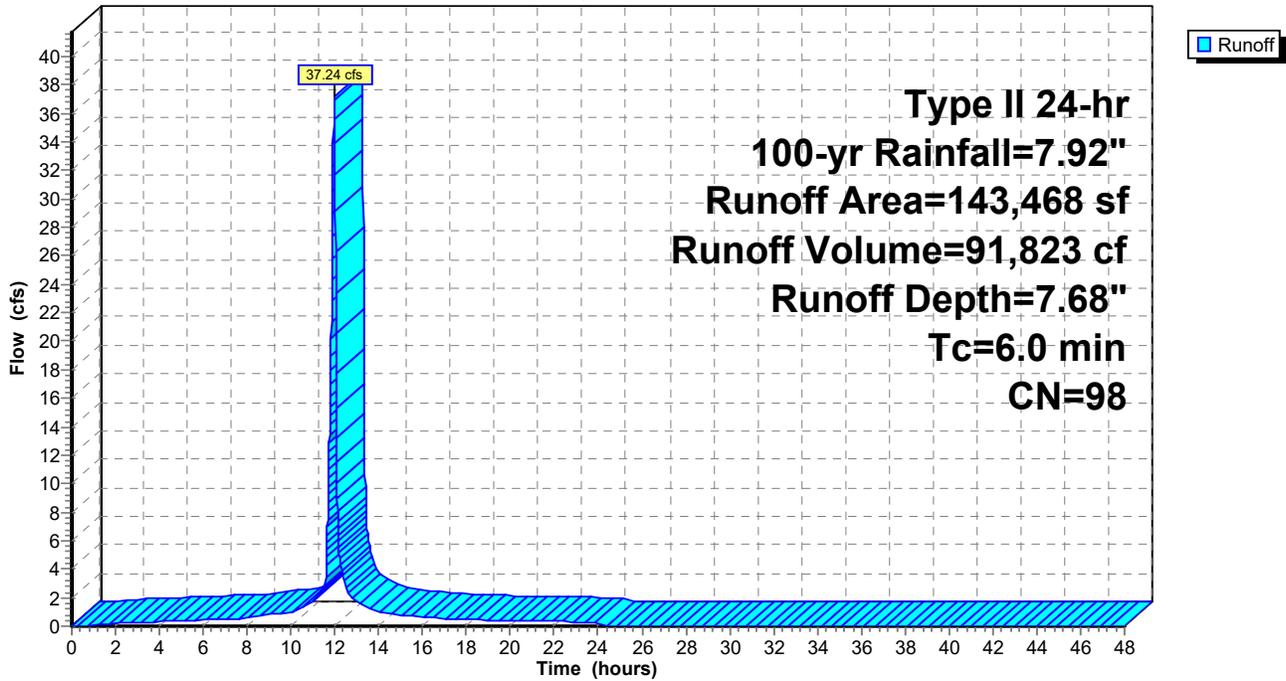
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
143,468	98	Unconnected roofs, HSG A
143,468		100.00% Impervious Area
143,468		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"

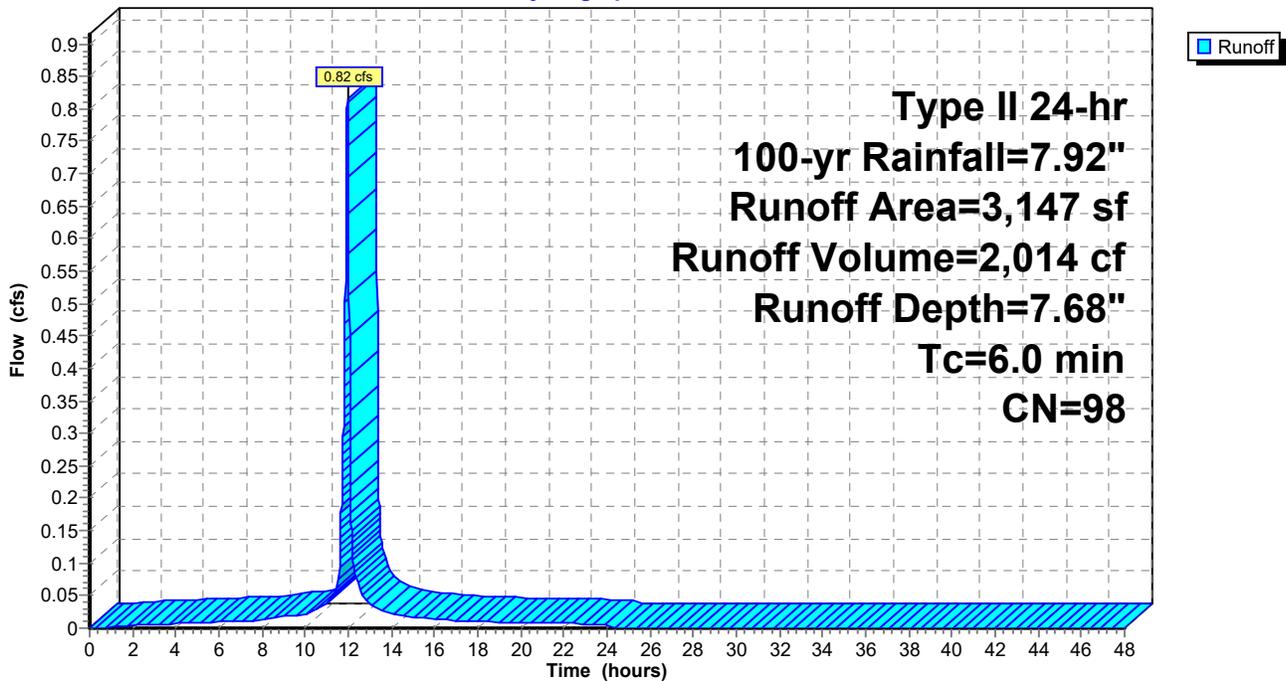
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
3,147	98	Unconnected roofs, HSG A
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 = 47.33 cfs @ 12.01 hrs, Volume= 109,884 cf, Depth= 4.62"

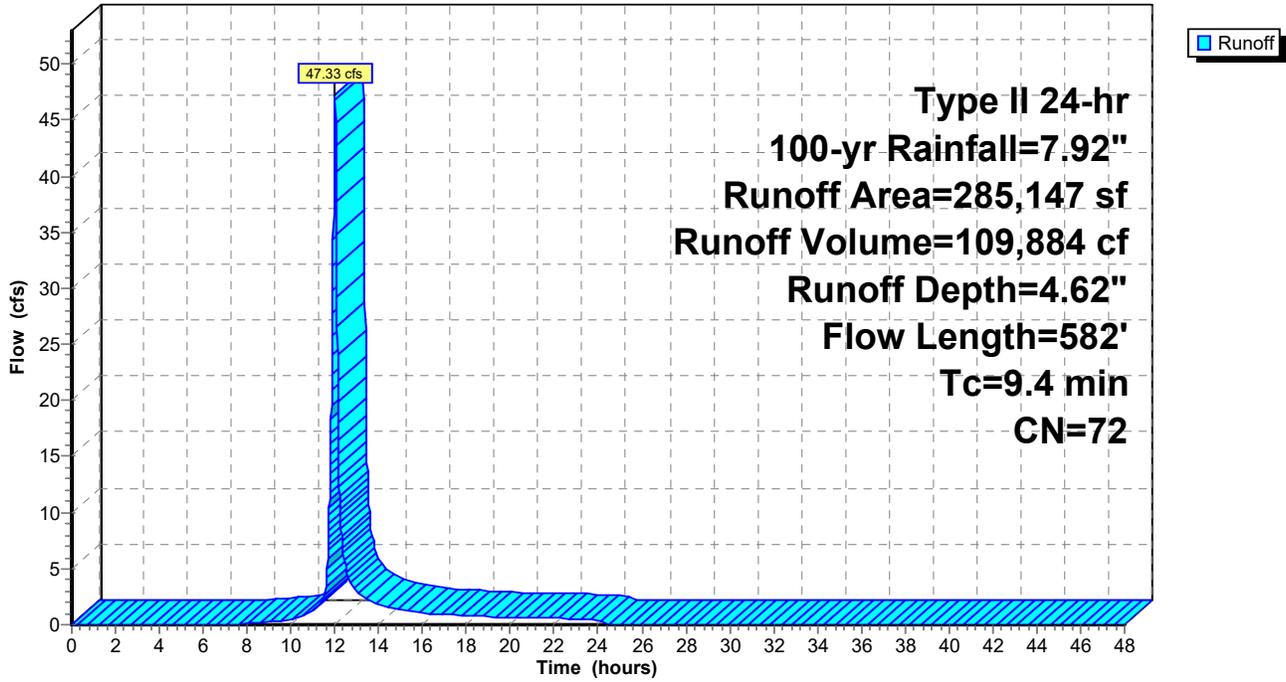
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
136,860	98	Paved parking, HSG A
87,354	30	Woods, Good, HSG A
20,947	96	Gravel surface, HSG A
14,044	39	>75% Grass cover, Good, HSG A
6,943	55	Woods, Good, HSG B
18,999	77	Woods, Good, HSG D
285,147	72	Weighted Average
148,287		52.00% Pervious Area
136,860		48.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1300	0.15		Sheet Flow, Woods Woods: Light underbrush n= 0.400 P2= 3.36"
1.5	124	0.0806	1.42		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
2.2	408	0.0240	3.14		Shallow Concentrated Flow, Paved Paved Kv= 20.3 fps
9.4	582	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"

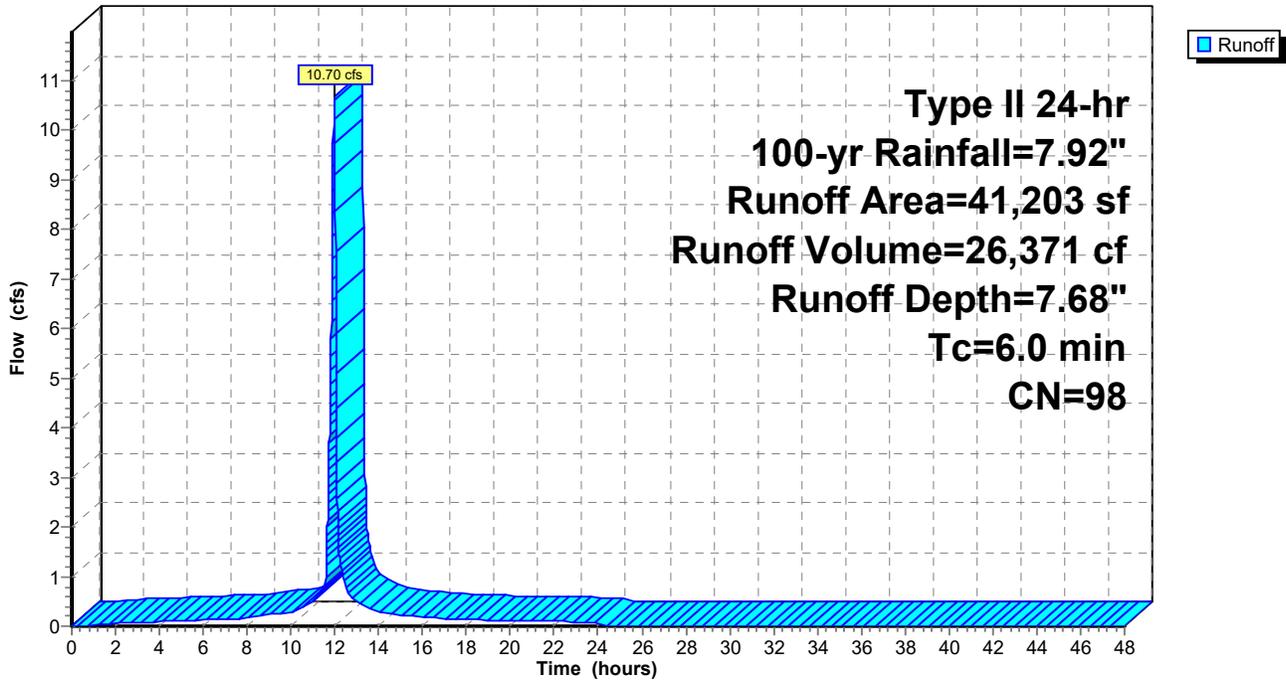
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
41,203	98	Unconnected roofs, HSG A
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

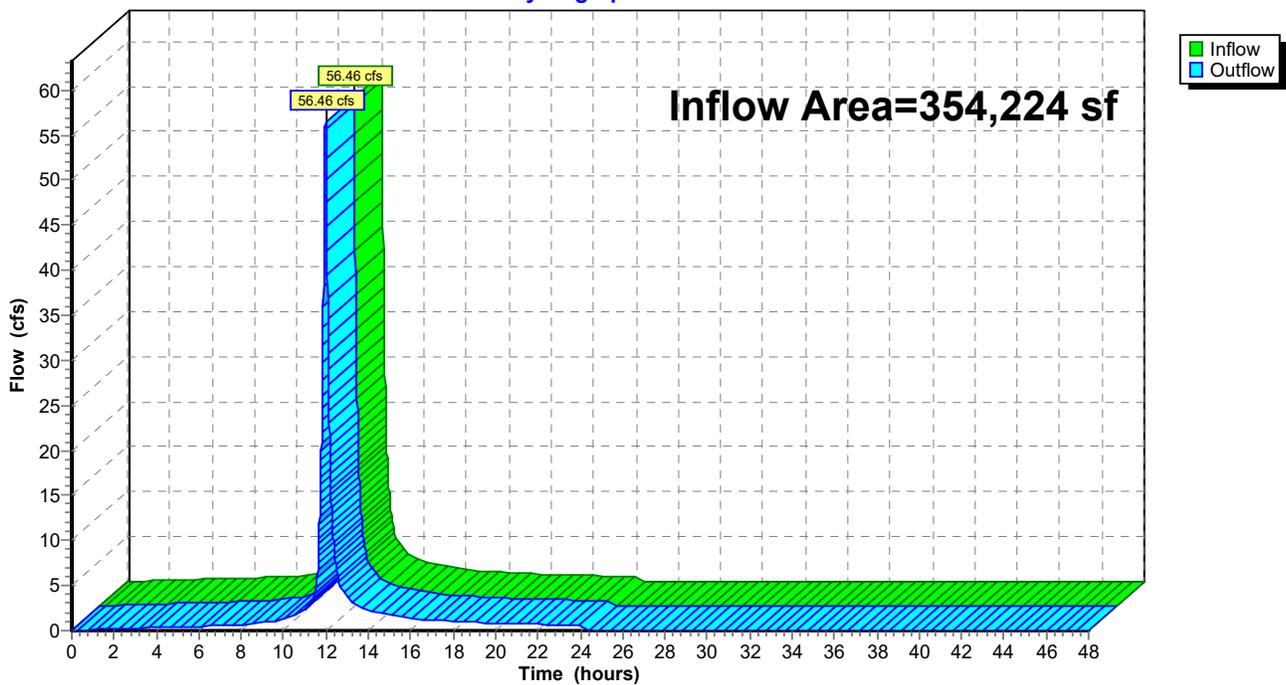
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 354,224 sf, 62.12% Impervious, Inflow Depth = 5.46" for 100-yr event
Inflow = 56.46 cfs @ 11.98 hrs, Volume= 161,059 cf
Outflow = 56.46 cfs @ 11.98 hrs, Volume= 161,059 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

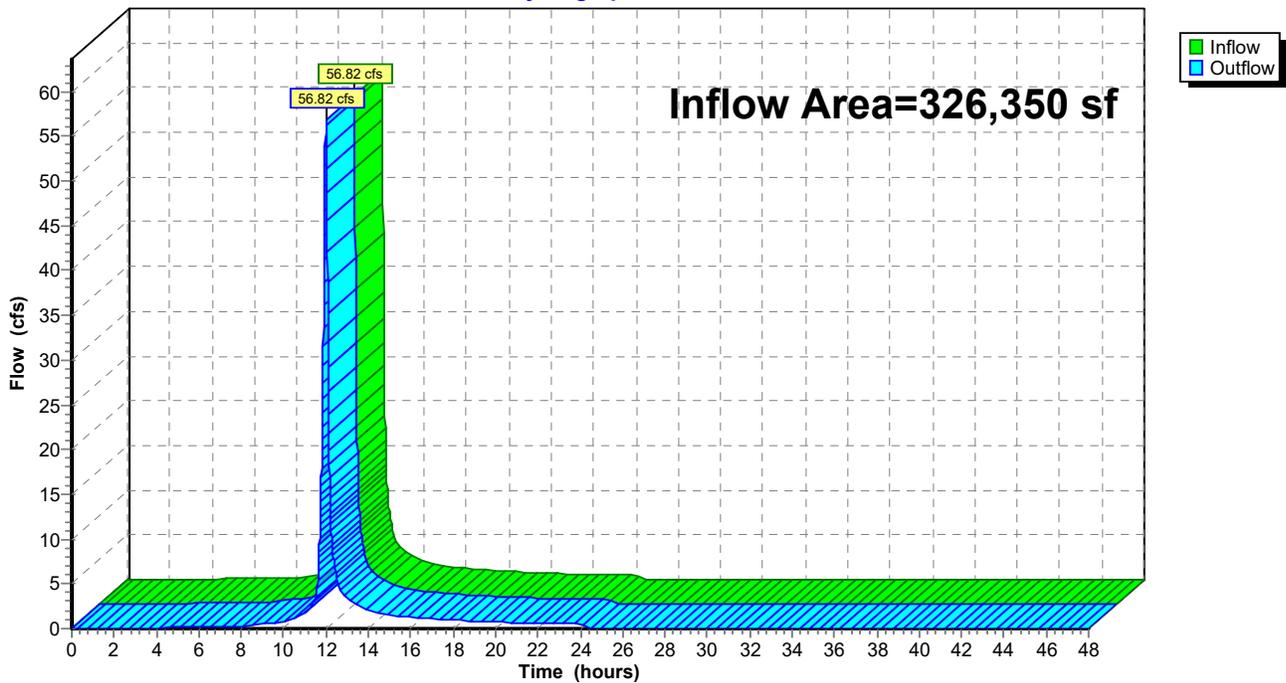
[40] Hint: Not Described (Outflow=Inflow)

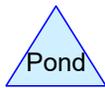
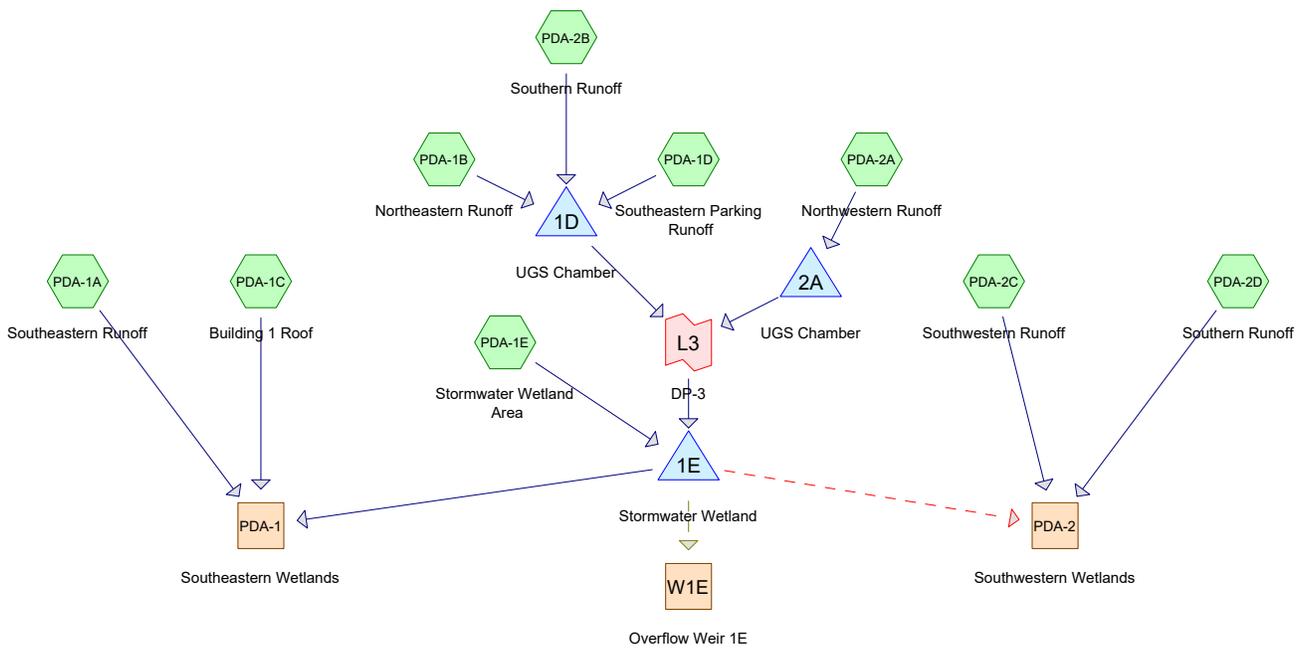
Inflow Area = 326,350 sf, 54.56% Impervious, Inflow Depth = 5.01" for 100-yr event
Inflow = 56.82 cfs @ 12.00 hrs, Volume= 136,255 cf
Outflow = 56.82 cfs @ 12.00 hrs, Volume= 136,255 cf, Atten= 0%, Lag= 0.0 min

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
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Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
18,551	39	>75% Grass cover, Good, HSG A (PDA-1B, PDA-1D, PDA-2A, PDA-2B)
44	80	>75% Grass cover, Good, HSG D (PDA-1D)
370,397	98	Paved parking, HSG A (PDA-1B, PDA-1D, PDA-2A, PDA-2B, PDA-2C)
143,468	98	Unconnected roofs, HSG A (PDA-1C)
13,771	98	Water Surface, HSG A (PDA-1E)
25,067	43	Woods/grass comb., Fair, HSG A (PDA-2C)
1,454	82	Woods/grass comb., Fair, HSG D (PDA-2C)
54,025	32	Woods/grass comb., Good, HSG A (PDA-1A, PDA-1B)
7,784	58	Woods/grass comb., Good, HSG B (PDA-1A, PDA-2D)
46,013	79	Woods/grass comb., Good, HSG D (PDA-1A, PDA-2D)
680,574	87	TOTAL AREA

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Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
625,279	HSG A	PDA-1A, PDA-1B, PDA-1C, PDA-1D, PDA-1E, PDA-2A, PDA-2B, PDA-2C
7,784	HSG B	PDA-1A, PDA-2D
0	HSG C	
47,511	HSG D	PDA-1A, PDA-1D, PDA-2C, PDA-2D
0	Other	
680,574		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
18,551	0	0	44	0	18,595	>75% Grass cover, Good
370,397	0	0	0	0	370,397	Paved parking
143,468	0	0	0	0	143,468	Unconnected roofs
13,771	0	0	0	0	13,771	Water Surface
25,067	0	0	1,454	0	26,521	Woods/grass comb., Fair
54,025	7,784	0	46,013	0	107,822	Woods/grass comb., Good
625,279	7,784	0	47,511	0	680,574	TOTAL AREA

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Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1D	140.50	140.22	11.0	0.0255	0.011	24.0	0.0	0.0
2	1E	140.00	139.50	72.0	0.0069	0.012	18.0	0.0	0.0
3	1E	140.00	139.50	71.0	0.0070	0.012	18.0	0.0	0.0
4	2A	143.50	142.17	195.0	0.0068	0.011	24.0	0.0	0.0

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

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPDA-1A: Southeastern	Runoff Area=52,370 sf 0.00% Impervious Runoff Depth=0.36" Flow Length=164' Tc=9.2 min CN=57 Runoff=0.44 cfs 1,592 cf
SubcatchmentPDA-1B: Northeastern	Runoff Area=100,339 sf 62.51% Impervious Runoff Depth=1.14" Flow Length=265' Tc=27.9 min CN=74 Runoff=2.26 cfs 9,568 cf
SubcatchmentPDA-1C: Building 1 Roof	Runoff Area=143,468 sf 100.00% Impervious Runoff Depth=3.13" Tc=6.0 min CN=98 Runoff=15.66 cfs 37,384 cf
SubcatchmentPDA-1D: Southeastern	Runoff Area=56,696 sf 99.22% Impervious Runoff Depth=3.13" Tc=6.0 min CN=98 Runoff=6.19 cfs 14,774 cf
SubcatchmentPDA-1E: Stormwater	Runoff Area=13,771 sf 100.00% Impervious Runoff Depth=3.13" Tc=6.0 min CN=98 Runoff=1.50 cfs 3,588 cf
SubcatchmentPDA-2A: Northwestern	Runoff Area=152,357 sf 93.58% Impervious Runoff Depth=2.70" Tc=6.0 min CN=94 Runoff=15.52 cfs 34,271 cf
SubcatchmentPDA-2B: Southern Runoff	Runoff Area=90,674 sf 99.11% Impervious Runoff Depth=3.02" Tc=6.0 min CN=97 Runoff=9.77 cfs 22,785 cf
SubcatchmentPDA-2C: Southwestern	Runoff Area=45,499 sf 41.71% Impervious Runoff Depth=0.77" Flow Length=220' Tc=6.6 min CN=67 Runoff=1.33 cfs 2,929 cf
SubcatchmentPDA-2D: Southern Runoff	Runoff Area=25,400 sf 0.00% Impervious Runoff Depth=1.09" Flow Length=107' Tc=19.2 min CN=73 Runoff=0.69 cfs 2,300 cf
Reach PDA-1: Southeastern Wetlands	Inflow=18.11 cfs 81,058 cf Outflow=18.11 cfs 81,058 cf
Reach PDA-2: Southwestern Wetlands	Inflow=5.40 cfs 47,366 cf Outflow=5.40 cfs 47,366 cf
Reach W1E: Overflow Weir 1E	Inflow=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf
Pond 1D: UGS Chamber	Peak Elev=141.55' Storage=17,827 cf Inflow=16.65 cfs 47,127 cf Outflow=4.61 cfs 46,629 cf
Pond 1E: Stormwater Wetland	Peak Elev=141.25' Storage=9,454 cf Inflow=12.39 cfs 84,435 cf Primary=4.67 cfs 42,082 cf Secondary=4.67 cfs 42,137 cf Tertiary=0.00 cfs 0 cf Outflow=9.34 cfs 84,219 cf
Pond 2A: UGS Chamber	Peak Elev=144.97' Storage=11,016 cf Inflow=15.52 cfs 34,271 cf Outflow=7.27 cfs 34,217 cf
Link L3: DP-3	Inflow=11.74 cfs 80,847 cf Primary=11.74 cfs 80,847 cf

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

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Total Runoff Area = 680,574 sf Runoff Volume = 129,192 cf Average Runoff Depth = 2.28"
22.47% Pervious = 152,938 sf 77.53% Impervious = 527,636 sf

Summary for Subcatchment PDA-1A: Southeastern Runoff

Runoff = 0.44 cfs @ 12.05 hrs, Volume= 1,592 cf, Depth= 0.36"

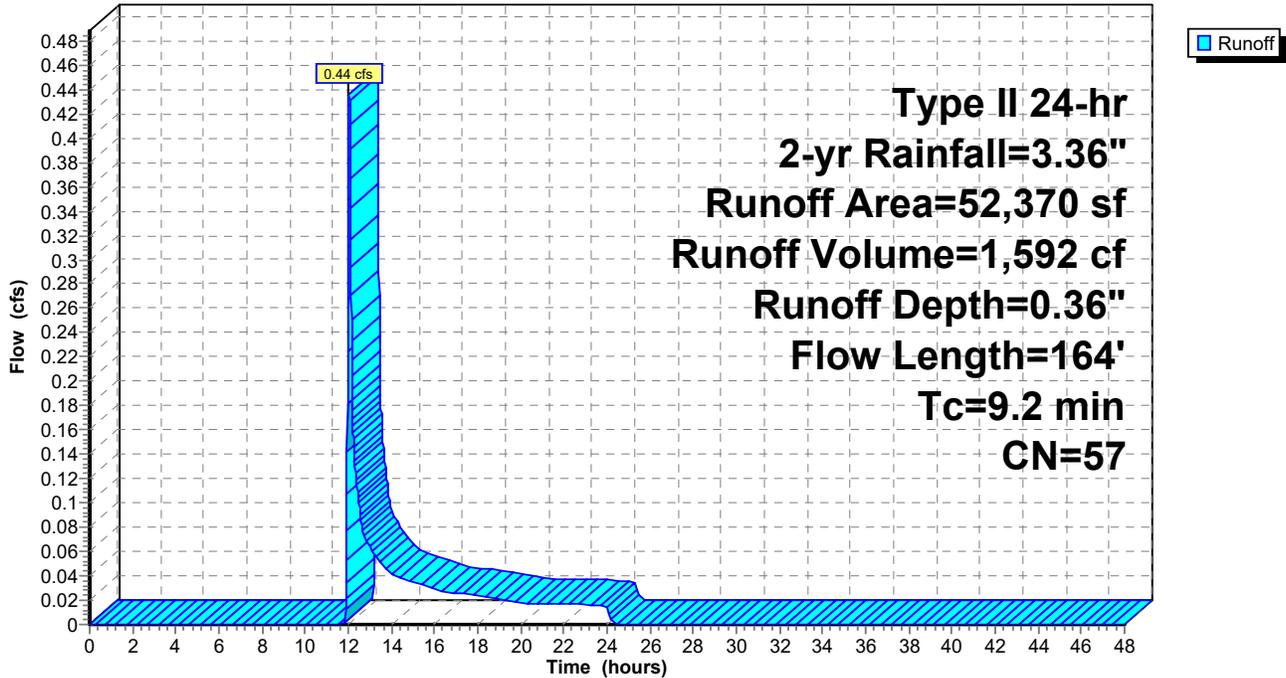
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
23,973	32	Woods/grass comb., Good, HSG A
841	58	Woods/grass comb., Good, HSG B
27,556	79	Woods/grass comb., Good, HSG D
52,370	57	Weighted Average
52,370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	50	0.0220	0.11		Sheet Flow, Grass Grass: Dense n= 0.240 P2= 3.36"
1.0	74	0.0290	1.19		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0418	1.43		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
9.2	164	Total			

Subcatchment PDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1B: Northeastern Runoff

Runoff = 2.26 cfs @ 12.24 hrs, Volume= 9,568 cf, Depth= 1.14"

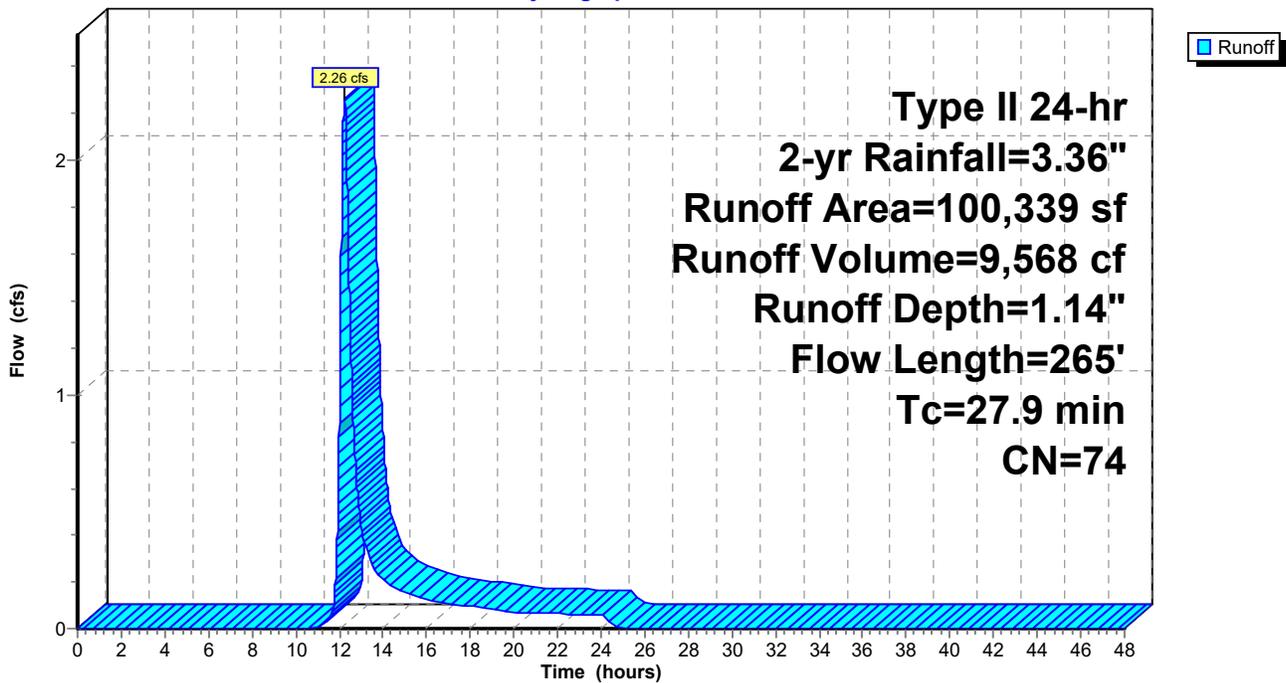
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
62,721	98	Paved parking, HSG A
7,566	39	>75% Grass cover, Good, HSG A
30,052	32	Woods/grass comb., Good, HSG A
100,339	74	Weighted Average
37,618		37.49% Pervious Area
62,721		62.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.1	102	0.0120	0.07		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
1.3	87	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
27.9	265	Total			

Subcatchment PDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1C: Building 1 Roof

Runoff = 15.66 cfs @ 11.97 hrs, Volume= 37,384 cf, Depth= 3.13"

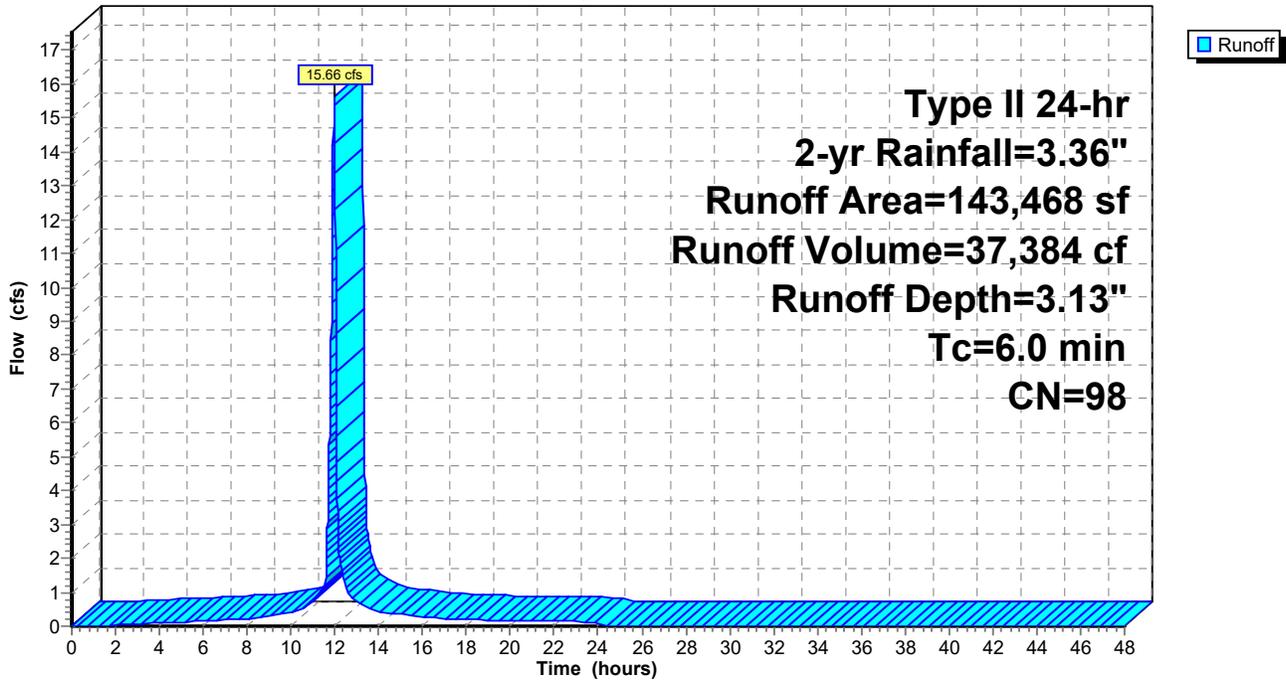
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
143,468	98	Unconnected roofs, HSG A
143,468		100.00% Impervious Area
143,468		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 = 6.19 cfs @ 11.97 hrs, Volume= 14,774 cf, Depth= 3.13"

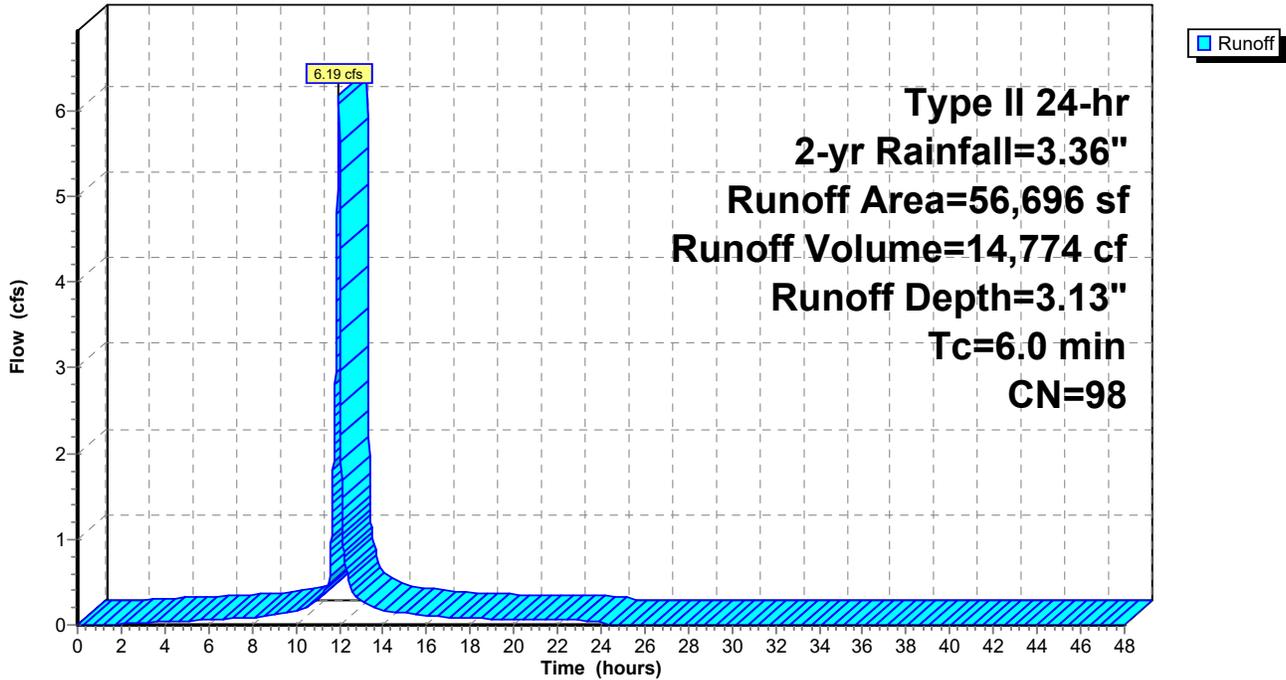
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
398	39	>75% Grass cover, Good, HSG A
56,254	98	Paved parking, HSG A
44	80	>75% Grass cover, Good, HSG D
56,696	98	Weighted Average
442		0.78% Pervious Area
56,254		99.22% 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-1E: Stormwater Wetland Area

Runoff = 1.50 cfs @ 11.97 hrs, Volume= 3,588 cf, Depth= 3.13"

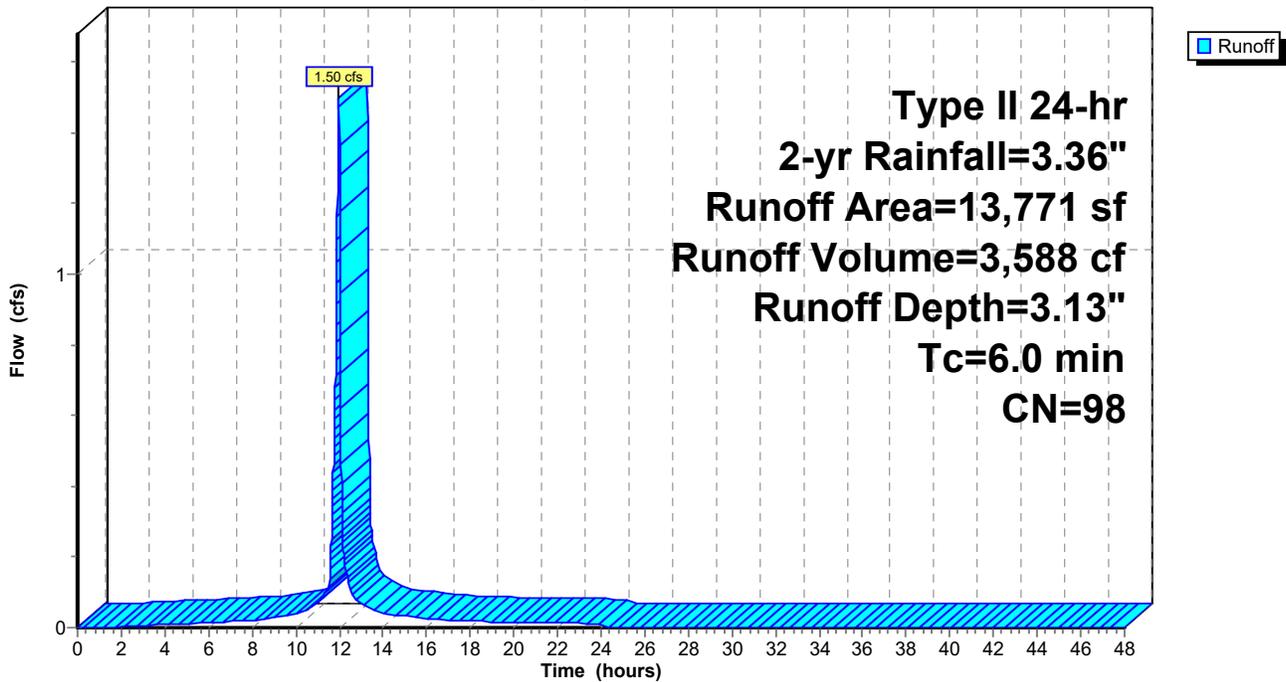
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
13,771	98	Water Surface, HSG A
13,771		100.00% Impervious Area

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

Subcatchment PDA-1E: Stormwater Wetland Area

Hydrograph



Summary for Subcatchment PDA-2A: Northwestern Runoff

Runoff = 15.52 cfs @ 11.97 hrs, Volume= 34,271 cf, Depth= 2.70"

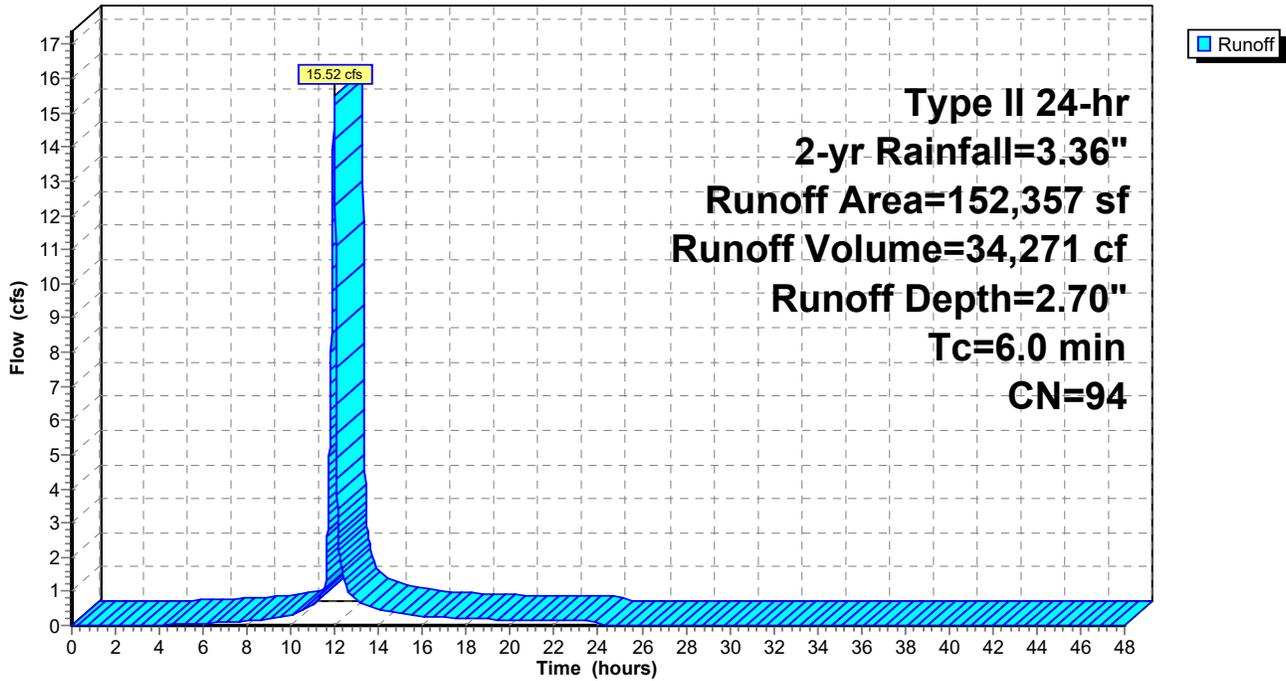
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
142,578	98	Paved parking, HSG A
9,779	39	>75% Grass cover, Good, HSG A
152,357	94	Weighted Average
9,779		6.42% Pervious Area
142,578		93.58% 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: Southern Runoff

Runoff = 9.77 cfs @ 11.97 hrs, Volume= 22,785 cf, Depth= 3.02"

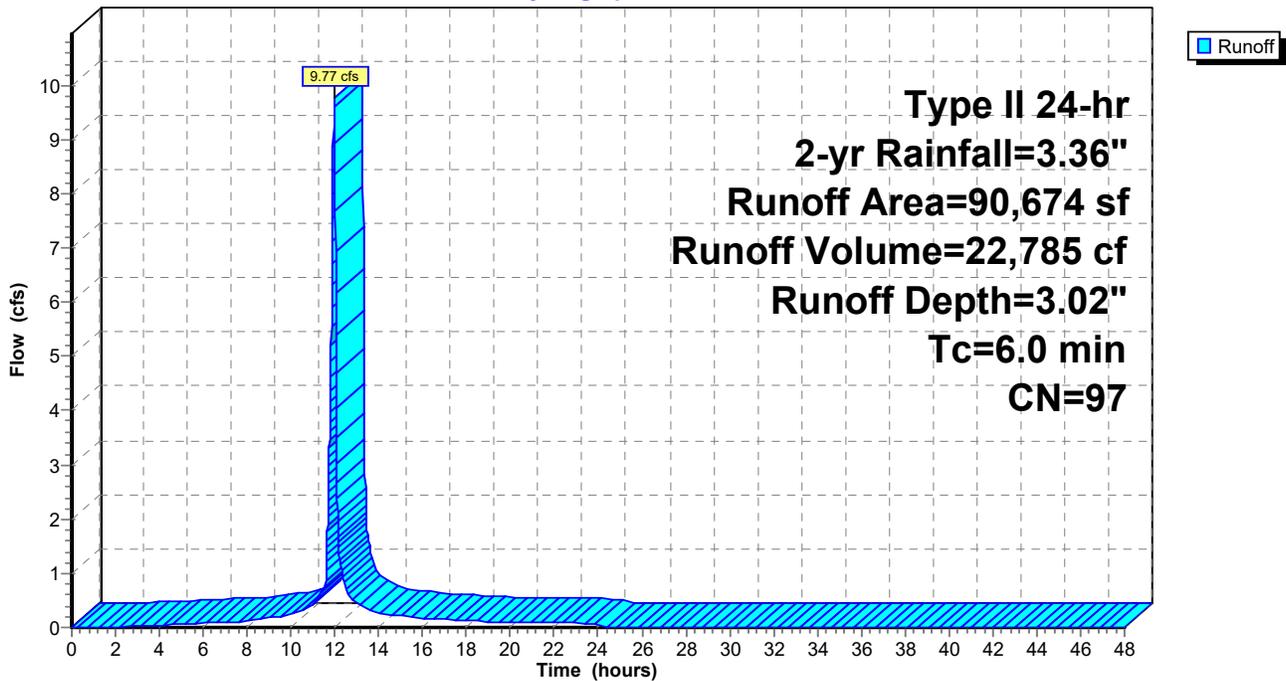
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
89,866	98	Paved parking, HSG A
808	39	>75% Grass cover, Good, HSG A
90,674	97	Weighted Average
808		0.89% Pervious Area
89,866		99.11% Impervious Area

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

Subcatchment PDA-2B: Southern Runoff

Hydrograph



Summary for Subcatchment PDA-2C: Southwestern Runoff

Runoff = 1.33 cfs @ 11.99 hrs, Volume= 2,929 cf, Depth= 0.77"

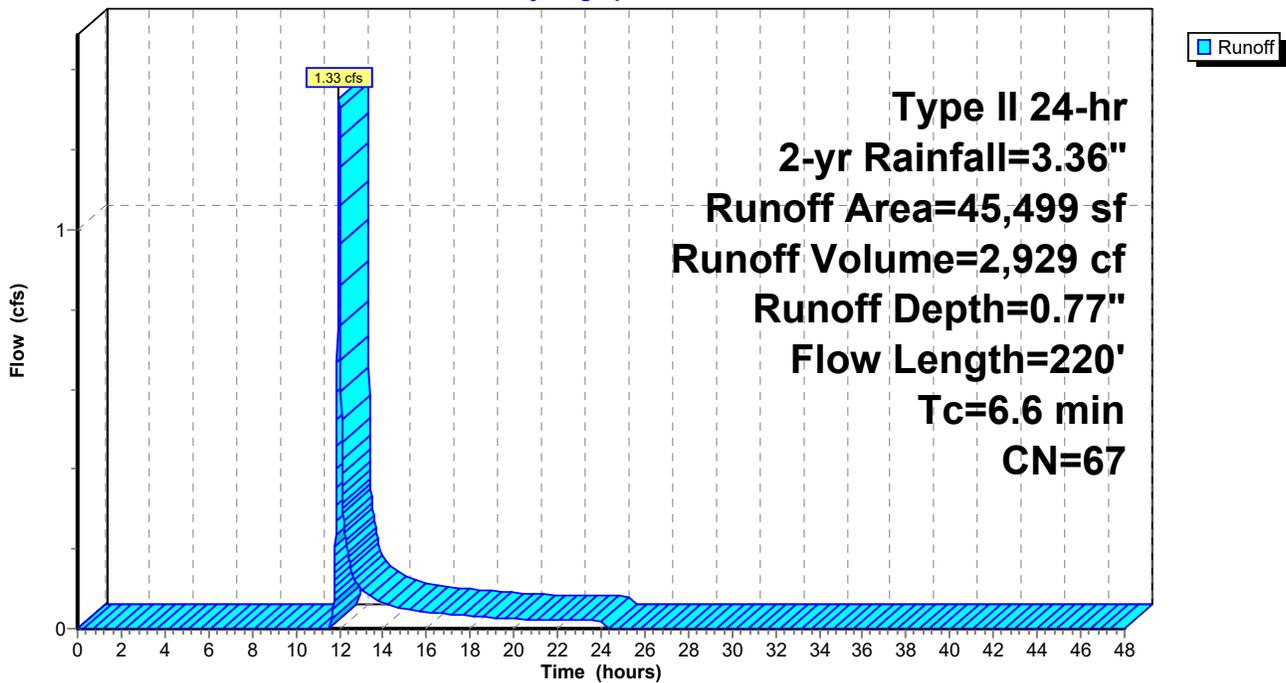
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
25,067	43	Woods/grass comb., Fair, HSG A
18,978	98	Paved parking, HSG A
1,454	82	Woods/grass comb., Fair, HSG D
45,499	67	Weighted Average
26,521		58.29% Pervious Area
18,978		41.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0484	0.15		Sheet Flow, Grass Grass: Dense n= 0.240 P2= 3.36"
0.3	40	0.0945	2.15		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
0.7	130	0.0236	3.12		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
6.6	220	Total			

Subcatchment PDA-2C: Southwestern Runoff

Hydrograph



Summary for Subcatchment PDA-2D: Southern Runoff

Runoff = 0.69 cfs @ 12.13 hrs, Volume= 2,300 cf, Depth= 1.09"

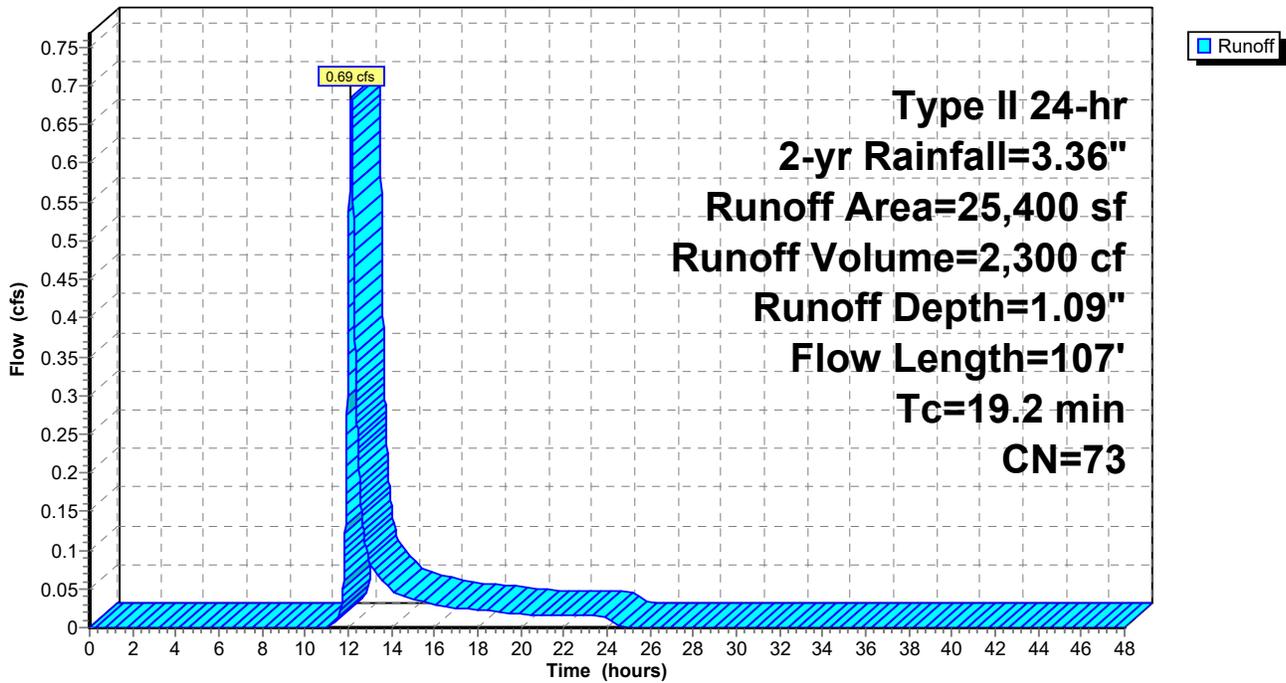
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-yr Rainfall=3.36"

Area (sf)	CN	Description
18,457	79	Woods/grass comb., Good, HSG D
6,943	58	Woods/grass comb., Good, HSG B
25,400	73	Weighted Average
25,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	50	0.0276	0.05		Sheet Flow, Grass/Woods Woods: Dense underbrush n= 0.800 P2= 3.36"
0.8	57	0.0544	1.17		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
19.2	107	Total			

Subcatchment PDA-2D: Southern Runoff

Hydrograph



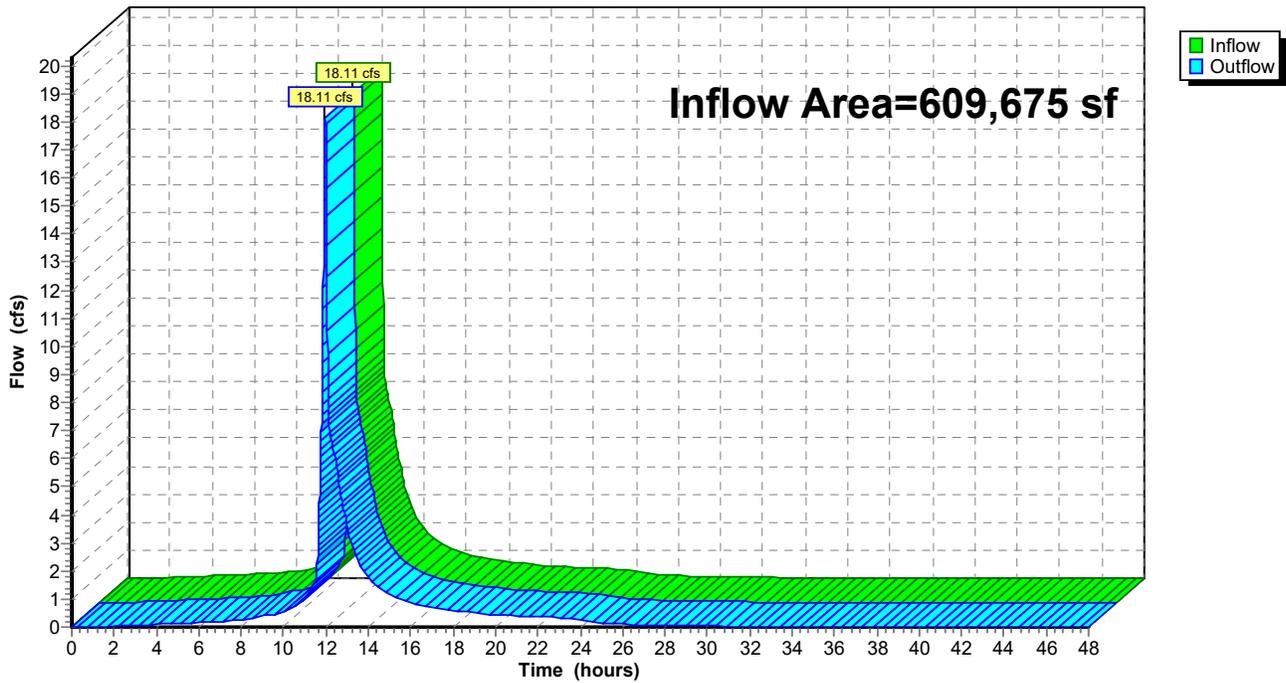
Summary for Reach PDA-1: Southeastern Wetlands

Inflow Area = 609,675 sf, 83.43% Impervious, Inflow Depth > 1.60" for 2-yr event
Inflow = 18.11 cfs @ 11.97 hrs, Volume= 81,058 cf
Outflow = 18.11 cfs @ 11.97 hrs, Volume= 81,058 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



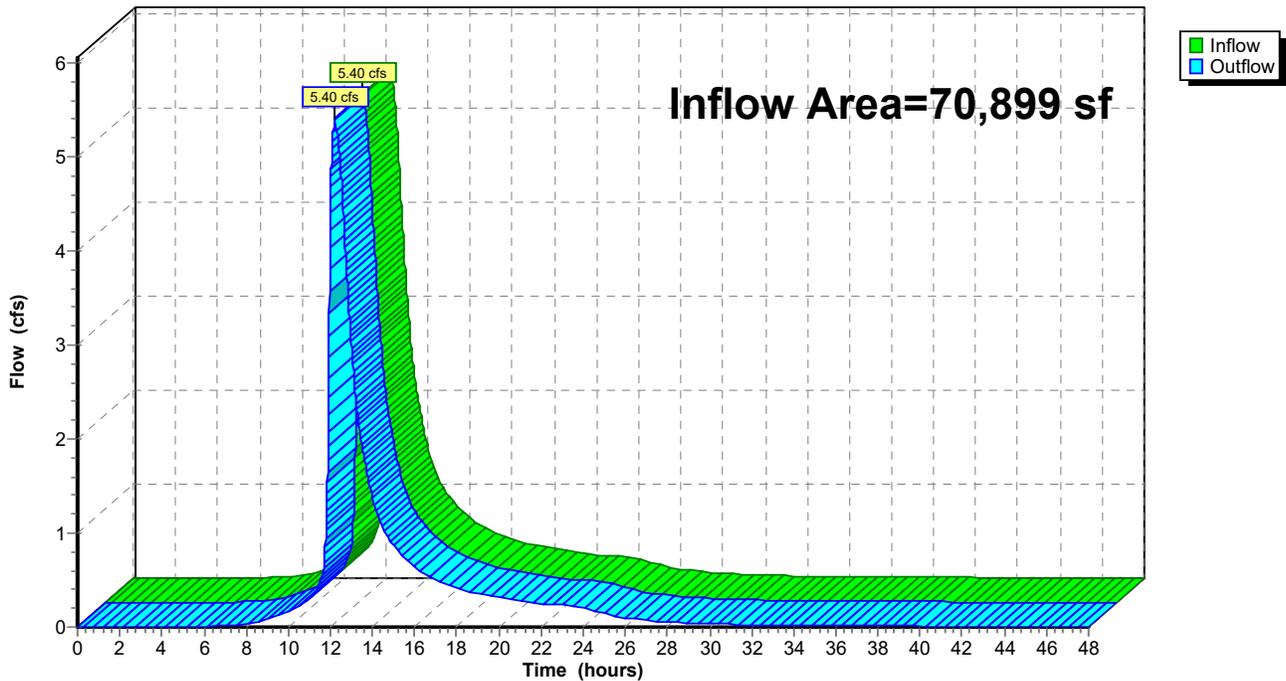
Summary for Reach PDA-2: Southwestern Wetlands

Inflow Area = 70,899 sf, 26.77% Impervious, Inflow Depth > 8.02" for 2-yr event
Inflow = 5.40 cfs @ 12.20 hrs, Volume= 47,366 cf
Outflow = 5.40 cfs @ 12.20 hrs, Volume= 47,366 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



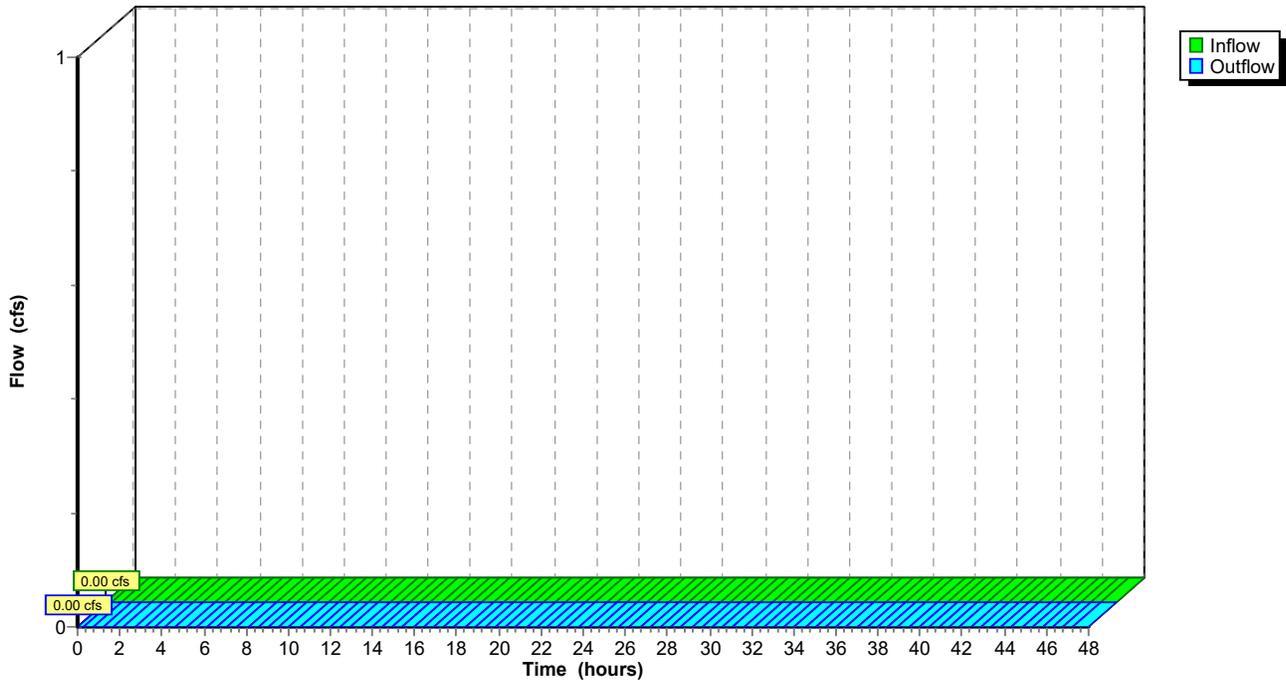
Summary for Reach W1E: Overflow Weir 1E

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 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 W1E: Overflow Weir 1E

Hydrograph



Summary for Pond 1D: UGS Chamber

Inflow Area = 247,709 sf, 84.31% Impervious, Inflow Depth = 2.28" for 2-yr event
 Inflow = 16.65 cfs @ 11.97 hrs, Volume= 47,127 cf
 Outflow = 4.61 cfs @ 12.16 hrs, Volume= 46,629 cf, Atten= 72%, Lag= 11.7 min
 Primary = 4.61 cfs @ 12.16 hrs, Volume= 46,629 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 141.55' @ 12.16 hrs Surf.Area= 19,456 sf Storage= 17,827 cf

Plug-Flow detention time= 143.9 min calculated for 46,629 cf (99% of inflow)
 Center-of-Mass det. time= 137.0 min (918.4 - 781.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	140.50'	0 cf	152.00'W x 128.00'L x 3.17'H Field A 61,611 cf Overall - 61,611 cf Embedded = 0 cf x 40.0% Voids
#2A	140.50'	42,463 cf	retain_it retain_it 2.5' x 304 Inside #1 Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf 19 Rows adjusted for 231.0 cf perimeter wall
		42,463 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	140.50'	24.0" Round Culvert L= 11.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 140.50' / 140.22' S= 0.0255 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	140.50'	18.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	143.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	142.25'	18.0" W x 8.5" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=4.61 cfs @ 12.16 hrs HW=141.55' (Free Discharge)

- ↑ **1=Culvert** (Passes 4.61 cfs of 5.33 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 4.61 cfs @ 3.49 fps)
- ↑ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **4=Orifice/Grate** (Controls 0.00 cfs)

Pond 1D: UGS Chamber - Chamber Wizard Field A

Chamber Model = retain_it retain_it 2.5' (retain-it@)

Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf

Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf

19 Rows adjusted for 231.0 cf perimeter wall

16 Chambers/Row x 8.00' Long = 128.00' Row Length

19 Rows x 96.0" Wide = 152.00' Base Width

38.0" Chamber Height = 3.17' Field Height

3.3 cf Sidewall x 16 x 2 + 3.3 cf Endwall x 19 x 2 = 231.0 cf Perimeter Wall

304 Chambers x 140.4 cf - 231.0 cf Perimeter wall = 42,462.8 cf Chamber Storage

304 Chambers x 202.7 cf = 61,610.7 cf Displacement

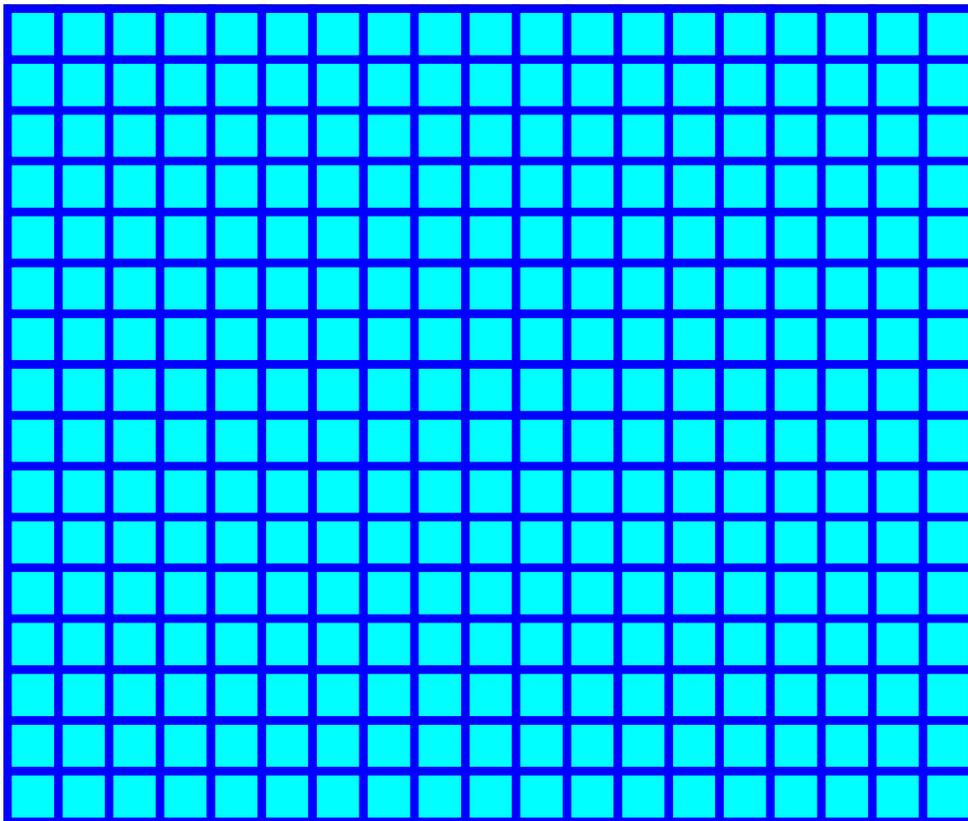
Chamber Storage = 42,462.8 cf = 0.975 af

Overall Storage Efficiency = 68.9%

Overall System Size = 128.00' x 152.00' x 3.17'

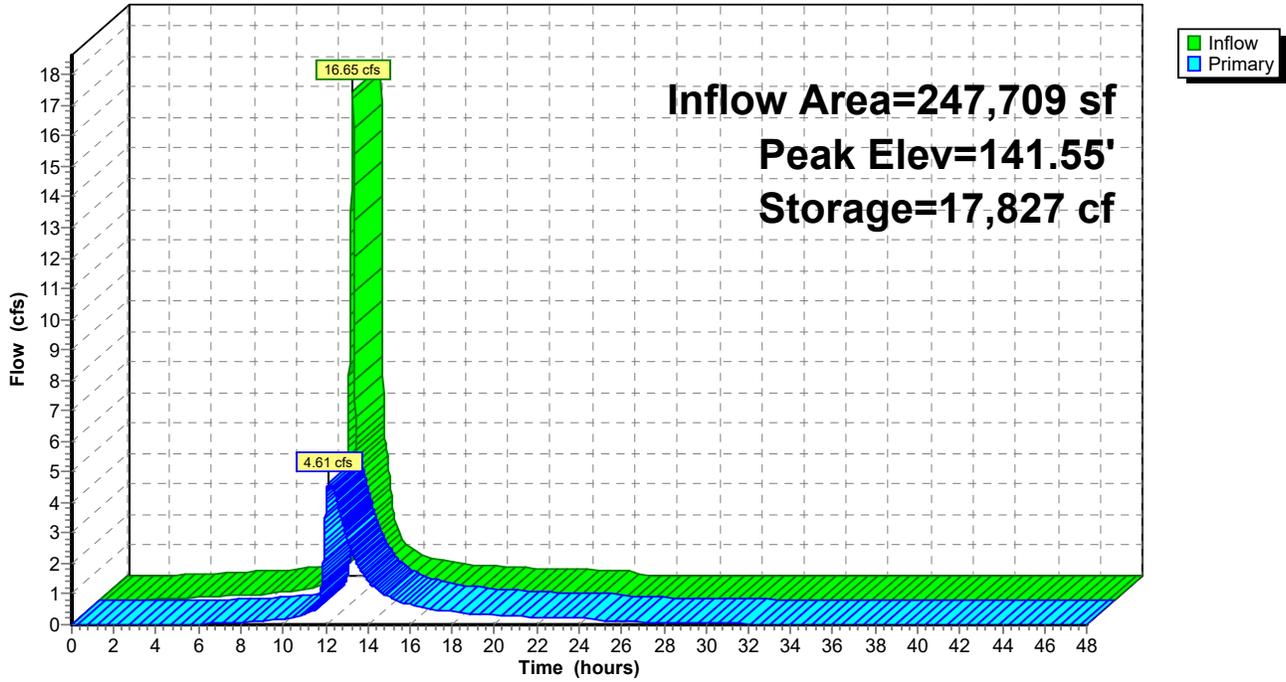
304 Chambers

2,281.9 cy Field



Pond 1D: UGS Chamber

Hydrograph



Summary for Pond 1E: Stormwater Wetland

Inflow Area = 413,837 sf, 88.24% Impervious, Inflow Depth > 2.45" for 2-yr event
 Inflow = 12.39 cfs @ 12.05 hrs, Volume= 84,435 cf
 Outflow = 9.34 cfs @ 12.32 hrs, Volume= 84,219 cf, Atten= 25%, Lag= 16.4 min
 Primary = 4.67 cfs @ 12.32 hrs, Volume= 42,082 cf
 Secondary = 4.67 cfs @ 12.32 hrs, Volume= 42,137 cf
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.25' @ 12.32 hrs Surf.Area= 8,294 sf Storage= 9,454 cf

Plug-Flow detention time= 36.0 min calculated for 84,219 cf (100% of inflow)
 Center-of-Mass det. time= 31.5 min (915.4 - 883.9)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	25,393 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
140.00	6,787	0	0
141.00	8,071	7,429	7,429
142.00	8,971	8,521	15,950
142.50	9,430	4,600	20,550
143.00	9,940	4,843	25,393

Device	Routing	Invert	Outlet Devices
#1	Primary	140.00'	18.0" Round Culvert L= 72.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0069 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#2	Secondary	140.00'	18.0" Round Culvert L= 71.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0070 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#3	Tertiary	142.50'	20.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Device 1	140.00'	15.0" Vert. Orifice/Grate C= 0.600
#5	Device 2	140.00'	15.0" Vert. Orifice/Grate C= 0.600
#6	Device 1	142.00'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#7	Device 2	142.00'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.67 cfs @ 12.32 hrs HW=141.25' (Free Discharge)

- ↑ 1=Culvert (Passes 4.67 cfs of 5.35 cfs potential flow)
- ↑ 4=Orifice/Grate (Orifice Controls 4.67 cfs @ 3.80 fps)
- ↑ 6=Orifice/Grate (Controls 0.00 cfs)

Secondary OutFlow Max=4.67 cfs @ 12.32 hrs HW=141.25' (Free Discharge)

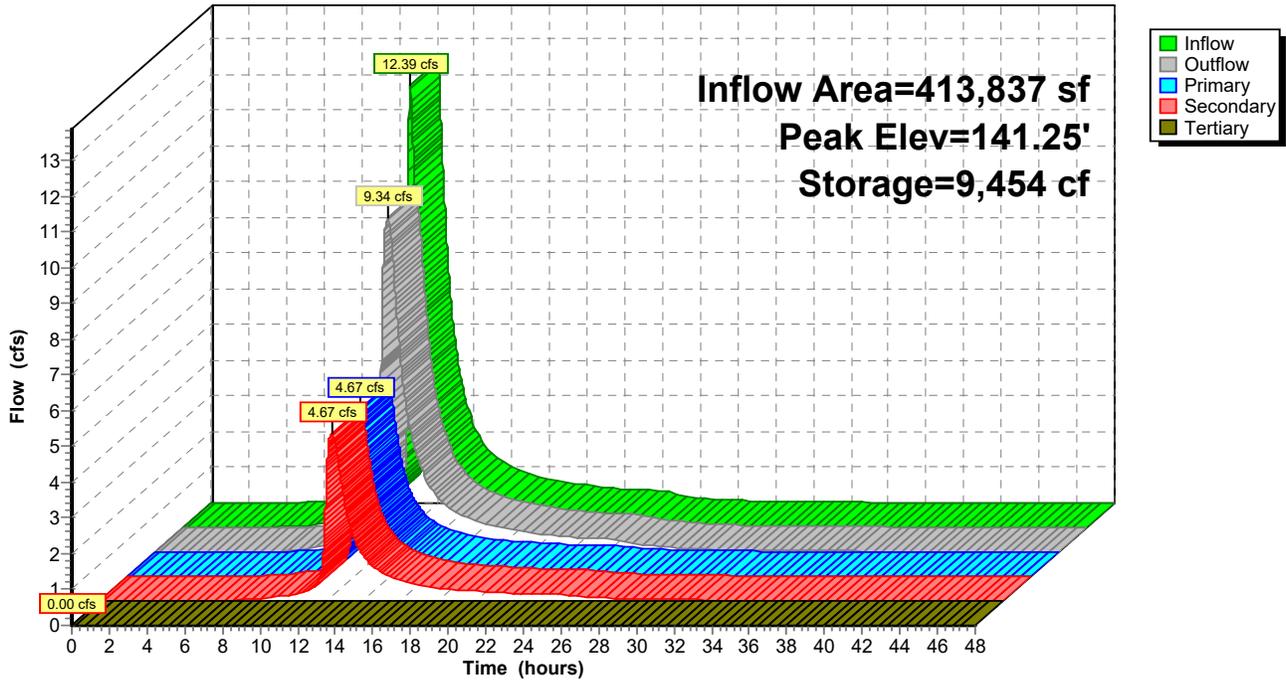
- ↑ 2=Culvert (Passes 4.67 cfs of 5.37 cfs potential flow)
- ↑ 5=Orifice/Grate (Orifice Controls 4.67 cfs @ 3.80 fps)
- ↑ 7=Orifice/Grate (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=140.00' (Free Discharge)

- ↑ 3=Broad-Crested Rectangular Weir(Controls 0.00 cfs)

Pond 1E: Stormwater Wetland

Hydrograph



Summary for Pond 2A: UGS Chamber

Inflow Area = 152,357 sf, 93.58% Impervious, Inflow Depth = 2.70" for 2-yr event
 Inflow = 15.52 cfs @ 11.97 hrs, Volume= 34,271 cf
 Outflow = 7.27 cfs @ 12.06 hrs, Volume= 34,217 cf, Atten= 53%, Lag= 5.6 min
 Primary = 7.27 cfs @ 12.06 hrs, Volume= 34,217 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 144.97' @ 12.06 hrs Surf.Area= 8,448 sf Storage= 11,016 cf

Plug-Flow detention time= 69.3 min calculated for 34,210 cf (100% of inflow)
 Center-of-Mass det. time= 68.5 min (850.7 - 782.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	143.50'	0 cf	48.00'W x 176.00'L x 4.17'H Field A 35,200 cf Overall - 35,200 cf Embedded = 0 cf x 40.0% Voids
#2A	143.50'	26,159 cf	retain_it retain_it 3.5' x 132 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 6 Rows adjusted for 343.8 cf perimeter wall
		26,159 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	143.50'	24.0" Round Culvert L= 195.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 143.50' / 142.17' S= 0.0068 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	143.50'	18.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	147.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Primary	145.50'	18.0" W x 10.0" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=7.27 cfs @ 12.06 hrs HW=144.97' (Free Discharge)

- 1=Culvert (Passes 7.27 cfs of 10.25 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 7.27 cfs @ 4.13 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Orifice/Grate (Controls 0.00 cfs)

1901517-HYDRO

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

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Pond 2A: UGS Chamber - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it@)

Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf

Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf

6 Rows adjusted for 343.8 cf perimeter wall

22 Chambers/Row x 8.00' Long = 176.00' Row Length

6 Rows x 96.0" Wide = 48.00' Base Width

50.0" Chamber Height = 4.17' Field Height

6.1 cf Sidewall x 22 x 2 + 6.1 cf Endwall x 6 x 2 = 343.8 cf Perimeter Wall

132 Chambers x 200.8 cf - 343.8 cf Perimeter wall = 26,159.2 cf Chamber Storage

132 Chambers x 266.7 cf = 35,200.0 cf Displacement

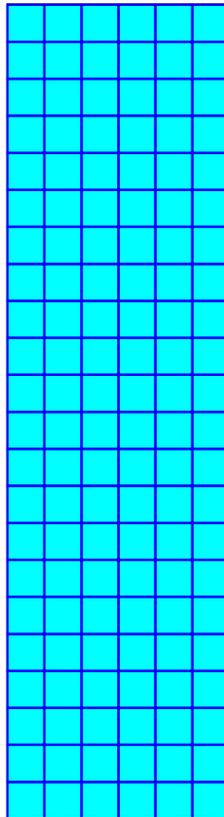
Chamber Storage = 26,159.2 cf = 0.601 af

Overall Storage Efficiency = 74.3%

Overall System Size = 176.00' x 48.00' x 4.17'

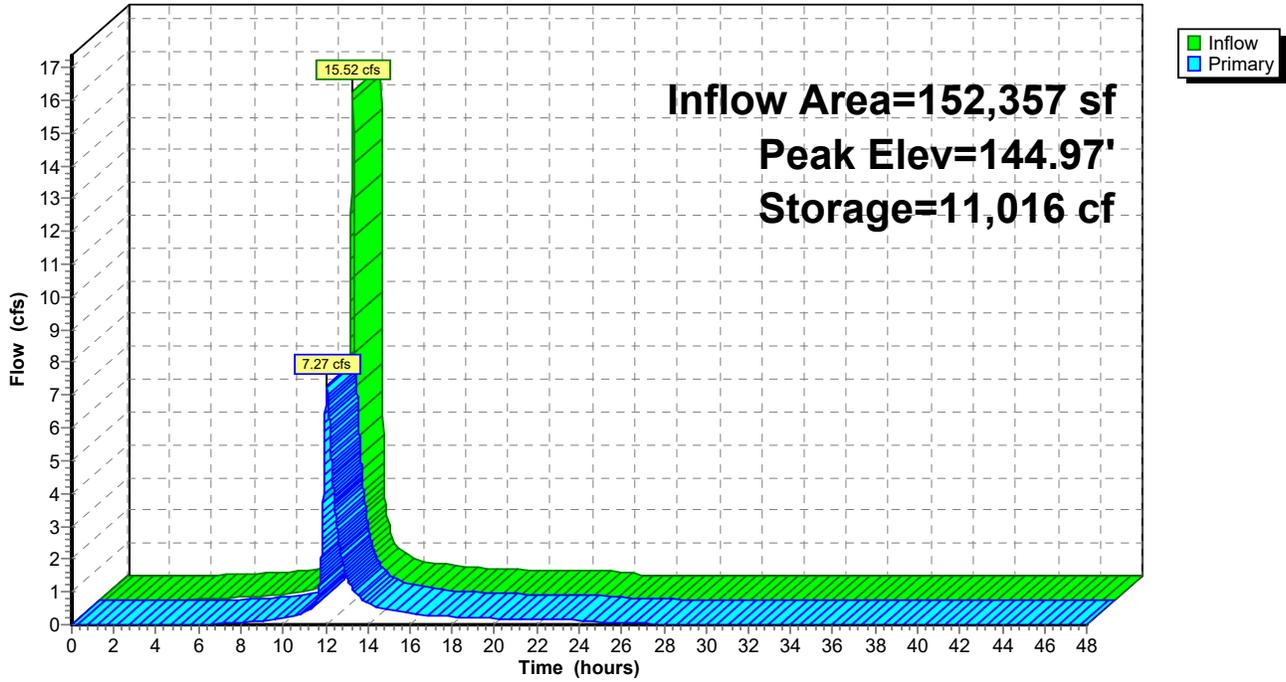
132 Chambers

1,303.7 cy Field



Pond 2A: UGS Chamber

Hydrograph



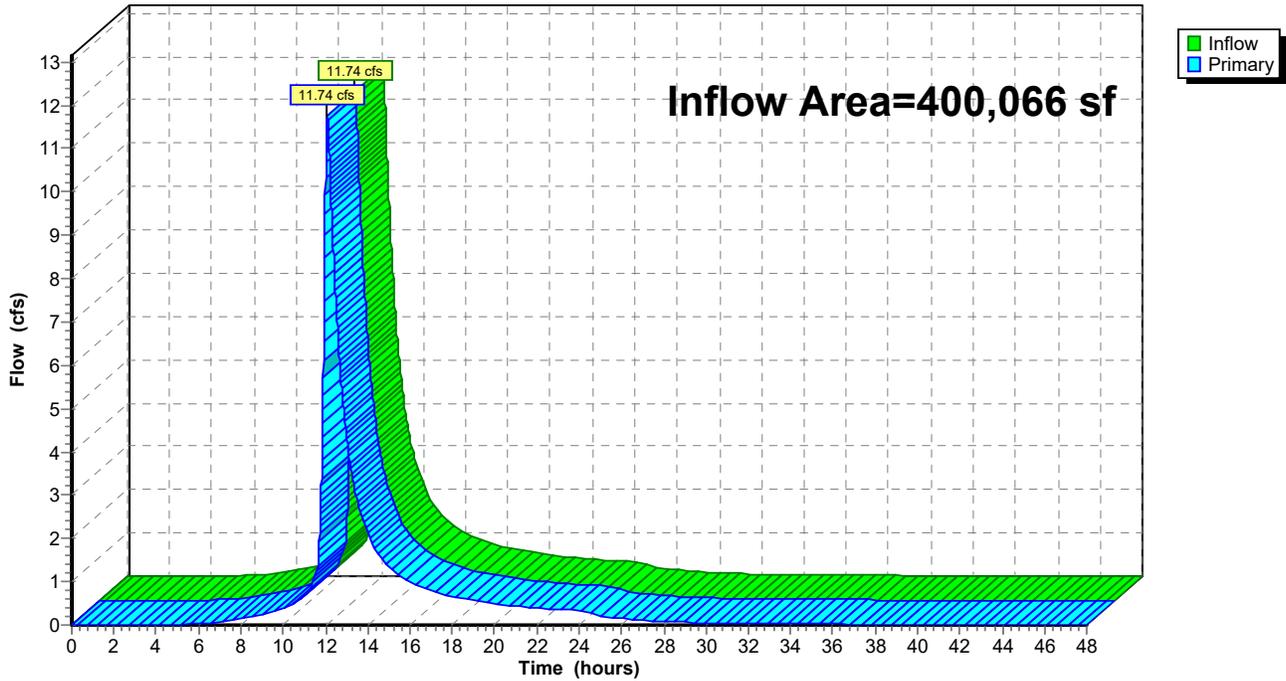
Summary for Link L3: DP-3

Inflow Area = 400,066 sf, 87.84% Impervious, Inflow Depth > 2.43" for 2-yr event
Inflow = 11.74 cfs @ 12.08 hrs, Volume= 80,847 cf
Primary = 11.74 cfs @ 12.08 hrs, Volume= 80,847 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link L3: DP-3

Hydrograph



1901517-HYDRO

Type II 24-hr 10-yr Rainfall=5.12"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPDA-1A: Southeastern	Runoff Area=52,370 sf 0.00% Impervious Runoff Depth=1.17" Flow Length=164' Tc=9.2 min CN=57 Runoff=2.05 cfs 5,102 cf
SubcatchmentPDA-1B: Northeastern	Runoff Area=100,339 sf 62.51% Impervious Runoff Depth=2.46" Flow Length=265' Tc=27.9 min CN=74 Runoff=5.10 cfs 20,572 cf
SubcatchmentPDA-1C: Building 1 Roof	Runoff Area=143,468 sf 100.00% Impervious Runoff Depth=4.88" Tc=6.0 min CN=98 Runoff=24.01 cfs 58,379 cf
SubcatchmentPDA-1D: Southeastern	Runoff Area=56,696 sf 99.22% Impervious Runoff Depth=4.88" Tc=6.0 min CN=98 Runoff=9.49 cfs 23,070 cf
SubcatchmentPDA-1E: Stormwater	Runoff Area=13,771 sf 100.00% Impervious Runoff Depth=4.88" Tc=6.0 min CN=98 Runoff=2.30 cfs 5,604 cf
SubcatchmentPDA-2A: Northwestern	Runoff Area=152,357 sf 93.58% Impervious Runoff Depth=4.43" Tc=6.0 min CN=94 Runoff=24.62 cfs 56,199 cf
SubcatchmentPDA-2B: Southern Runoff	Runoff Area=90,674 sf 99.11% Impervious Runoff Depth=4.77" Tc=6.0 min CN=97 Runoff=15.08 cfs 36,018 cf
SubcatchmentPDA-2C: Southwestern	Runoff Area=45,499 sf 41.71% Impervious Runoff Depth=1.89" Flow Length=220' Tc=6.6 min CN=67 Runoff=3.44 cfs 7,155 cf
SubcatchmentPDA-2D: Southern Runoff	Runoff Area=25,400 sf 0.00% Impervious Runoff Depth=2.37" Flow Length=107' Tc=19.2 min CN=73 Runoff=1.57 cfs 5,027 cf
Reach PDA-1: Southeastern Wetlands	Inflow=29.88 cfs 133,792 cf Outflow=29.88 cfs 133,792 cf
Reach PDA-2: Southwestern Wetlands	Inflow=9.20 cfs 82,543 cf Outflow=9.20 cfs 82,543 cf
Reach W1E: Overflow Weir 1E	Inflow=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf
Pond 1D: UGS Chamber	Peak Elev=142.11' Storage=27,278 cf Inflow=26.47 cfs 79,661 cf Outflow=7.87 cfs 79,146 cf
Pond 1E: Stormwater Wetland	Peak Elev=142.05' Storage=16,387 cf Inflow=19.71 cfs 140,893 cf Primary=7.34 cfs 70,311 cf Secondary=7.34 cfs 70,361 cf Tertiary=0.00 cfs 0 cf Outflow=14.68 cfs 140,671 cf
Pond 2A: UGS Chamber	Peak Elev=145.76' Storage=16,858 cf Inflow=24.62 cfs 56,199 cf Outflow=11.06 cfs 56,143 cf
Link L3: DP-3	Inflow=18.66 cfs 135,289 cf Primary=18.66 cfs 135,289 cf

1901517-HYDRO

Type II 24-hr 10-yr Rainfall=5.12"

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Total Runoff Area = 680,574 sf Runoff Volume = 217,127 cf Average Runoff Depth = 3.83"
22.47% Pervious = 152,938 sf 77.53% Impervious = 527,636 sf

Summary for Subcatchment PDA-1A: Southeastern Runoff

Runoff = 2.05 cfs @ 12.02 hrs, Volume= 5,102 cf, Depth= 1.17"

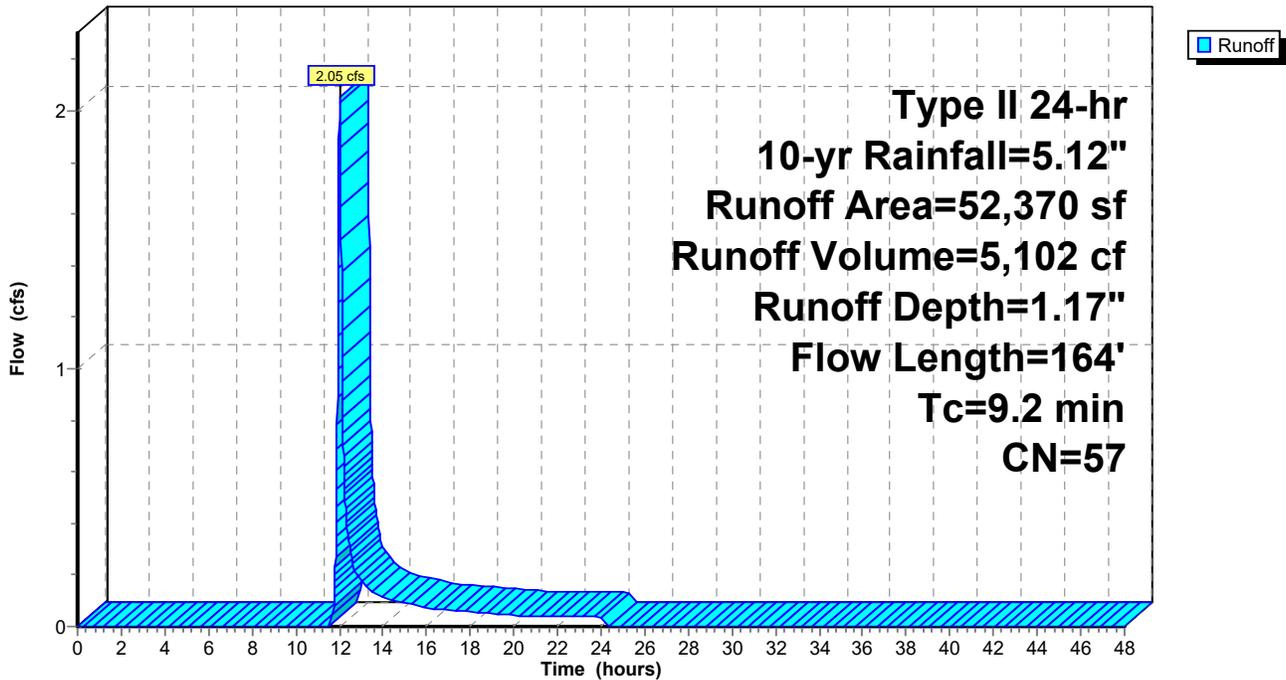
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
23,973	32	Woods/grass comb., Good, HSG A
841	58	Woods/grass comb., Good, HSG B
27,556	79	Woods/grass comb., Good, HSG D
52,370	57	Weighted Average
52,370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	50	0.0220	0.11		Sheet Flow, Grass Grass: Dense n= 0.240 P2= 3.36"
1.0	74	0.0290	1.19		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0418	1.43		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
9.2	164	Total			

Subcatchment PDA-1A: Southeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1B: Northeastern Runoff

Runoff = 5.10 cfs @ 12.22 hrs, Volume= 20,572 cf, Depth= 2.46"

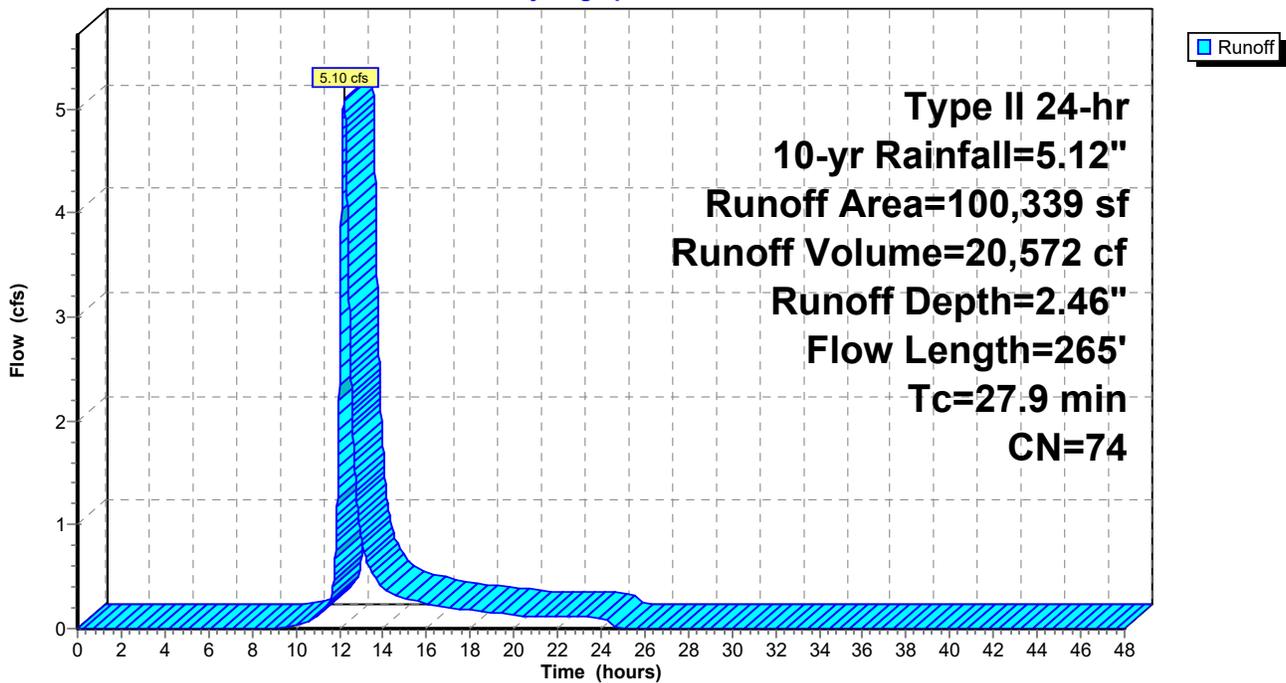
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
62,721	98	Paved parking, HSG A
7,566	39	>75% Grass cover, Good, HSG A
30,052	32	Woods/grass comb., Good, HSG A
100,339	74	Weighted Average
37,618		37.49% Pervious Area
62,721		62.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.1	102	0.0120	0.07		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
1.3	87	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
27.9	265	Total			

Subcatchment PDA-1B: Northeastern Runoff

Hydrograph



Summary for Subcatchment PDA-1C: Building 1 Roof

Runoff = 24.01 cfs @ 11.97 hrs, Volume= 58,379 cf, Depth= 4.88"

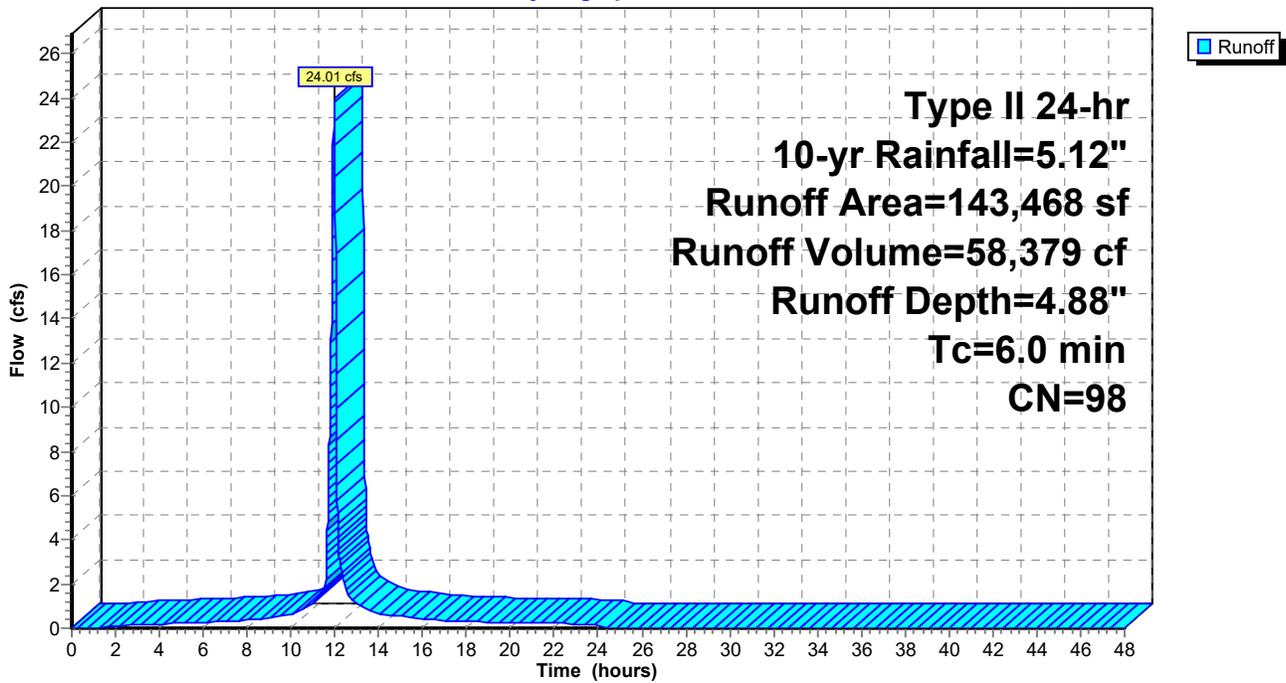
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
143,468	98	Unconnected roofs, HSG A
143,468		100.00% Impervious Area
143,468		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 = 9.49 cfs @ 11.97 hrs, Volume= 23,070 cf, Depth= 4.88"

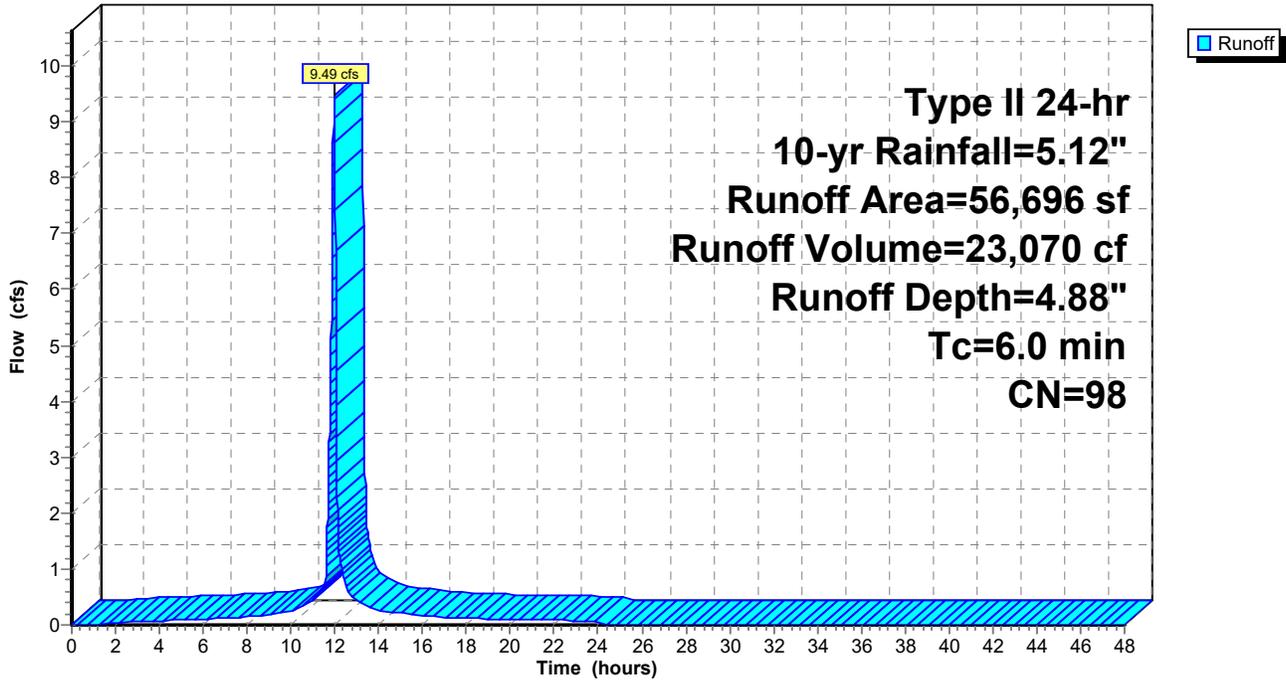
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
398	39	>75% Grass cover, Good, HSG A
56,254	98	Paved parking, HSG A
44	80	>75% Grass cover, Good, HSG D
56,696	98	Weighted Average
442		0.78% Pervious Area
56,254		99.22% 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-1E: Stormwater Wetland Area

Runoff = 2.30 cfs @ 11.97 hrs, Volume= 5,604 cf, Depth= 4.88"

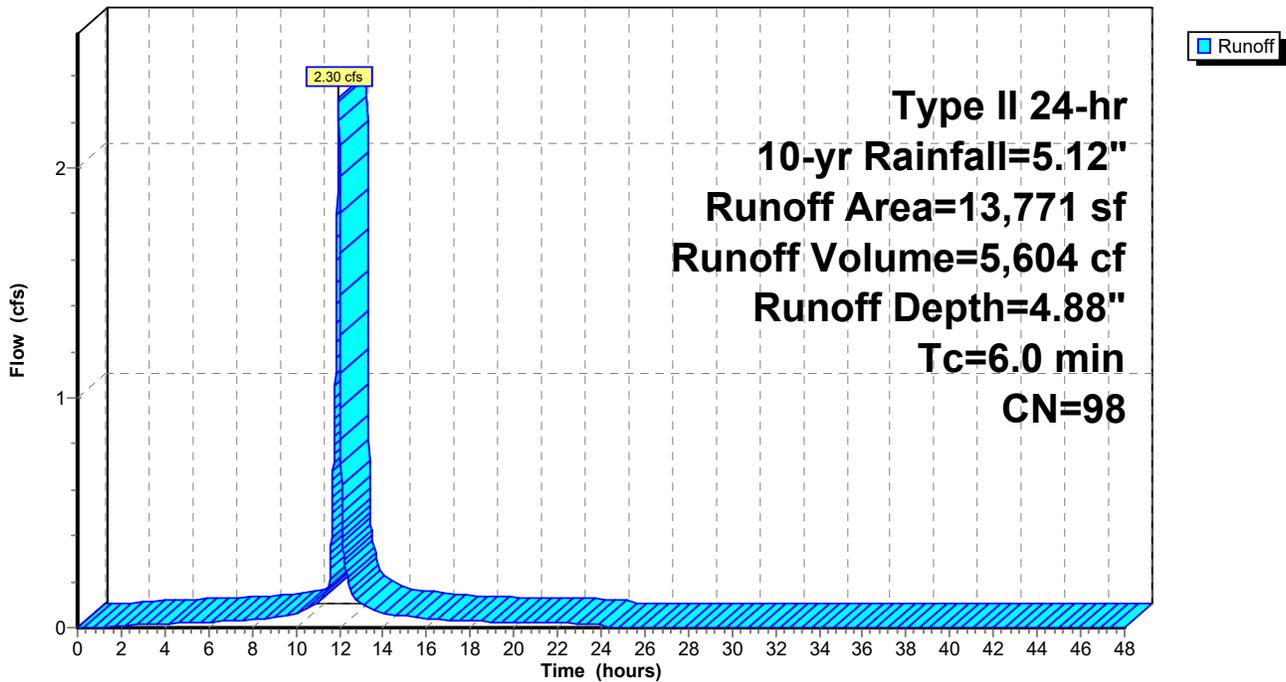
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
13,771	98	Water Surface, HSG A
13,771		100.00% Impervious Area

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

Subcatchment PDA-1E: Stormwater Wetland Area

Hydrograph



Summary for Subcatchment PDA-2A: Northwestern Runoff

Runoff = 24.62 cfs @ 11.97 hrs, Volume= 56,199 cf, Depth= 4.43"

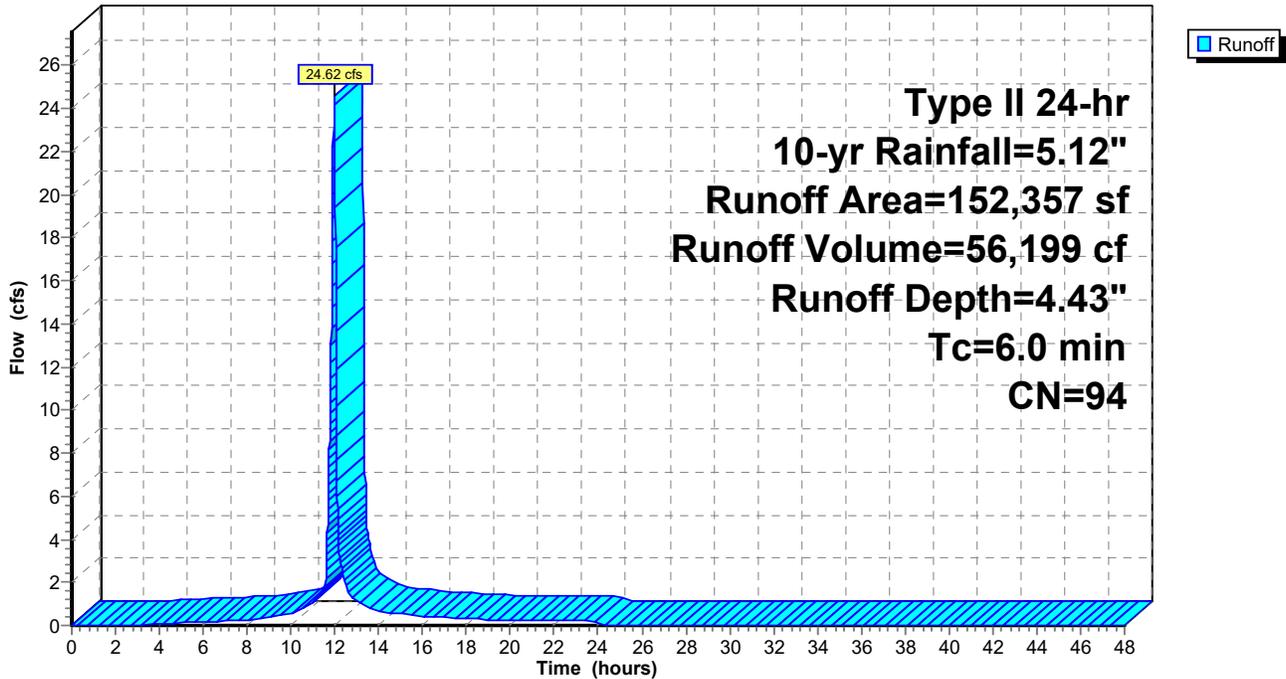
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
142,578	98	Paved parking, HSG A
9,779	39	>75% Grass cover, Good, HSG A
152,357	94	Weighted Average
9,779		6.42% Pervious Area
142,578		93.58% 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: Southern Runoff

Runoff = 15.08 cfs @ 11.97 hrs, Volume= 36,018 cf, Depth= 4.77"

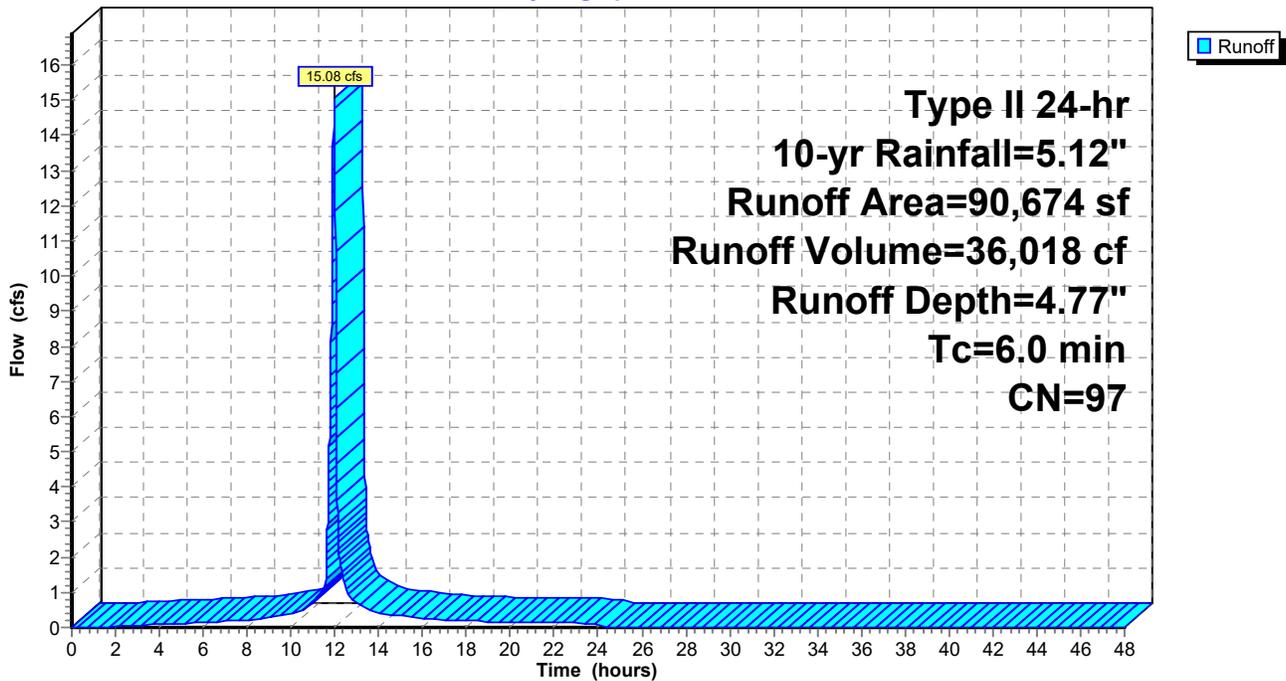
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
89,866	98	Paved parking, HSG A
808	39	>75% Grass cover, Good, HSG A
90,674	97	Weighted Average
808		0.89% Pervious Area
89,866		99.11% Impervious Area

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

Subcatchment PDA-2B: Southern Runoff

Hydrograph



Summary for Subcatchment PDA-2C: Southwestern Runoff

Runoff = 3.44 cfs @ 11.99 hrs, Volume= 7,155 cf, Depth= 1.89"

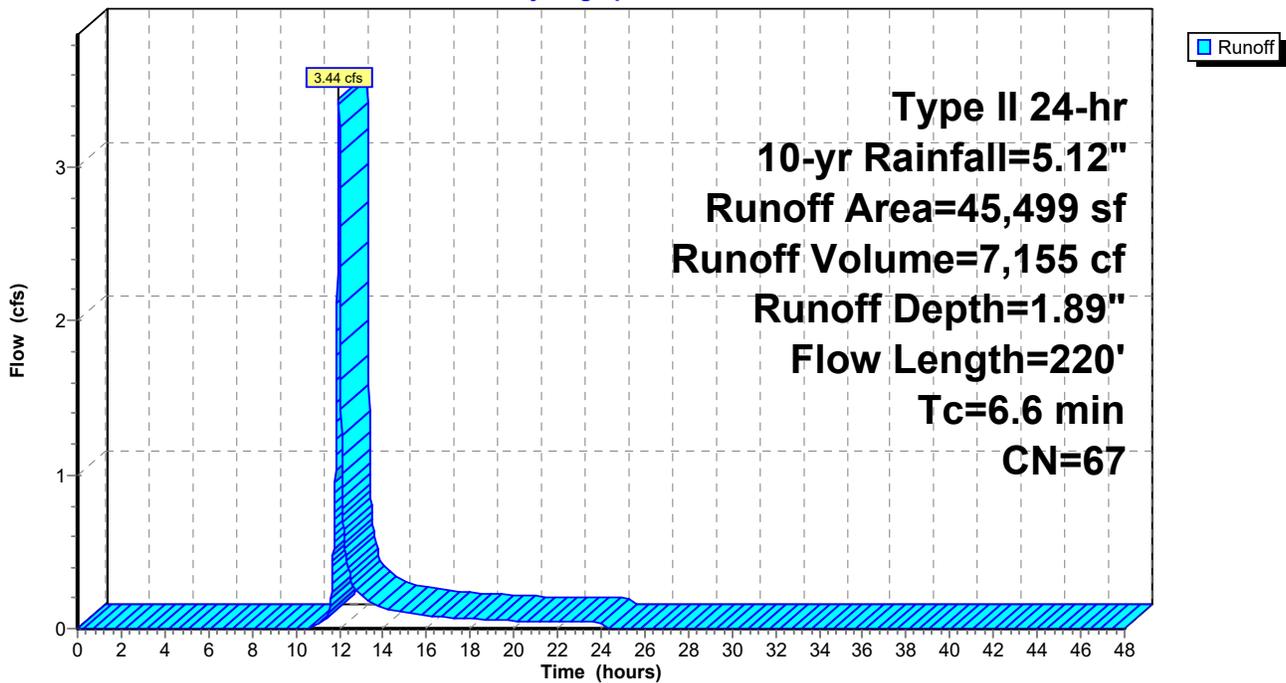
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
25,067	43	Woods/grass comb., Fair, HSG A
18,978	98	Paved parking, HSG A
1,454	82	Woods/grass comb., Fair, HSG D
45,499	67	Weighted Average
26,521		58.29% Pervious Area
18,978		41.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0484	0.15		Sheet Flow, Grass Grass: Dense n= 0.240 P2= 3.36"
0.3	40	0.0945	2.15		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
0.7	130	0.0236	3.12		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
6.6	220	Total			

Subcatchment PDA-2C: Southwestern Runoff

Hydrograph



Summary for Subcatchment PDA-2D: Southern Runoff

Runoff = 1.57 cfs @ 12.12 hrs, Volume= 5,027 cf, Depth= 2.37"

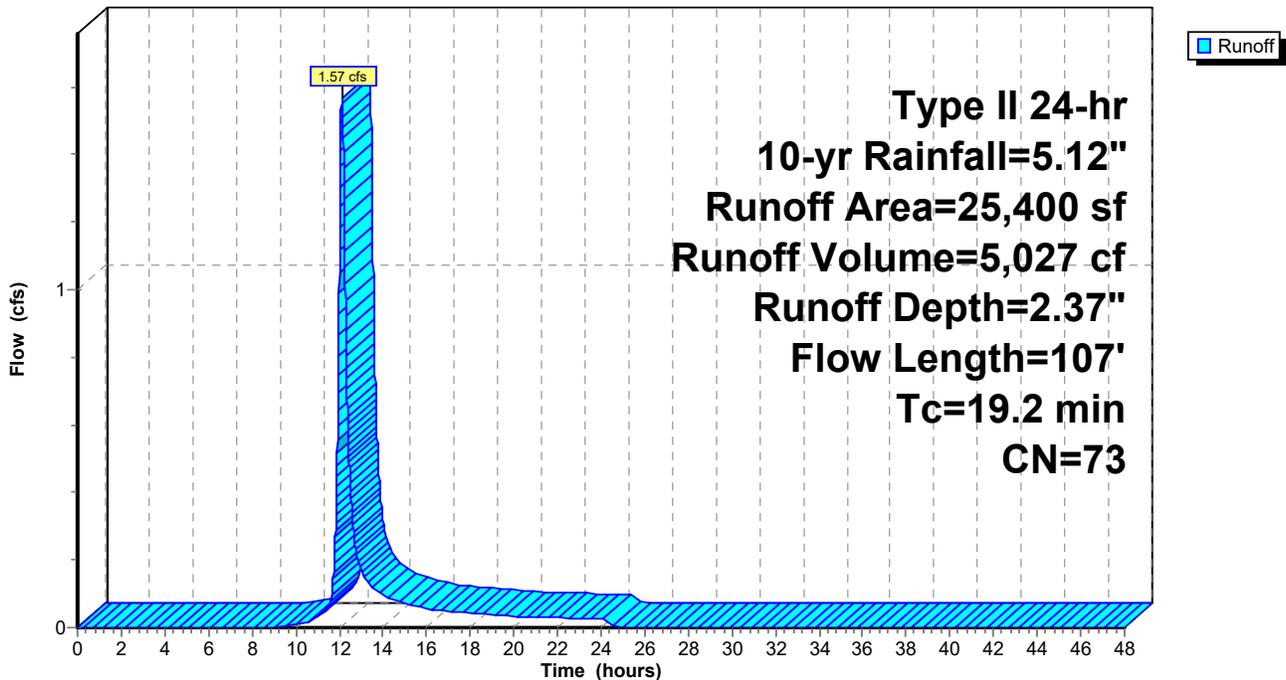
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-yr Rainfall=5.12"

Area (sf)	CN	Description
18,457	79	Woods/grass comb., Good, HSG D
6,943	58	Woods/grass comb., Good, HSG B
25,400	73	Weighted Average
25,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	50	0.0276	0.05		Sheet Flow, Grass/Woods Woods: Dense underbrush n= 0.800 P2= 3.36"
0.8	57	0.0544	1.17		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
19.2	107	Total			

Subcatchment PDA-2D: Southern Runoff

Hydrograph



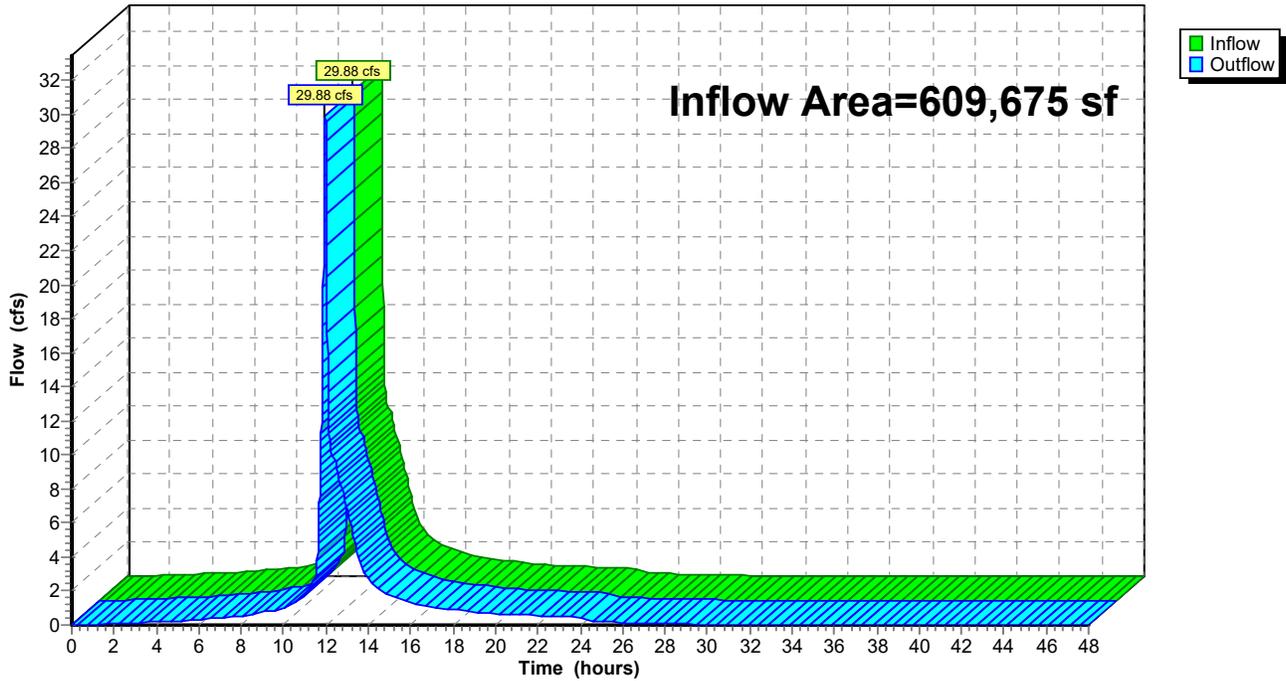
Summary for Reach PDA-1: Southeastern Wetlands

Inflow Area = 609,675 sf, 83.43% Impervious, Inflow Depth > 2.63" for 10-yr event
Inflow = 29.88 cfs @ 11.97 hrs, Volume= 133,792 cf
Outflow = 29.88 cfs @ 11.97 hrs, Volume= 133,792 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



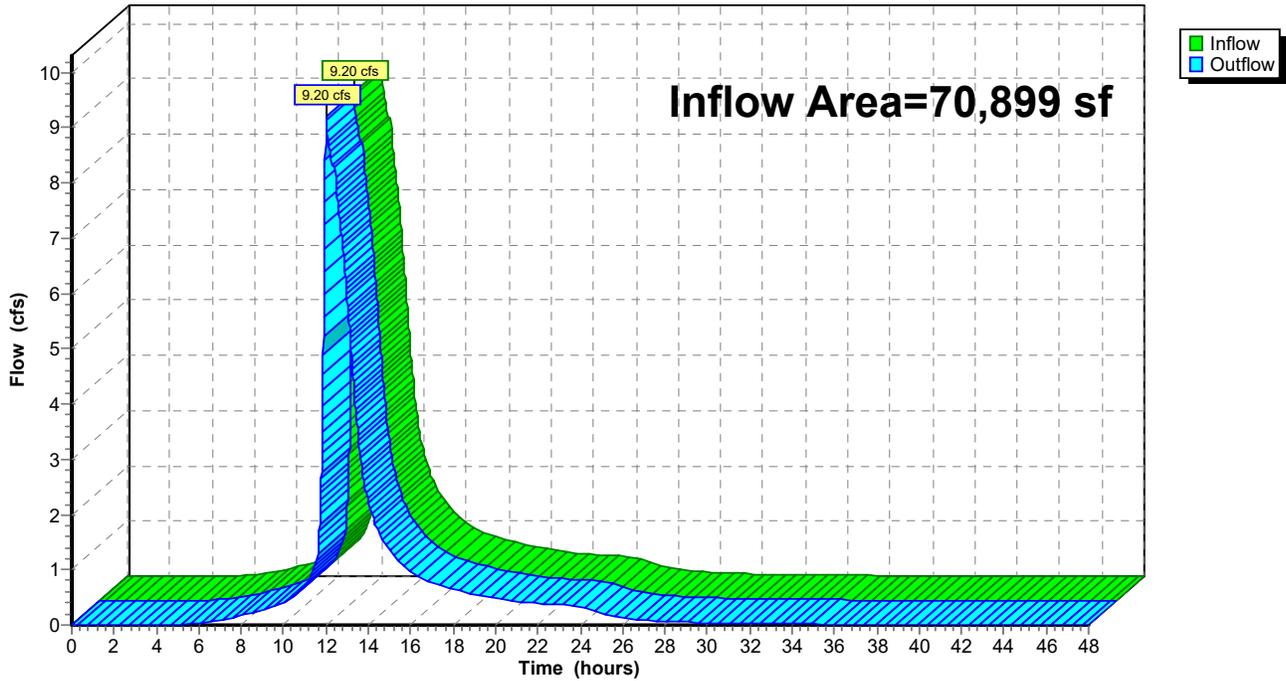
Summary for Reach PDA-2: Southwestern Wetlands

Inflow Area = 70,899 sf, 26.77% Impervious, Inflow Depth > 13.97" for 10-yr event
Inflow = 9.20 cfs @ 12.02 hrs, Volume= 82,543 cf
Outflow = 9.20 cfs @ 12.02 hrs, Volume= 82,543 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



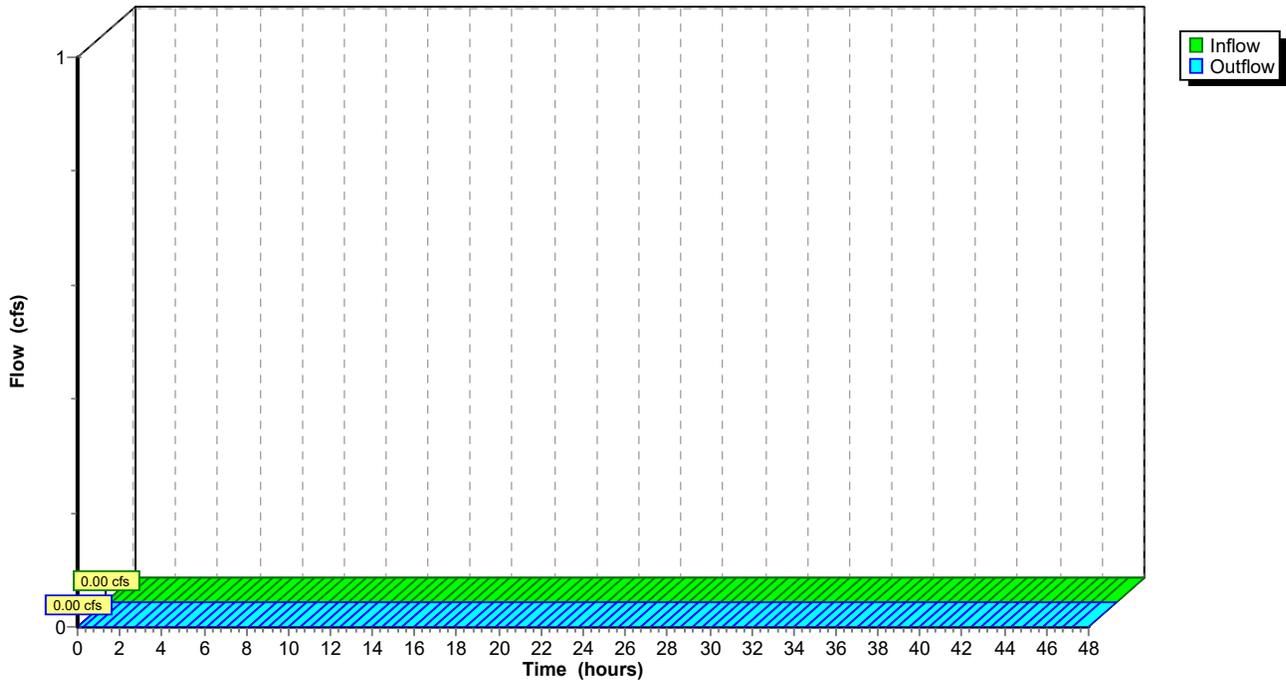
Summary for Reach W1E: Overflow Weir 1E

Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 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 W1E: Overflow Weir 1E

Hydrograph



Summary for Pond 1D: UGS Chamber

Inflow Area = 247,709 sf, 84.31% Impervious, Inflow Depth = 3.86" for 10-yr event
 Inflow = 26.47 cfs @ 11.97 hrs, Volume= 79,661 cf
 Outflow = 7.87 cfs @ 12.26 hrs, Volume= 79,146 cf, Atten= 70%, Lag= 17.4 min
 Primary = 7.87 cfs @ 12.26 hrs, Volume= 79,146 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 142.11' @ 12.26 hrs Surf.Area= 19,456 sf Storage= 27,278 cf

Plug-Flow detention time= 114.4 min calculated for 79,130 cf (99% of inflow)
 Center-of-Mass det. time= 110.4 min (885.8 - 775.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	140.50'	0 cf	152.00'W x 128.00'L x 3.17'H Field A 61,611 cf Overall - 61,611 cf Embedded = 0 cf x 40.0% Voids
#2A	140.50'	42,463 cf	retain_it retain_it 2.5' x 304 Inside #1 Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf 19 Rows adjusted for 231.0 cf perimeter wall
		42,463 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	140.50'	24.0" Round Culvert L= 11.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 140.50' / 140.22' S= 0.0255 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	140.50'	18.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	143.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	142.25'	18.0" W x 8.5" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=7.87 cfs @ 12.26 hrs HW=142.11' (Free Discharge)

- ↑ **1=Culvert** (Passes 7.87 cfs of 10.40 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 7.87 cfs @ 4.45 fps)
- ↑ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **4=Orifice/Grate** (Controls 0.00 cfs)

Pond 1D: UGS Chamber - Chamber Wizard Field A

Chamber Model = retain_it retain_it 2.5' (retain-it@)

Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf

Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf

19 Rows adjusted for 231.0 cf perimeter wall

16 Chambers/Row x 8.00' Long = 128.00' Row Length

19 Rows x 96.0" Wide = 152.00' Base Width

38.0" Chamber Height = 3.17' Field Height

3.3 cf Sidewall x 16 x 2 + 3.3 cf Endwall x 19 x 2 = 231.0 cf Perimeter Wall

304 Chambers x 140.4 cf - 231.0 cf Perimeter wall = 42,462.8 cf Chamber Storage

304 Chambers x 202.7 cf = 61,610.7 cf Displacement

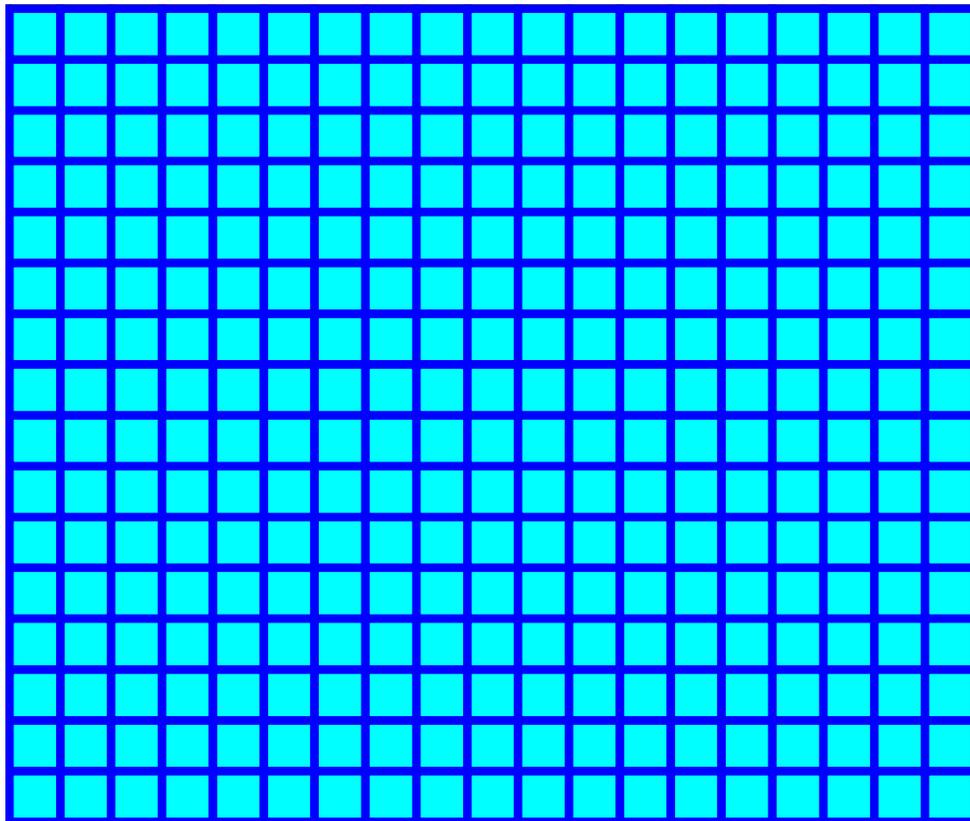
Chamber Storage = 42,462.8 cf = 0.975 af

Overall Storage Efficiency = 68.9%

Overall System Size = 128.00' x 152.00' x 3.17'

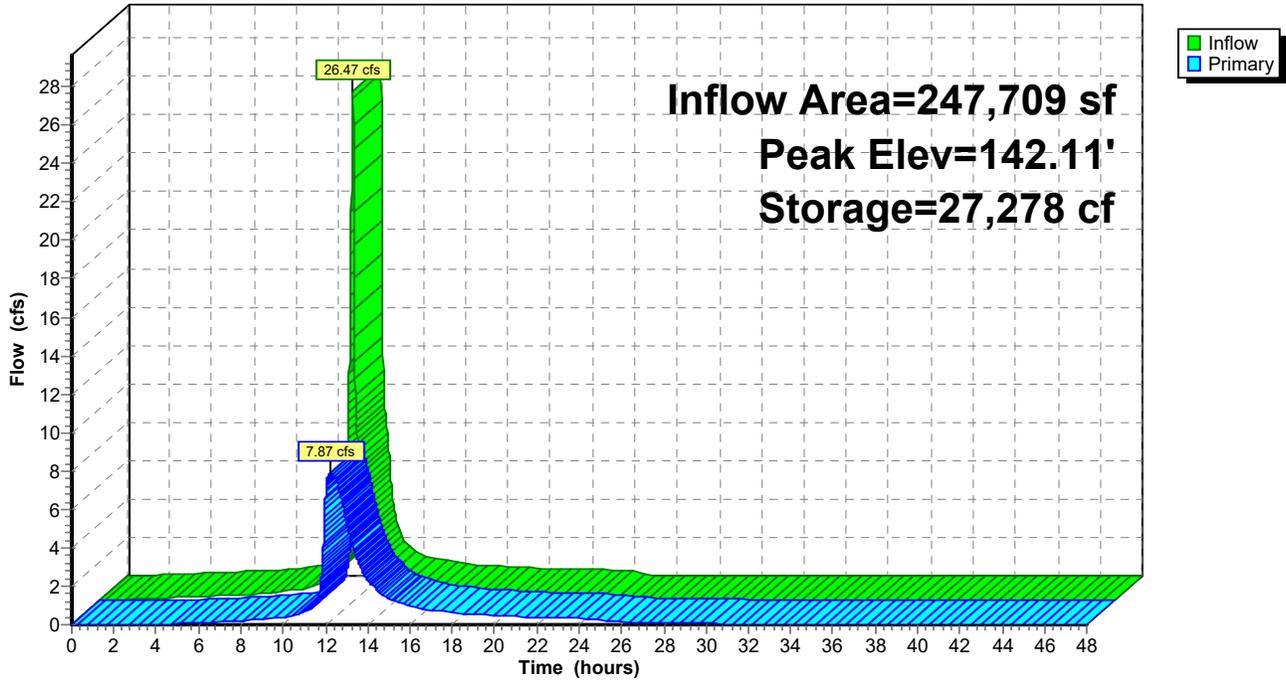
304 Chambers

2,281.9 cy Field



Pond 1D: UGS Chamber

Hydrograph



Summary for Pond 1E: Stormwater Wetland

Inflow Area = 413,837 sf, 88.24% Impervious, Inflow Depth > 4.09" for 10-yr event
 Inflow = 19.71 cfs @ 12.05 hrs, Volume= 140,893 cf
 Outflow = 14.68 cfs @ 12.42 hrs, Volume= 140,671 cf, Atten= 26%, Lag= 22.4 min
 Primary = 7.34 cfs @ 12.42 hrs, Volume= 70,311 cf
 Secondary = 7.34 cfs @ 12.42 hrs, Volume= 70,361 cf
 Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 142.05' @ 12.42 hrs Surf.Area= 9,016 sf Storage= 16,387 cf

Plug-Flow detention time= 30.1 min calculated for 140,642 cf (100% of inflow)
 Center-of-Mass det. time= 27.3 min (883.6 - 856.3)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	25,393 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
140.00	6,787	0	0
141.00	8,071	7,429	7,429
142.00	8,971	8,521	15,950
142.50	9,430	4,600	20,550
143.00	9,940	4,843	25,393

Device	Routing	Invert	Outlet Devices
#1	Primary	140.00'	18.0" Round Culvert L= 72.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0069 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#2	Secondary	140.00'	18.0" Round Culvert L= 71.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0070 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#3	Tertiary	142.50'	20.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Device 1	140.00'	15.0" Vert. Orifice/Grate C= 0.600
#5	Device 2	140.00'	15.0" Vert. Orifice/Grate C= 0.600
#6	Device 1	142.00'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#7	Device 2	142.00'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=7.33 cfs @ 12.42 hrs HW=142.05' (Free Discharge)

- ↑ 1=Culvert (Passes 7.33 cfs of 8.97 cfs potential flow)
- ↑ 4=Orifice/Grate (Orifice Controls 7.05 cfs @ 5.74 fps)
- ↑ 6=Orifice/Grate (Weir Controls 0.28 cfs @ 0.72 fps)

Secondary OutFlow Max=7.33 cfs @ 12.42 hrs HW=142.05' (Free Discharge)

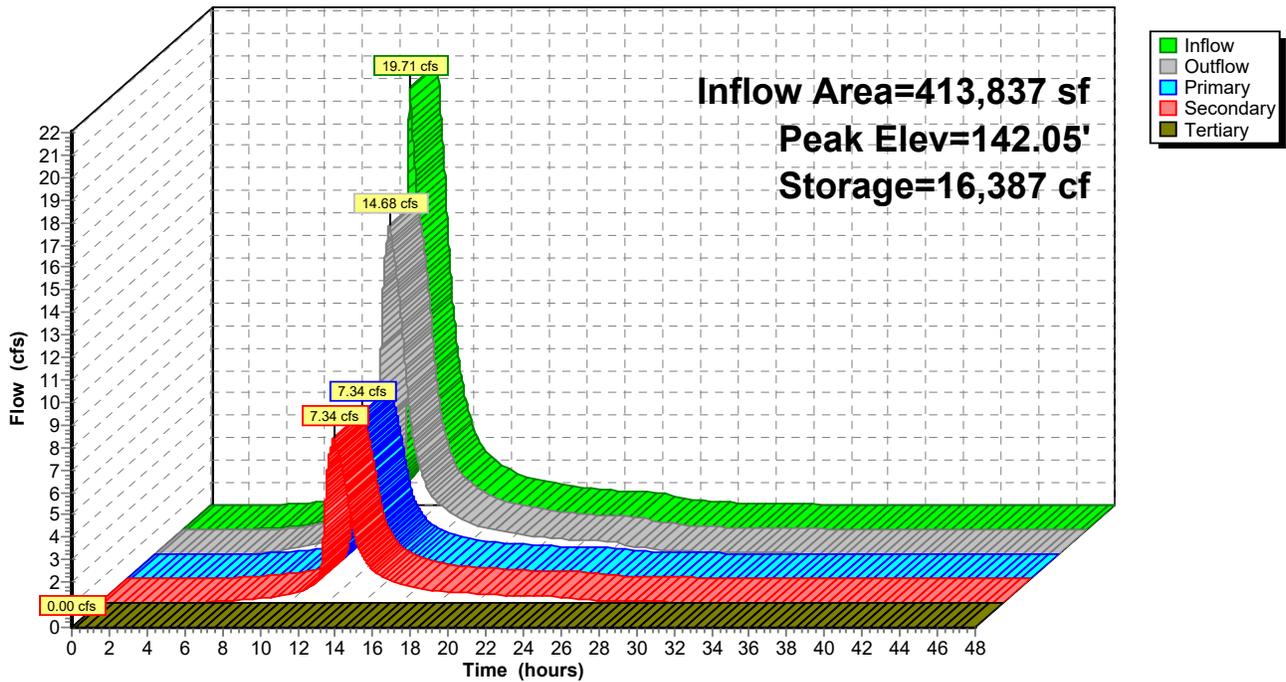
- ↑ 2=Culvert (Passes 7.33 cfs of 8.99 cfs potential flow)
- ↑ 5=Orifice/Grate (Orifice Controls 7.05 cfs @ 5.74 fps)
- ↑ 7=Orifice/Grate (Weir Controls 0.28 cfs @ 0.72 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=140.00' (Free Discharge)

- ↑ 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1E: Stormwater Wetland

Hydrograph



Summary for Pond 2A: UGS Chamber

Inflow Area = 152,357 sf, 93.58% Impervious, Inflow Depth = 4.43" for 10-yr event
 Inflow = 24.62 cfs @ 11.97 hrs, Volume= 56,199 cf
 Outflow = 11.06 cfs @ 12.06 hrs, Volume= 56,143 cf, Atten= 55%, Lag= 5.8 min
 Primary = 11.06 cfs @ 12.06 hrs, Volume= 56,143 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 145.76' @ 12.06 hrs Surf.Area= 8,448 sf Storage= 16,858 cf

Plug-Flow detention time= 57.3 min calculated for 56,143 cf (100% of inflow)
 Center-of-Mass det. time= 56.6 min (825.9 - 769.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	143.50'	0 cf	48.00'W x 176.00'L x 4.17'H Field A 35,200 cf Overall - 35,200 cf Embedded = 0 cf x 40.0% Voids
#2A	143.50'	26,159 cf	retain_it retain_it 3.5' x 132 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 6 Rows adjusted for 343.8 cf perimeter wall
		26,159 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	143.50'	24.0" Round Culvert L= 195.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 143.50' / 142.17' S= 0.0068 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	143.50'	18.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	147.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Primary	145.50'	18.0" W x 10.0" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=11.05 cfs @ 12.06 hrs HW=145.75' (Free Discharge)

- 1=Culvert (Passes 10.44 cfs of 16.94 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 10.44 cfs @ 5.91 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Orifice/Grate (Orifice Controls 0.62 cfs @ 1.62 fps)

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Type II 24-hr 10-yr Rainfall=5.12"

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Pond 2A: UGS Chamber - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it@)

Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf

Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf

6 Rows adjusted for 343.8 cf perimeter wall

22 Chambers/Row x 8.00' Long = 176.00' Row Length

6 Rows x 96.0" Wide = 48.00' Base Width

50.0" Chamber Height = 4.17' Field Height

6.1 cf Sidewall x 22 x 2 + 6.1 cf Endwall x 6 x 2 = 343.8 cf Perimeter Wall

132 Chambers x 200.8 cf - 343.8 cf Perimeter wall = 26,159.2 cf Chamber Storage

132 Chambers x 266.7 cf = 35,200.0 cf Displacement

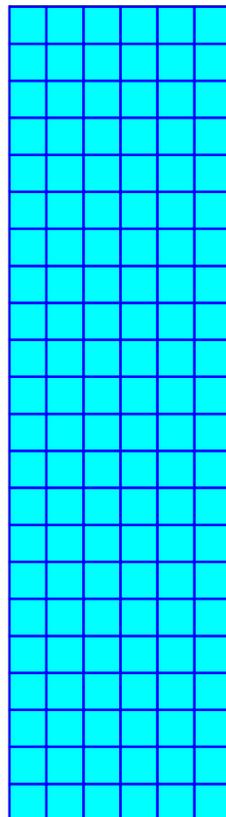
Chamber Storage = 26,159.2 cf = 0.601 af

Overall Storage Efficiency = 74.3%

Overall System Size = 176.00' x 48.00' x 4.17'

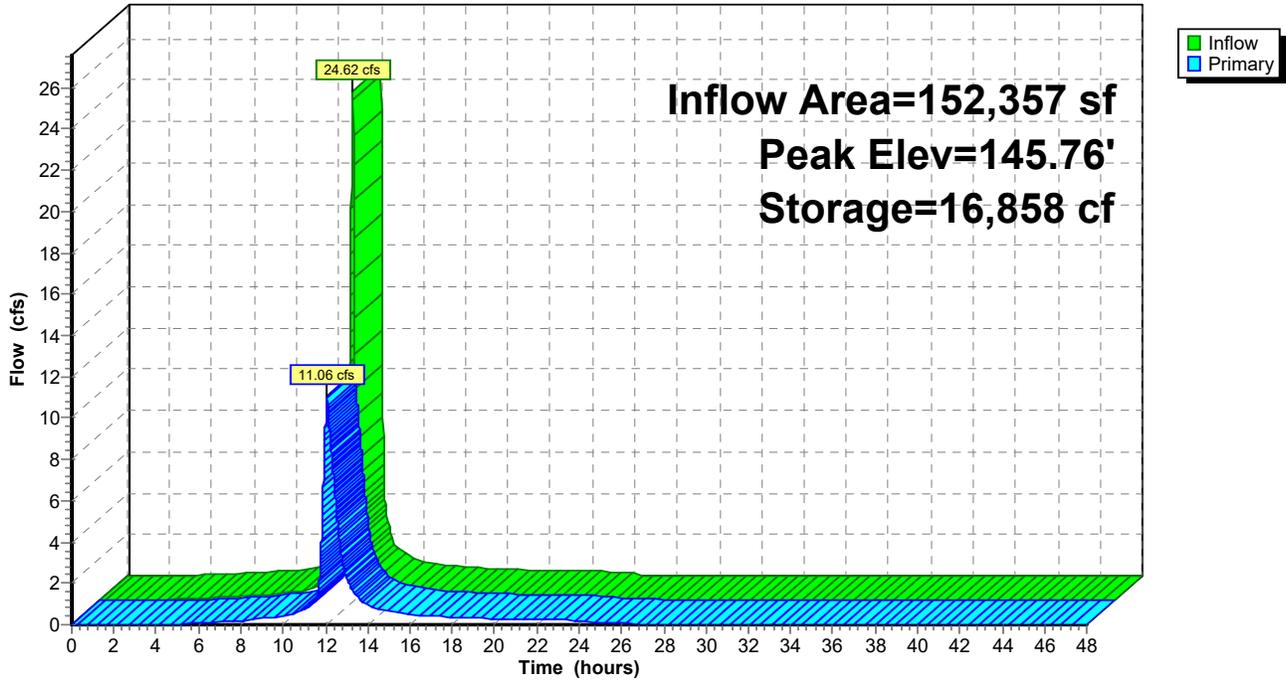
132 Chambers

1,303.7 cy Field



Pond 2A: UGS Chamber

Hydrograph



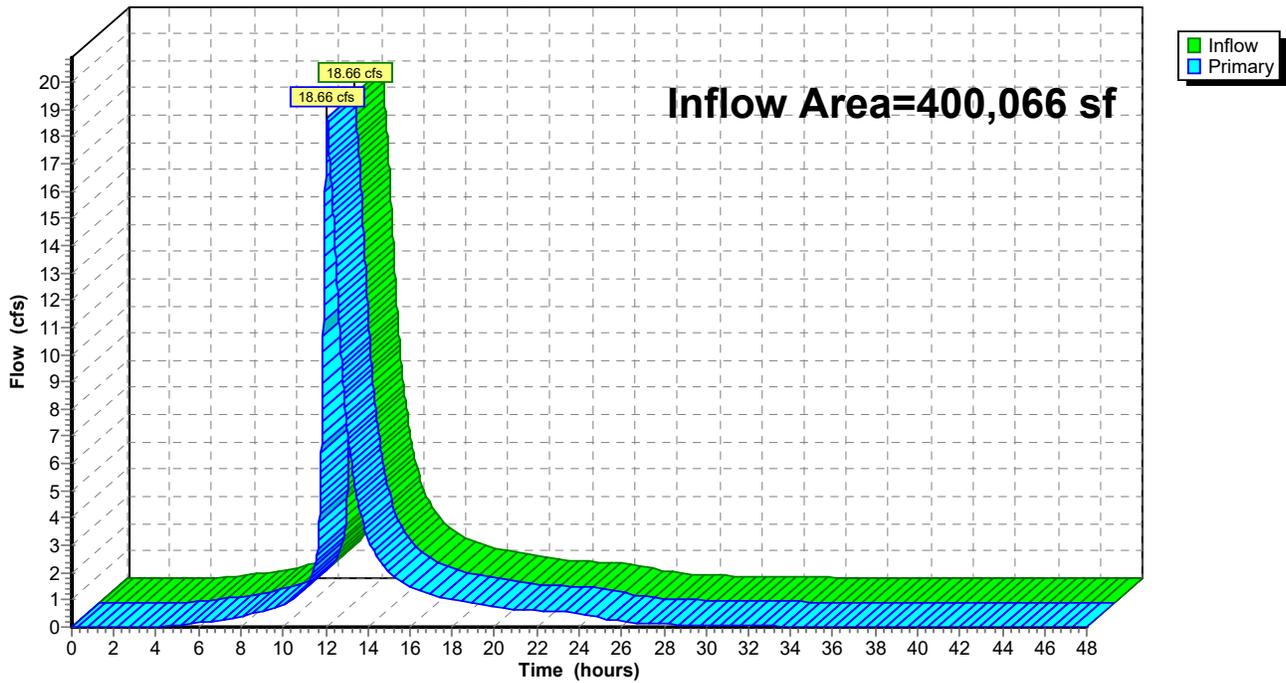
Summary for Link L3: DP-3

Inflow Area = 400,066 sf, 87.84% Impervious, Inflow Depth > 4.06" for 10-yr event
Inflow = 18.66 cfs @ 12.08 hrs, Volume= 135,289 cf
Primary = 18.66 cfs @ 12.08 hrs, Volume= 135,289 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link L3: DP-3

Hydrograph



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

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPDA-1A: Southeastern Runoff Area=52,370 sf 0.00% Impervious Runoff Depth=2.95"
 Flow Length=164' Tc=9.2 min CN=57 Runoff=5.59 cfs 12,854 cf

SubcatchmentPDA-1B: Northeastern Runoff Area=100,339 sf 62.51% Impervious Runoff Depth=4.85"
 Flow Length=265' Tc=27.9 min CN=74 Runoff=10.16 cfs 40,589 cf

SubcatchmentPDA-1C: Building 1 Roof Runoff Area=143,468 sf 100.00% Impervious Runoff Depth=7.68"
 Tc=6.0 min CN=98 Runoff=37.24 cfs 91,823 cf

SubcatchmentPDA-1D: Southeastern Runoff Area=56,696 sf 99.22% Impervious Runoff Depth=7.68"
 Tc=6.0 min CN=98 Runoff=14.72 cfs 36,287 cf

SubcatchmentPDA-1E: Stormwater Runoff Area=13,771 sf 100.00% Impervious Runoff Depth=7.68"
 Tc=6.0 min CN=98 Runoff=3.57 cfs 8,814 cf

SubcatchmentPDA-2A: Northwestern Runoff Area=152,357 sf 93.58% Impervious Runoff Depth=7.20"
 Tc=6.0 min CN=94 Runoff=38.91 cfs 91,444 cf

SubcatchmentPDA-2B: Southern Runoff Runoff Area=90,674 sf 99.11% Impervious Runoff Depth=7.56"
 Tc=6.0 min CN=97 Runoff=23.48 cfs 57,129 cf

SubcatchmentPDA-2C: Southwestern Runoff Area=45,499 sf 41.71% Impervious Runoff Depth=4.05"
 Flow Length=220' Tc=6.6 min CN=67 Runoff=7.39 cfs 15,375 cf

SubcatchmentPDA-2D: Southern Runoff Runoff Area=25,400 sf 0.00% Impervious Runoff Depth=4.74"
 Flow Length=107' Tc=19.2 min CN=73 Runoff=3.14 cfs 10,031 cf

Reach PDA-1: Southeastern Wetlands Inflow=48.25 cfs 218,607 cf
 Outflow=48.25 cfs 218,607 cf

Reach PDA-2: Southwestern Wetlands Inflow=17.64 cfs 139,461 cf
 Outflow=17.64 cfs 139,461 cf

Reach W1E: Overflow Weir 1E Inflow=5.73 cfs 5,462 cf
 Outflow=5.73 cfs 5,462 cf

Pond 1D: UGS Chamber Peak Elev=142.98' Storage=42,107 cf Inflow=42.42 cfs 134,004 cf
 Outflow=14.17 cfs 133,475 cf

Pond 1E: Stormwater Wetland Peak Elev=142.74' Storage=22,799 cf Inflow=34.17 cfs 233,674 cf
 Primary=11.54 cfs 113,930 cf Secondary=11.57 cfs 114,056 cf Tertiary=5.73 cfs 5,462 cf Outflow=28.84 cfs 233,448 cf

Pond 2A: UGS Chamber Peak Elev=146.85' Storage=25,028 cf Inflow=38.91 cfs 91,444 cf
 Outflow=19.48 cfs 91,385 cf

Link L3: DP-3 Inflow=32.66 cfs 224,860 cf
 Primary=32.66 cfs 224,860 cf

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

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Total Runoff Area = 680,574 sf Runoff Volume = 364,345 cf Average Runoff Depth = 6.42"
22.47% Pervious = 152,938 sf 77.53% Impervious = 527,636 sf

Summary for Subcatchment PDA-1A: Southeastern Runoff

Runoff = 5.59 cfs @ 12.01 hrs, Volume= 12,854 cf, Depth= 2.95"

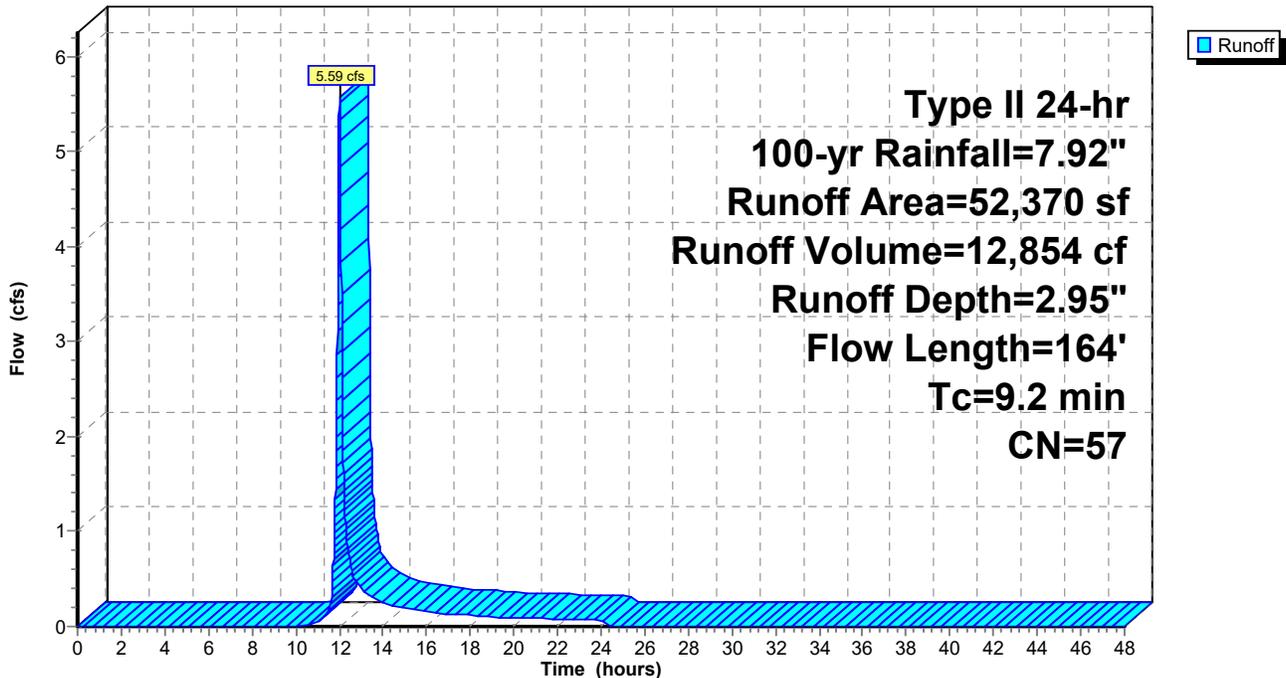
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
23,973	32	Woods/grass comb., Good, HSG A
841	58	Woods/grass comb., Good, HSG B
27,556	79	Woods/grass comb., Good, HSG D
52,370	57	Weighted Average
52,370		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	50	0.0220	0.11		Sheet Flow, Grass Grass: Dense n= 0.240 P2= 3.36"
1.0	74	0.0290	1.19		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0418	1.43		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
9.2	164	Total			

Subcatchment PDA-1A: Southeastern Runoff

Hydrograph



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

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Summary for Subcatchment PDA-1B: Northeastern Runoff

Runoff = 10.16 cfs @ 12.21 hrs, Volume= 40,589 cf, Depth= 4.85"

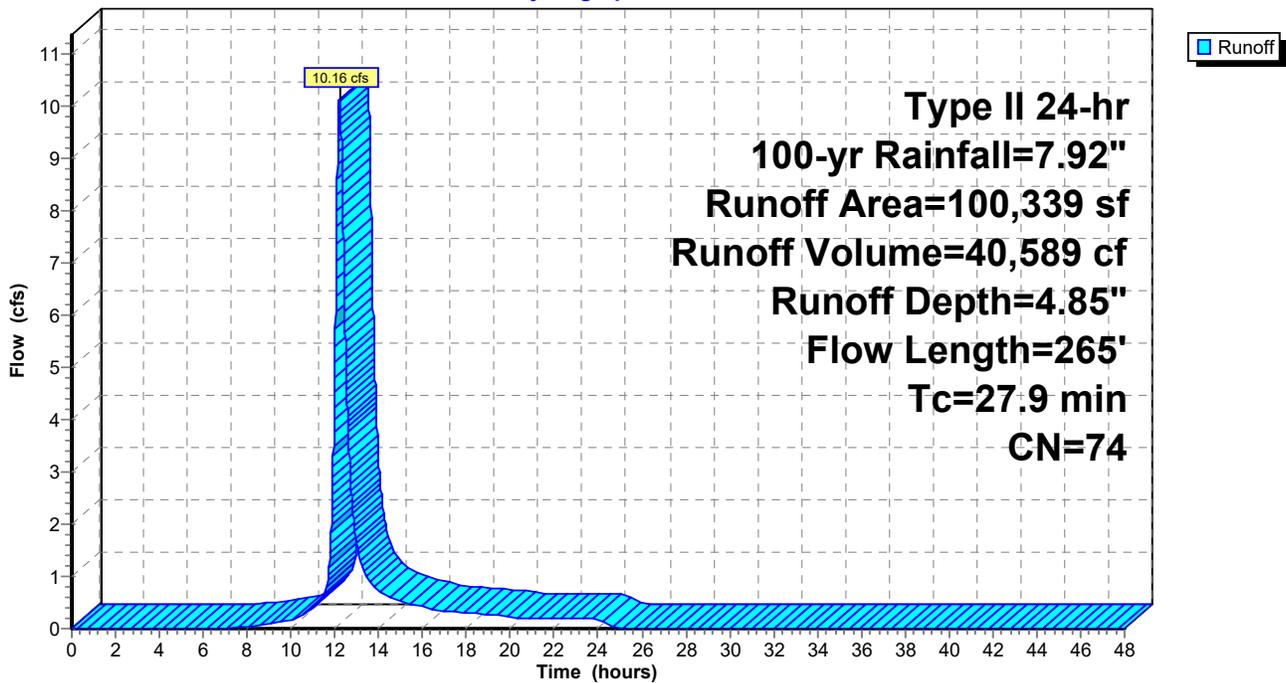
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
62,721	98	Paved parking, HSG A
7,566	39	>75% Grass cover, Good, HSG A
30,052	32	Woods/grass comb., Good, HSG A
100,339	74	Weighted Average
37,618		37.49% Pervious Area
62,721		62.51% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.1	102	0.0120	0.07		Sheet Flow, Grass/Woods Woods: Light underbrush n= 0.400 P2= 3.36"
1.3	87	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
27.9	265	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"

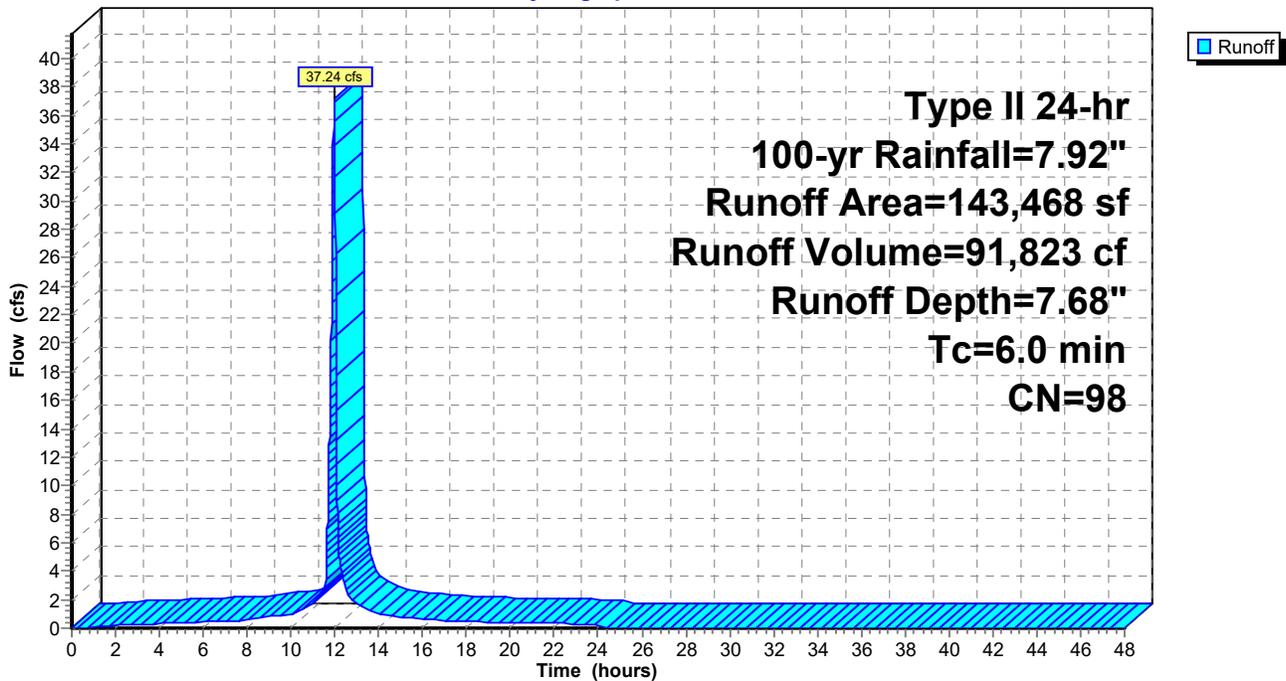
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
143,468	98	Unconnected roofs, HSG A
143,468		100.00% Impervious Area
143,468		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 = 14.72 cfs @ 11.97 hrs, Volume= 36,287 cf, Depth= 7.68"

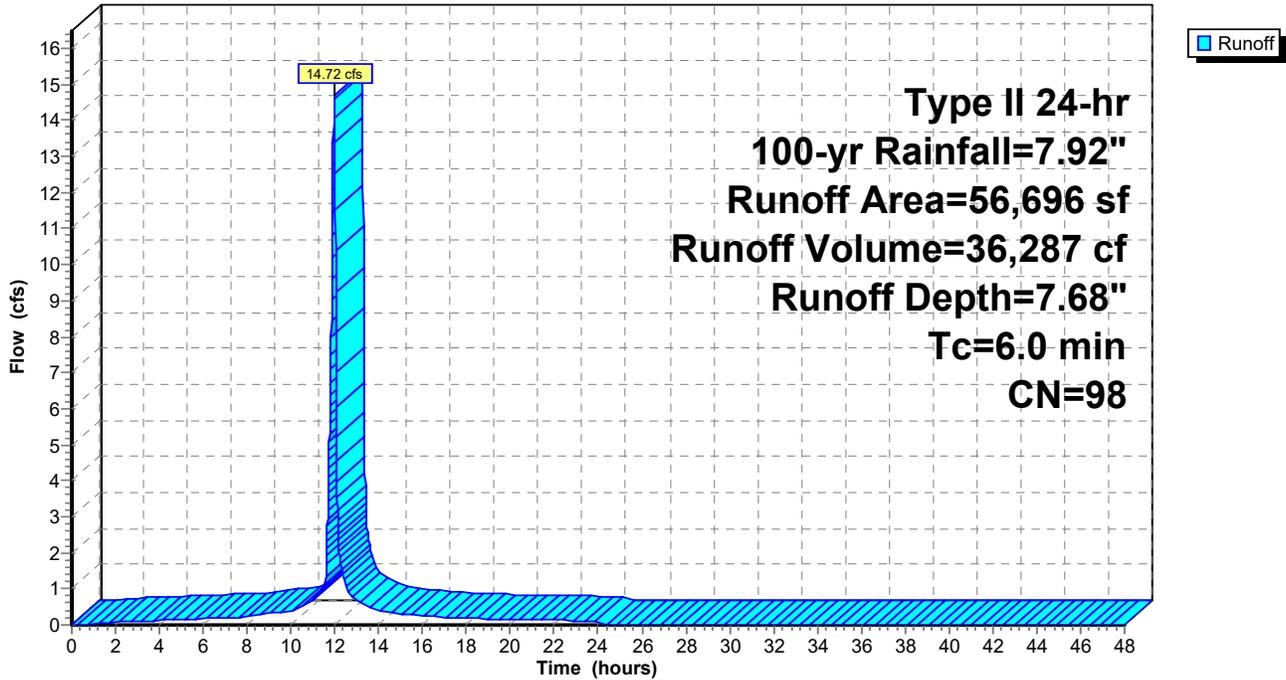
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
398	39	>75% Grass cover, Good, HSG A
56,254	98	Paved parking, HSG A
44	80	>75% Grass cover, Good, HSG D
56,696	98	Weighted Average
442		0.78% Pervious Area
56,254		99.22% 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-1E: Stormwater Wetland Area

Runoff = 3.57 cfs @ 11.97 hrs, Volume= 8,814 cf, Depth= 7.68"

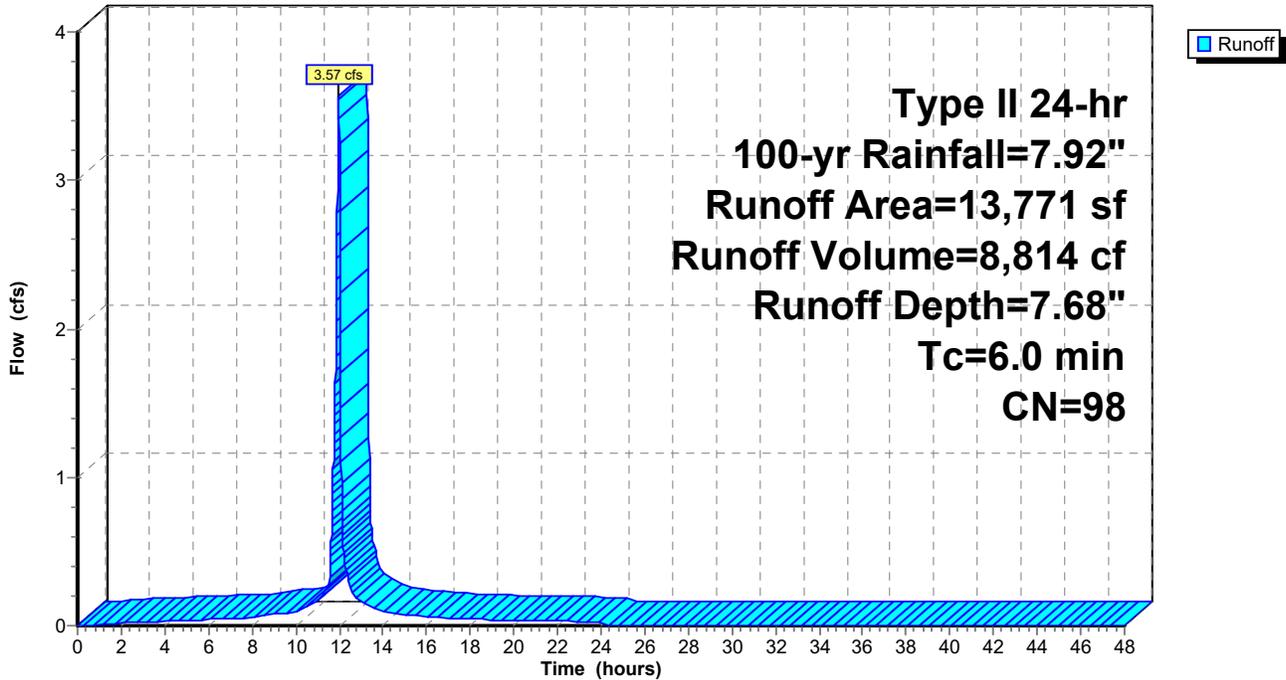
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
13,771	98	Water Surface, HSG A
13,771		100.00% Impervious Area

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

Subcatchment PDA-1E: Stormwater Wetland Area

Hydrograph



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

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Summary for Subcatchment PDA-2A: Northwestern Runoff

Runoff = 38.91 cfs @ 11.97 hrs, Volume= 91,444 cf, Depth= 7.20"

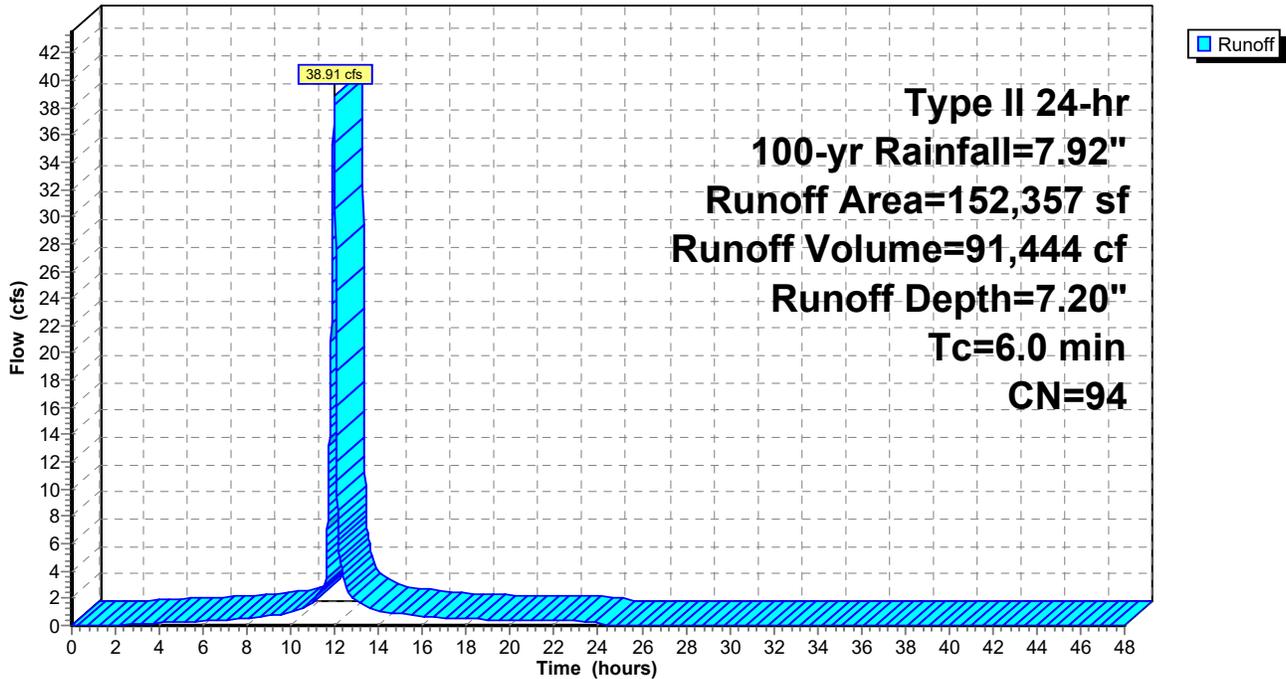
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
142,578	98	Paved parking, HSG A
9,779	39	>75% Grass cover, Good, HSG A
152,357	94	Weighted Average
9,779		6.42% Pervious Area
142,578		93.58% 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: Southern Runoff

Runoff = 23.48 cfs @ 11.97 hrs, Volume= 57,129 cf, Depth= 7.56"

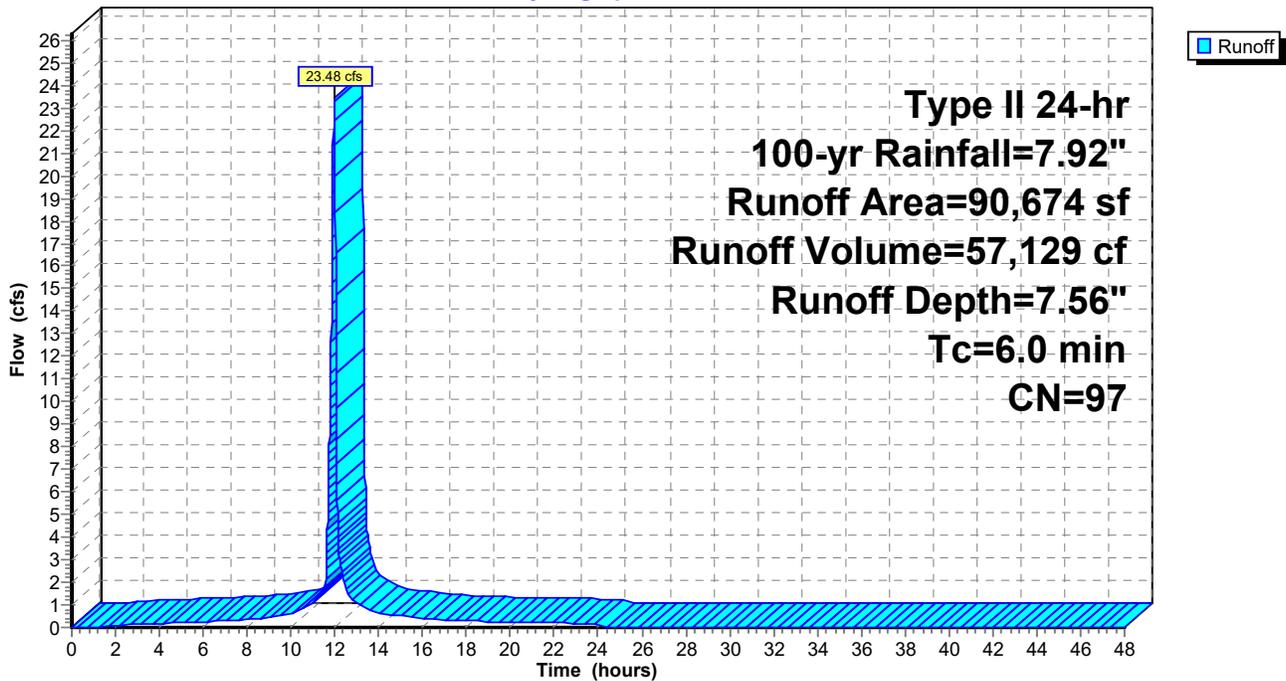
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
89,866	98	Paved parking, HSG A
808	39	>75% Grass cover, Good, HSG A
90,674	97	Weighted Average
808		0.89% Pervious Area
89,866		99.11% Impervious Area

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

Subcatchment PDA-2B: Southern Runoff

Hydrograph



Summary for Subcatchment PDA-2C: Southwestern Runoff

Runoff = 7.39 cfs @ 11.98 hrs, Volume= 15,375 cf, Depth= 4.05"

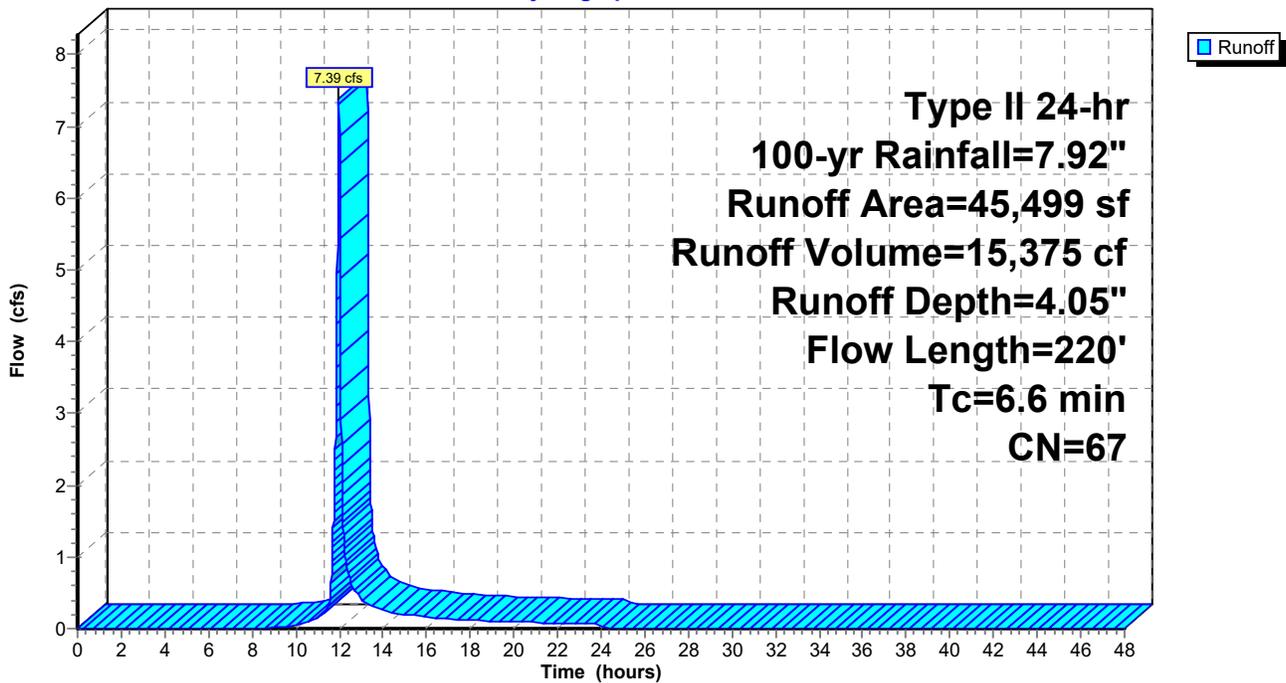
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
25,067	43	Woods/grass comb., Fair, HSG A
18,978	98	Paved parking, HSG A
1,454	82	Woods/grass comb., Fair, HSG D
45,499	67	Weighted Average
26,521		58.29% Pervious Area
18,978		41.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0484	0.15		Sheet Flow, Grass Grass: Dense n= 0.240 P2= 3.36"
0.3	40	0.0945	2.15		Shallow Concentrated Flow, Grass Short Grass Pasture Kv= 7.0 fps
0.7	130	0.0236	3.12		Shallow Concentrated Flow, Pavement Paved Kv= 20.3 fps
6.6	220	Total			

Subcatchment PDA-2C: Southwestern Runoff

Hydrograph



Summary for Subcatchment PDA-2D: Southern Runoff

Runoff = 3.14 cfs @ 12.12 hrs, Volume= 10,031 cf, Depth= 4.74"

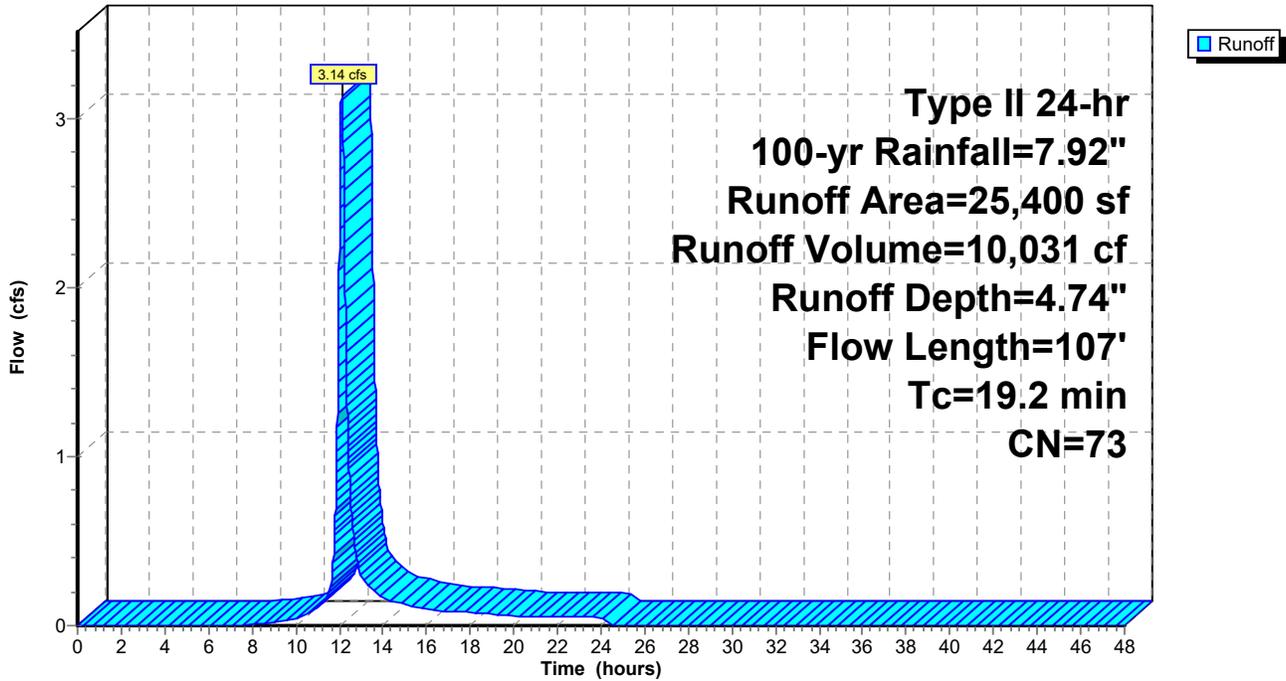
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-yr Rainfall=7.92"

Area (sf)	CN	Description
18,457	79	Woods/grass comb., Good, HSG D
6,943	58	Woods/grass comb., Good, HSG B
25,400	73	Weighted Average
25,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.4	50	0.0276	0.05		Sheet Flow, Grass/Woods Woods: Dense underbrush n= 0.800 P2= 3.36"
0.8	57	0.0544	1.17		Shallow Concentrated Flow, Woods Woodland Kv= 5.0 fps
19.2	107	Total			

Subcatchment PDA-2D: Southern Runoff

Hydrograph



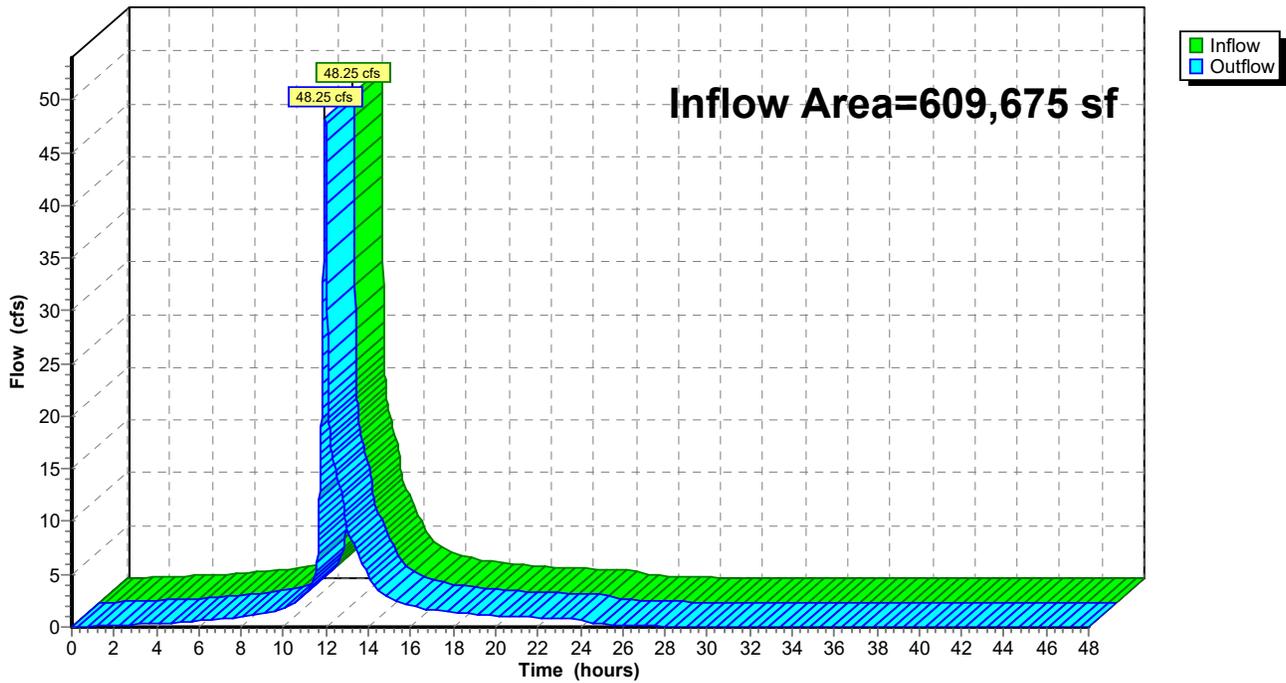
Summary for Reach PDA-1: Southeastern Wetlands

Inflow Area = 609,675 sf, 83.43% Impervious, Inflow Depth = 4.30" for 100-yr event
Inflow = 48.25 cfs @ 11.97 hrs, Volume= 218,607 cf
Outflow = 48.25 cfs @ 11.97 hrs, Volume= 218,607 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



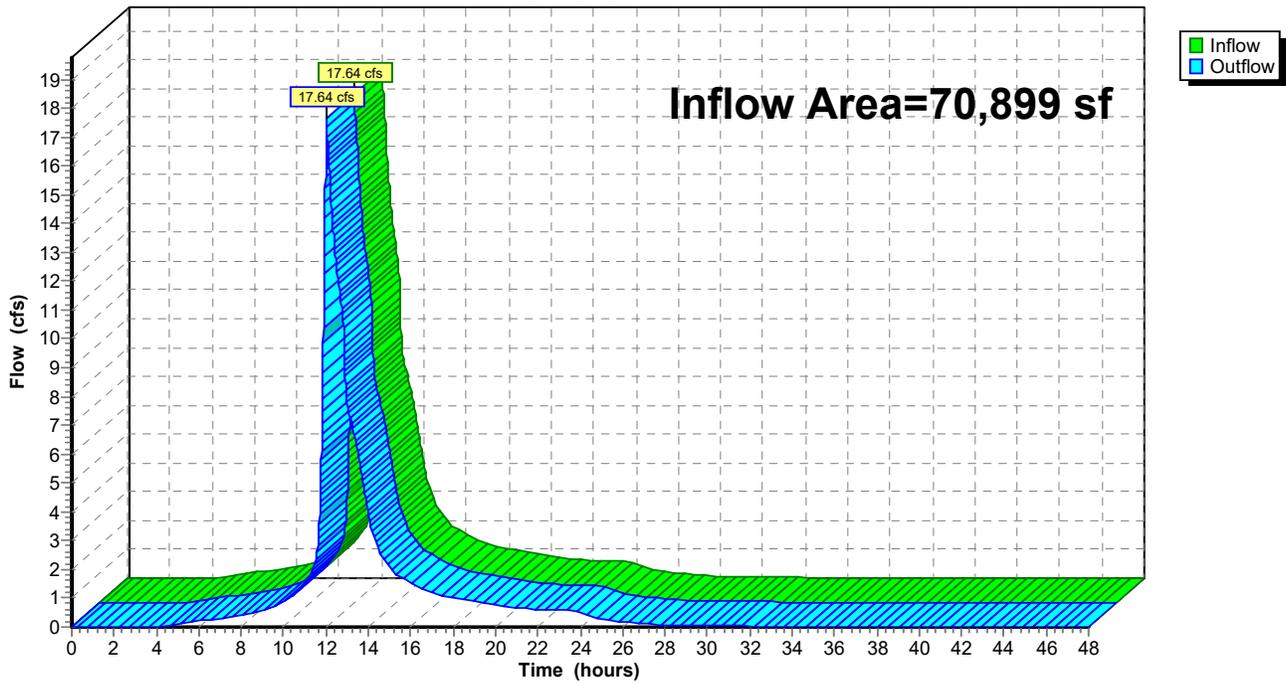
Summary for Reach PDA-2: Southwestern Wetlands

Inflow Area = 70,899 sf, 26.77% Impervious, Inflow Depth > 23.60" for 100-yr event
Inflow = 17.64 cfs @ 12.04 hrs, Volume= 139,461 cf
Outflow = 17.64 cfs @ 12.04 hrs, Volume= 139,461 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



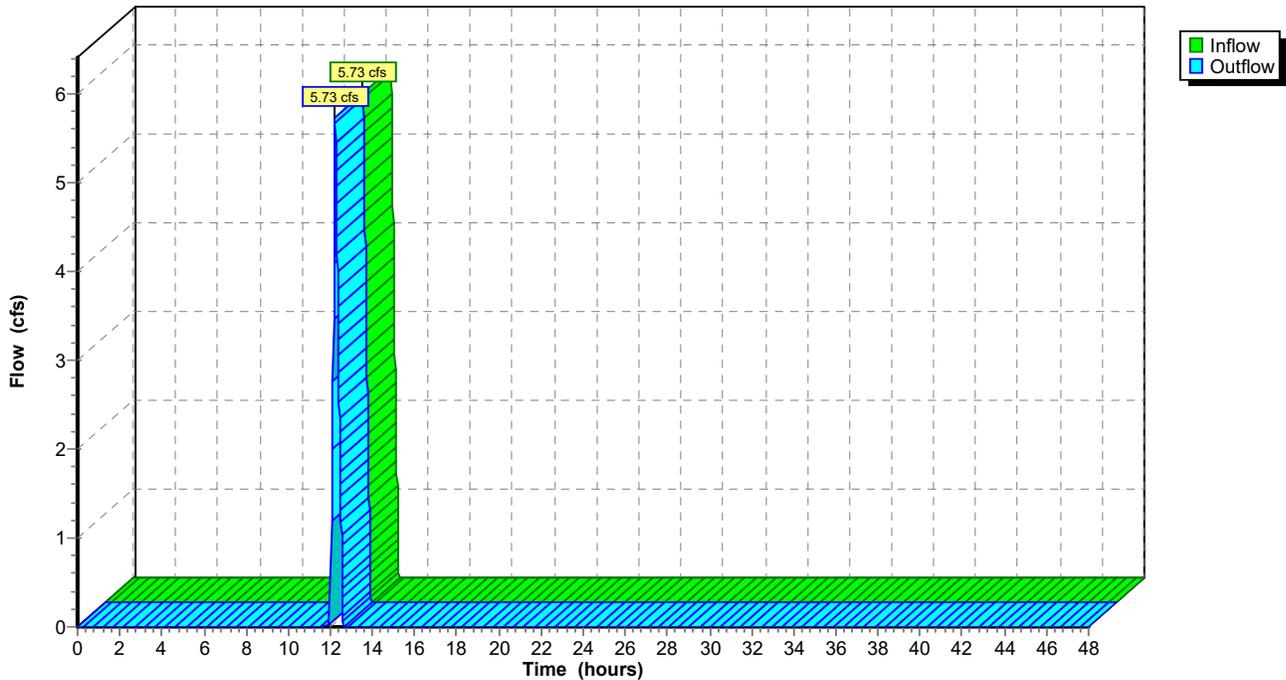
Summary for Reach W1E: Overflow Weir 1E

Inflow = 5.73 cfs @ 12.22 hrs, Volume= 5,462 cf
Outflow = 5.73 cfs @ 12.22 hrs, Volume= 5,462 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 W1E: Overflow Weir 1E

Hydrograph



Summary for Pond 1D: UGS Chamber

Inflow Area = 247,709 sf, 84.31% Impervious, Inflow Depth = 6.49" for 100-yr event
 Inflow = 42.42 cfs @ 11.97 hrs, Volume= 134,004 cf
 Outflow = 14.17 cfs @ 12.27 hrs, Volume= 133,475 cf, Atten= 67%, Lag= 17.9 min
 Primary = 14.17 cfs @ 12.27 hrs, Volume= 133,475 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 142.98' @ 12.27 hrs Surf.Area= 19,456 sf Storage= 42,107 cf

Plug-Flow detention time= 93.5 min calculated for 133,475 cf (100% of inflow)
 Center-of-Mass det. time= 90.9 min (859.9 - 769.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	140.50'	0 cf	152.00'W x 128.00'L x 3.17'H Field A 61,611 cf Overall - 61,611 cf Embedded = 0 cf x 40.0% Voids
#2A	140.50'	42,463 cf	retain_it retain_it 2.5' x 304 Inside #1 Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf 19 Rows adjusted for 231.0 cf perimeter wall
		42,463 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	140.50'	24.0" Round Culvert L= 11.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 140.50' / 140.22' S= 0.0255 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	140.50'	18.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	143.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Device 1	142.25'	18.0" W x 8.5" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=14.17 cfs @ 12.27 hrs HW=142.98' (Free Discharge)

- ↑ **1=Culvert** (Passes 14.17 cfs of 18.40 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 11.19 cfs @ 6.33 fps)
- ↑ **3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **4=Orifice/Grate** (Orifice Controls 2.98 cfs @ 2.81 fps)

Pond 1D: UGS Chamber - Chamber Wizard Field A

Chamber Model = retain_it retain_it 2.5' (retain-it@)

Inside= 84.0"W x 30.0"H => 17.56 sf x 8.00'L = 140.4 cf

Outside= 96.0"W x 38.0"H => 25.33 sf x 8.00'L = 202.7 cf

19 Rows adjusted for 231.0 cf perimeter wall

16 Chambers/Row x 8.00' Long = 128.00' Row Length

19 Rows x 96.0" Wide = 152.00' Base Width

38.0" Chamber Height = 3.17' Field Height

3.3 cf Sidewall x 16 x 2 + 3.3 cf Endwall x 19 x 2 = 231.0 cf Perimeter Wall

304 Chambers x 140.4 cf - 231.0 cf Perimeter wall = 42,462.8 cf Chamber Storage

304 Chambers x 202.7 cf = 61,610.7 cf Displacement

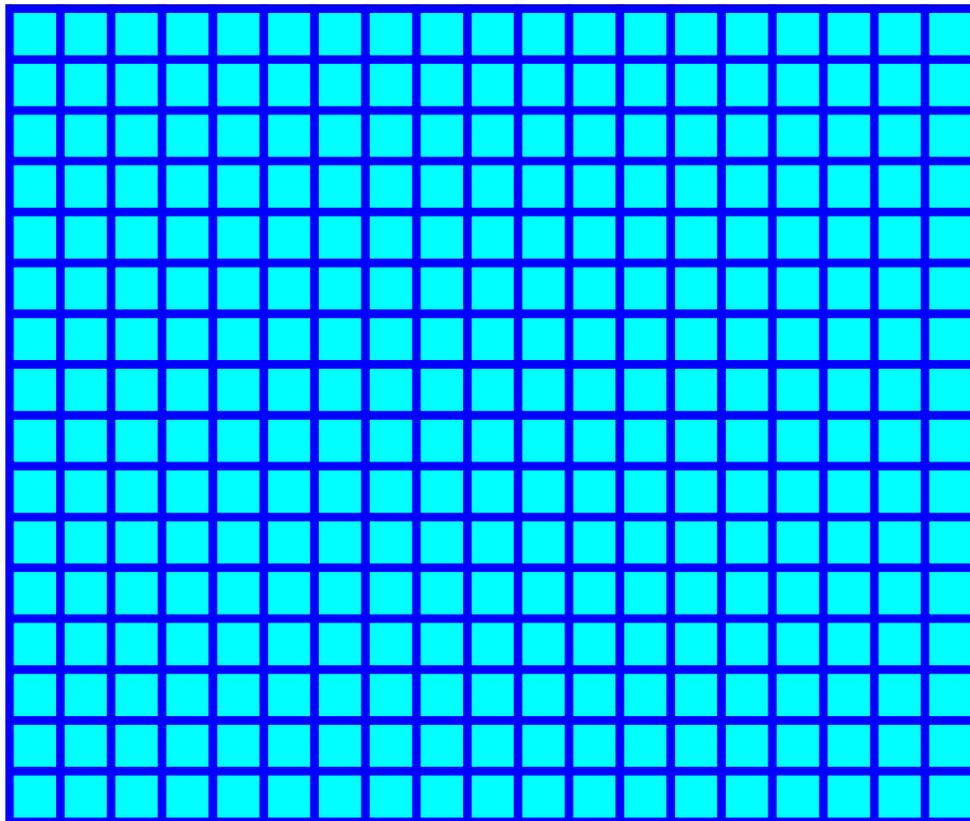
Chamber Storage = 42,462.8 cf = 0.975 af

Overall Storage Efficiency = 68.9%

Overall System Size = 128.00' x 152.00' x 3.17'

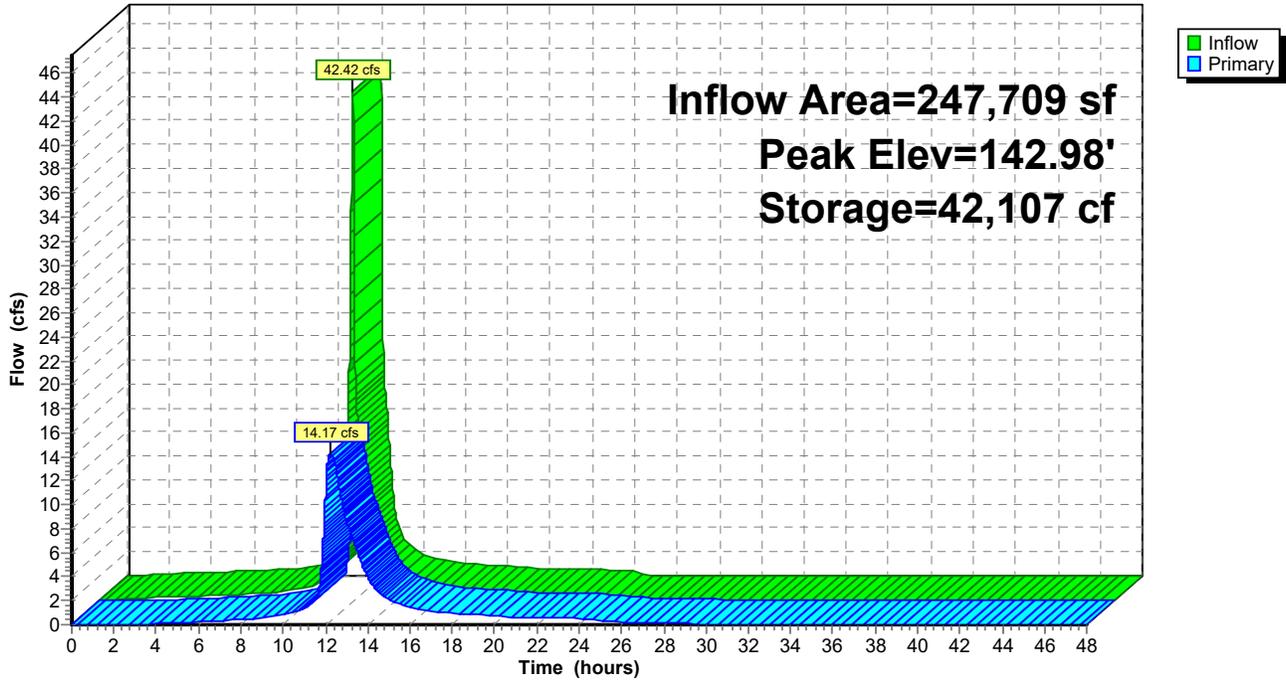
304 Chambers

2,281.9 cy Field



Pond 1D: UGS Chamber

Hydrograph



Summary for Pond 1E: Stormwater Wetland

Inflow Area = 413,837 sf, 88.24% Impervious, Inflow Depth > 6.78" for 100-yr event
 Inflow = 34.17 cfs @ 12.06 hrs, Volume= 233,674 cf
 Outflow = 28.84 cfs @ 12.22 hrs, Volume= 233,448 cf, Atten= 16%, Lag= 10.1 min
 Primary = 11.54 cfs @ 12.22 hrs, Volume= 113,930 cf
 Secondary = 11.57 cfs @ 12.22 hrs, Volume= 114,056 cf
 Tertiary = 5.73 cfs @ 12.22 hrs, Volume= 5,462 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 142.74' @ 12.22 hrs Surf.Area= 9,670 sf Storage= 22,799 cf

Plug-Flow detention time= 24.7 min calculated for 233,448 cf (100% of inflow)
 Center-of-Mass det. time= 23.0 min (856.7 - 833.7)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	25,393 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
140.00	6,787	0	0
141.00	8,071	7,429	7,429
142.00	8,971	8,521	15,950
142.50	9,430	4,600	20,550
143.00	9,940	4,843	25,393

Device	Routing	Invert	Outlet Devices
#1	Primary	140.00'	18.0" Round Culvert L= 72.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0069 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#2	Secondary	140.00'	18.0" Round Culvert L= 71.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0070 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#3	Tertiary	142.50'	20.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Device 1	140.00'	15.0" Vert. Orifice/Grate C= 0.600
#5	Device 2	140.00'	15.0" Vert. Orifice/Grate C= 0.600
#6	Device 1	142.00'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#7	Device 2	142.00'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=11.54 cfs @ 12.22 hrs HW=142.74' (Free Discharge)

- ↑ 1=Culvert (Barrel Controls 11.54 cfs @ 6.53 fps)
- ↑ 4=Orifice/Grate (Passes < 8.58 cfs potential flow)
- ↑ 6=Orifice/Grate (Passes < 16.49 cfs potential flow)

Secondary OutFlow Max=11.57 cfs @ 12.22 hrs HW=142.74' (Free Discharge)

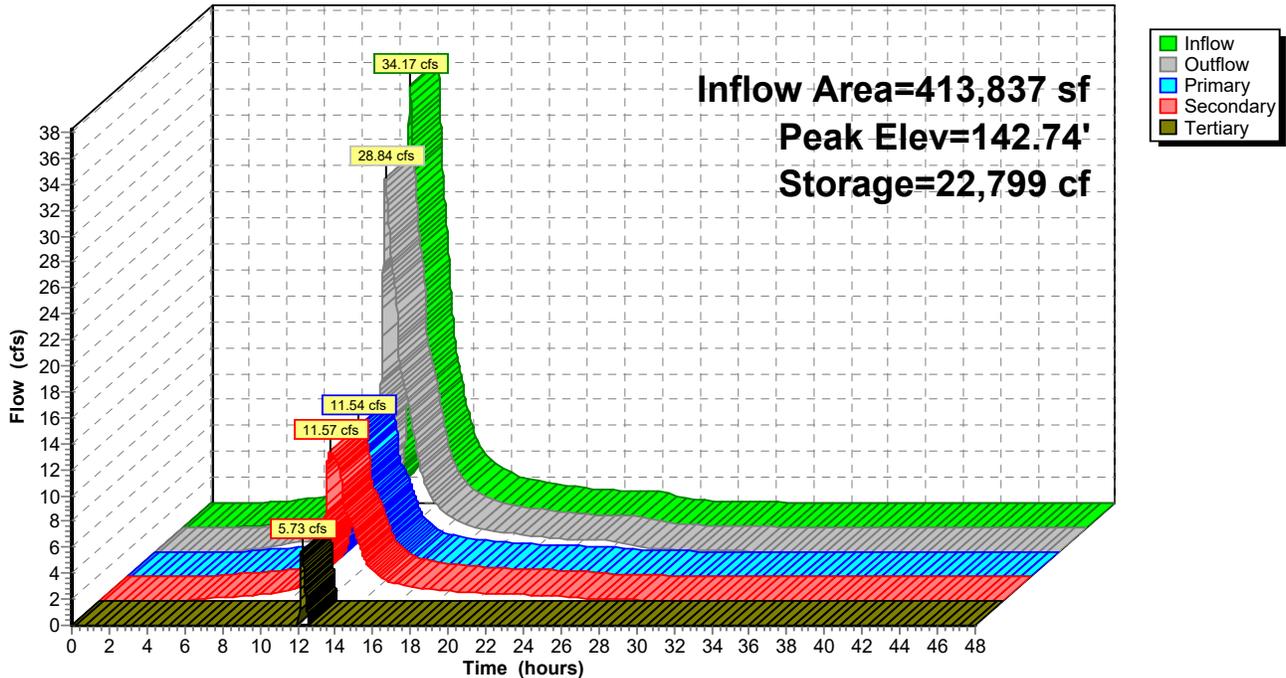
- ↑ 2=Culvert (Barrel Controls 11.57 cfs @ 6.55 fps)
- ↑ 5=Orifice/Grate (Passes < 8.58 cfs potential flow)
- ↑ 7=Orifice/Grate (Passes < 16.49 cfs potential flow)

Tertiary OutFlow Max=5.71 cfs @ 12.22 hrs HW=142.74' (Free Discharge)

- ↑ 3=Broad-Crested Rectangular Weir (Weir Controls 5.71 cfs @ 1.21 fps)

Pond 1E: Stormwater Wetland

Hydrograph



Summary for Pond 2A: UGS Chamber

Inflow Area = 152,357 sf, 93.58% Impervious, Inflow Depth = 7.20" for 100-yr event
 Inflow = 38.91 cfs @ 11.97 hrs, Volume= 91,444 cf
 Outflow = 19.48 cfs @ 12.06 hrs, Volume= 91,385 cf, Atten= 50%, Lag= 5.4 min
 Primary = 19.48 cfs @ 12.06 hrs, Volume= 91,385 cf

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 146.85' @ 12.06 hrs Surf.Area= 8,448 sf Storage= 25,028 cf

Plug-Flow detention time= 47.4 min calculated for 91,385 cf (100% of inflow)
 Center-of-Mass det. time= 46.9 min (804.7 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	143.50'	0 cf	48.00'W x 176.00'L x 4.17'H Field A 35,200 cf Overall - 35,200 cf Embedded = 0 cf x 40.0% Voids
#2A	143.50'	26,159 cf	retain_it retain_it 3.5' x 132 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 6 Rows adjusted for 343.8 cf perimeter wall
		26,159 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	143.50'	24.0" Round Culvert L= 195.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 143.50' / 142.17' S= 0.0068 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Device 1	143.50'	18.0" Vert. Orifice/Grate C= 0.600
#3	Device 1	147.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#4	Primary	145.50'	18.0" W x 10.0" H Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=19.47 cfs @ 12.06 hrs HW=146.85' (Free Discharge)

- 1=Culvert (Passes 13.71 cfs of 22.92 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 13.71 cfs @ 7.76 fps)
- 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 4=Orifice/Grate (Orifice Controls 5.76 cfs @ 4.60 fps)

1901517-HYDRO

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

Prepared by {enter your company name here}

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Pond 2A: UGS Chamber - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it@)

Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf

Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf

6 Rows adjusted for 343.8 cf perimeter wall

22 Chambers/Row x 8.00' Long = 176.00' Row Length

6 Rows x 96.0" Wide = 48.00' Base Width

50.0" Chamber Height = 4.17' Field Height

6.1 cf Sidewall x 22 x 2 + 6.1 cf Endwall x 6 x 2 = 343.8 cf Perimeter Wall

132 Chambers x 200.8 cf - 343.8 cf Perimeter wall = 26,159.2 cf Chamber Storage

132 Chambers x 266.7 cf = 35,200.0 cf Displacement

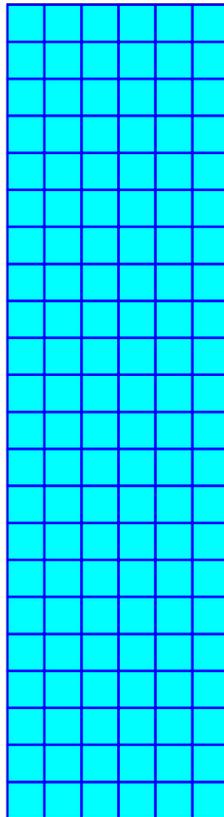
Chamber Storage = 26,159.2 cf = 0.601 af

Overall Storage Efficiency = 74.3%

Overall System Size = 176.00' x 48.00' x 4.17'

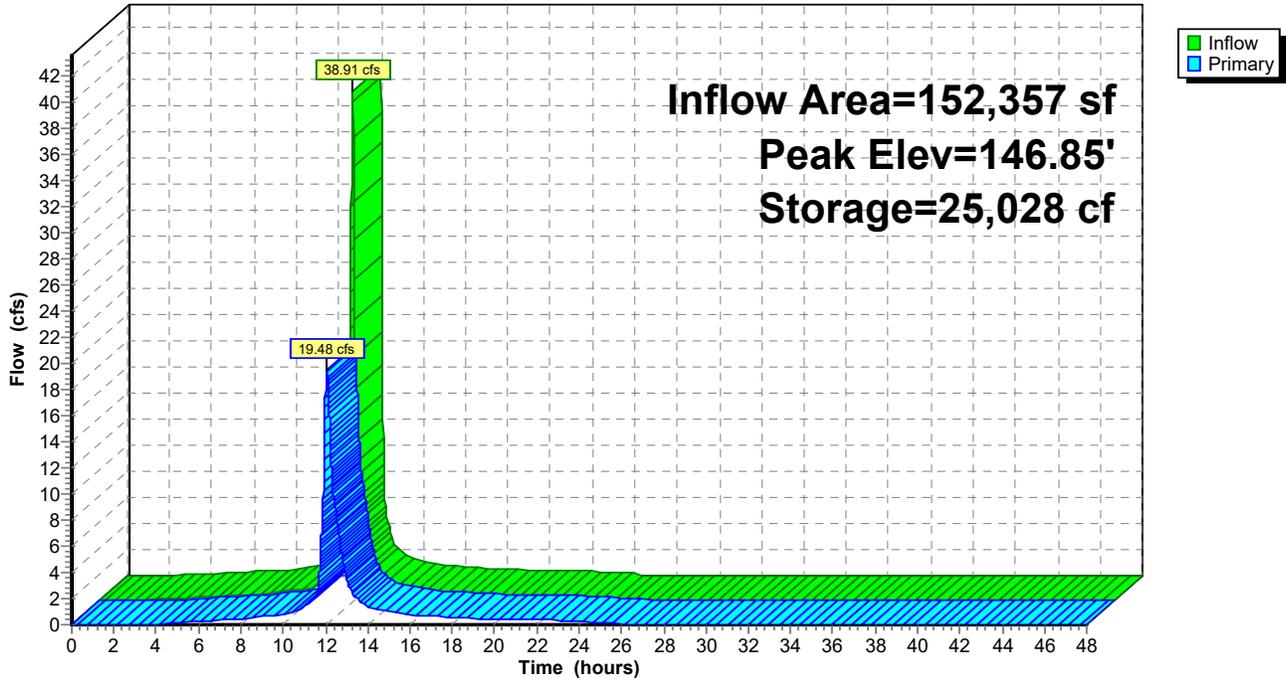
132 Chambers

1,303.7 cy Field



Pond 2A: UGS Chamber

Hydrograph



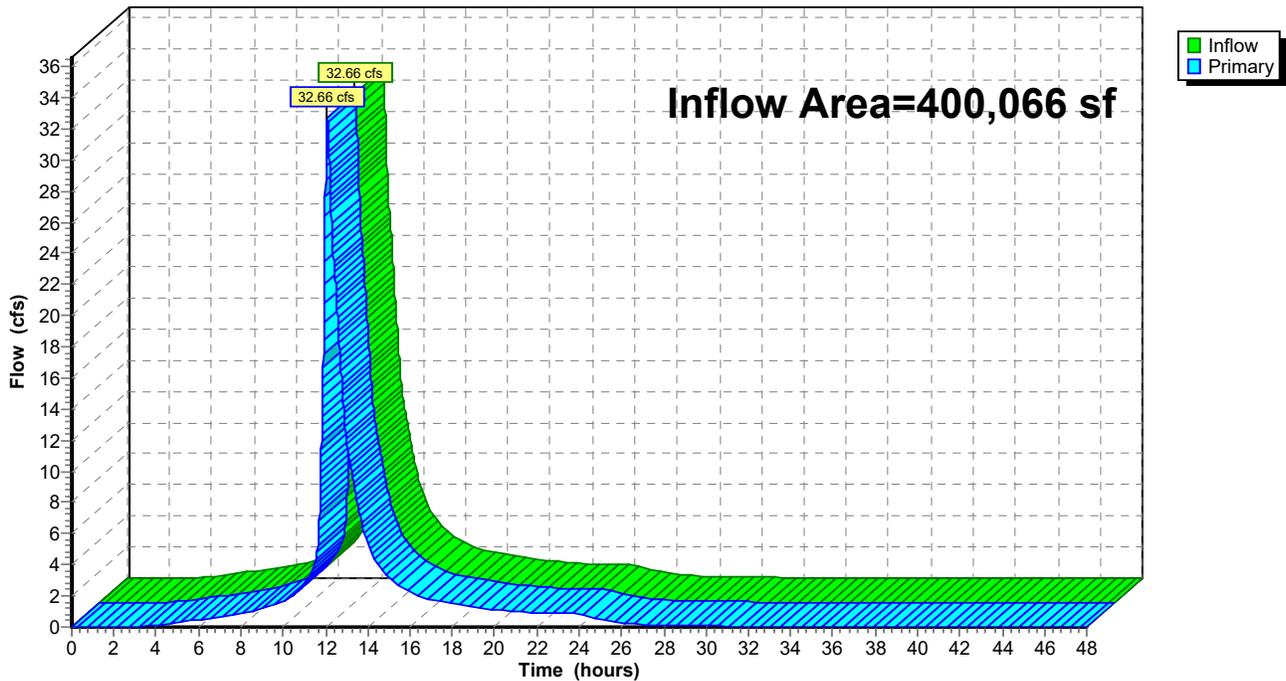
Summary for Link L3: DP-3

Inflow Area = 400,066 sf, 87.84% Impervious, Inflow Depth > 6.74" for 100-yr event
Inflow = 32.66 cfs @ 12.08 hrs, Volume= 224,860 cf
Primary = 32.66 cfs @ 12.08 hrs, Volume= 224,860 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link L3: DP-3

Hydrograph



APPENDIX C

PROPOSED HYDRAULIC ANALYSIS (10-YEAR STORM)

Computation Tables
Hydraulic Profiles

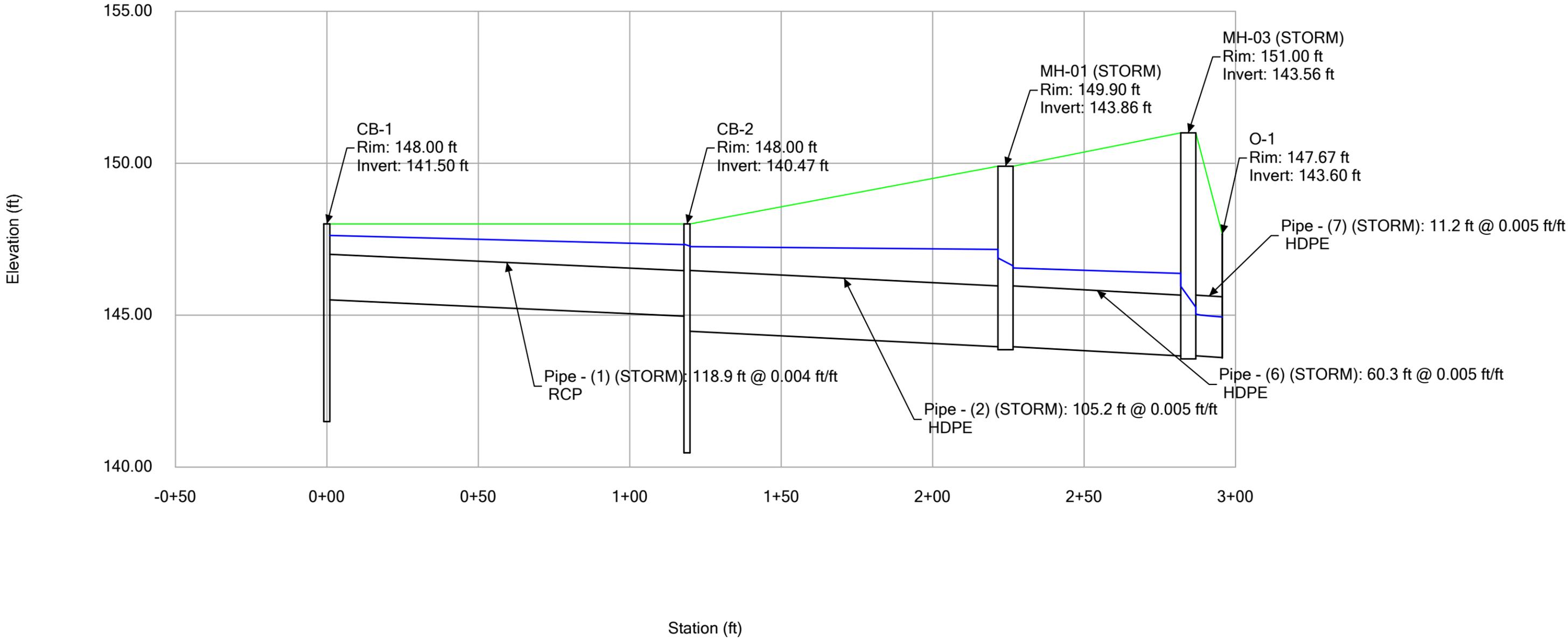
FlexTable: Conduit:DOT Hydraulic Grade Line Computations

Label	Start Node	Stop Node	Diameter (in)	Material	Size	Length (ft)	System Rational Flow (cfs)	Total System Flow (cfs)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Slope (Calculate d) (ft/ft)	Invert (Start) (ft)	Invert (Stop) (ft)	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)
Pipe - (1) (STORM)	CB-1	CB-2	18.0	<None>	<None>	118.9	6.28	6.28	8.31	3.55	0.004	145.50	144.97	147.82	147.52	147.62	147.32	148.00	148.00
Pipe - (2) (STORM)	CB-2	MH-01 (STORM)	24.0	<None>	<None>	105.2	7.90	7.90	18.59	2.52	0.005	144.47	143.96	147.35	147.26	147.25	147.16	148.00	149.90
Pipe - (5) (STORM)	CB-3	MH-01 (STORM)	18.0	<None>	<None>	126.4	9.85	9.85	8.82	5.57	0.005	145.10	144.46	148.21	147.41	147.73	146.93	148.25	149.90
Pipe - (6) (STORM)	MH-01 (STORM)	MH-03 (STORM)	24.0	<None>	<None>	60.3	14.74	14.74	18.90	4.69	0.005	143.96	143.66	146.90	146.71	146.55	146.37	149.90	151.00
Pipe - (7) (STORM)	MH-03 (STORM)	O-1	24.0	<None>	<None>	11.2	14.59	14.59	18.90	6.64	0.005	143.66	143.60	145.66	145.61	145.04	144.94	151.00	147.67
Pipe - (8) (3) (STORM)	OCS-2A (STORM)	MH-06 (STORM)	24.0	<None>	<None>	256.2	0.00	11.92	19.26	6.45	0.005	143.50	142.17	145.52	145.02	145.27	144.80	149.60	145.42
Pipe - (8) (STORM)	UGS-2A	OCS-2A (STORM)	24.0	<None>	<None>	62.7	0.00	11.92	0.00	3.79	0.000	143.50	143.50	145.79	145.66	145.56	145.44	145.68	149.60
Pipe - (10) (STORM)	CB-7	CB-8	18.0	<None>	<None>	71.5	5.81	5.81	9.12	3.29	0.005	145.57	145.18	148.18	148.03	148.01	147.86	148.60	149.25
Pipe - (11) (STORM)	CB-6	CB-7	18.0	<None>	<None>	128.2	2.77	2.77	8.70	1.57	0.005	146.20	145.57	148.32	148.25	148.28	148.21	148.70	148.60
Pipe - (12) (STORM)	MH-02 (STORM)	MH-11 (STORM)	24.0	<None>	<None>	188.2	6.88	6.88	19.78	2.19	0.005	142.38	141.35	146.23	146.09	146.15	146.00	150.25	150.10
Pipe - (14) (STORM)	MH-05 (STORM)	MH-02 (STORM)	24.0	<None>	<None>	351.3	8.02	8.02	19.24	2.55	0.005	144.20	142.38	146.66	146.34	146.56	146.24	149.00	150.25
Pipe - (15) (STORM)	CB-9	MH-04 (STORM)	18.0	<None>	<None>	129.3	2.37	2.37	8.44	1.34	0.005	144.50	143.90	146.87	146.82	146.84	146.79	148.50	149.30
Pipe - (16) (STORM)	CB-10	MH-10 (STORM)	18.0	<None>	<None>	66.8	3.90	3.90	10.20	2.21	0.007	143.19	142.74	146.71	146.65	146.64	146.57	147.50	148.08
Pipe - (17) (5) (STORM)	CB-12	CB-13	18.0	<None>	<None>	104.4	4.71	4.71	8.76	2.67	0.005	142.46	141.95	146.41	146.26	146.30	146.15	149.00	149.50
Pipe - (17) (STORM)	MH-10 (STORM)	CB-12	18.0	<None>	<None>	56.8	4.13	4.13	8.73	2.34	0.005	142.74	142.46	146.55	146.49	146.46	146.40	148.08	149.00
Pipe - (18) (STORM)	MH-04 (STORM)	CB-10	18.0	<None>	<None>	86.9	2.13	2.13	11.26	1.21	0.008	143.90	143.19	146.79	146.76	146.77	146.74	149.30	147.50
Pipe - (23) (STORM)	CB-8	MH-05 (STORM)	18.0	<None>	<None>	193.5	8.41	8.41	8.83	4.76	0.005	145.18	144.20	147.71	146.82	147.36	146.47	149.25	149.00
Pipe - (27) (STORM)	O-2	MH-11 (STORM)	24.0	<None>	<None>	67.6	11.88	11.88	18.87	3.78	0.005	141.35	140.94	145.89	145.71	145.64	145.46	143.67	150.10
Pipe - (32) (STORM)	CB-4	CB-3	18.0	<None>	<None>	101.7	4.79	4.79	9.93	2.71	0.006	145.75	145.10	148.53	148.38	148.41	148.26	148.25	148.25
Pipe - (34) (STORM)	CB-5	CB-2	18.0	<None>	<None>	110.7	0.63	0.63	10.42	0.36	0.007	145.75	144.97	147.44	147.44	147.44	147.44	148.25	148.00
Pipe - (35) (1) (STORM)	MH-09 (STORM)	O-4	24.0	<None>	<None>	27.9	0.00	19.67	18.69	6.73	0.005	140.14	140.00	142.60	142.46	141.89	141.75	150.00	142.50
Pipe - (35) (2) (STORM)	OCS-1D (STORM)	MH-09 (STORM)	24.0	<None>	<None>	28.3	0.00	7.75	30.14	2.47	0.013	140.50	140.14	143.42	143.40	143.33	143.30	150.00	150.00
Pipe - (35) (STORM)	UGS-1D	OCS-1D (STORM)	24.0	<None>	<None>	47.0	0.00	7.75	0.00	2.47	0.000	140.50	140.50	143.52	143.48	143.42	143.38	143.67	150.00
Pipe - (37) (STORM)	CB-14	CB-15	12.0	<None>	<None>	51.1	5.28	5.28	3.00	6.72	0.005	141.75	141.49	144.14	143.34	143.44	142.63	143.75	143.90
Pipe - (38) (STORM)	CB-15	CB-16	24.0	<None>	<None>	47.2	5.57	5.57	19.06	5.26	0.005	140.99	140.75	143.01	142.99	142.96	142.94	143.90	144.50
Pipe - (39) (1) (STORM)	MH-12 (STORM)	O-3	24.0	<None>	<None>	50.4	12.27	12.27	19.23	6.49	0.005	140.64	140.50	142.44	142.31	141.90	141.68	145.50	143.67
Pipe - (39) (STORM)	CB-16	MH-12 (STORM)	24.0	<None>	<None>	22.8	10.39	10.39	18.72	6.11	0.005	140.75	140.64	142.86	142.83	142.69	142.66	144.50	145.50
Pipe - (40) (1) (STORM)	MH-07 (STORM)	MH-08 (STORM)	24.0	<None>	<None>	187.2	0.00	11.92	17.86	3.79	0.004	141.97	141.13	144.46	144.09	144.24	143.86	145.22	145.00
Pipe - (40) (STORM)	MH-06 (STORM)	MH-07 (STORM)	24.0	<None>	<None>	51.7	0.00	11.92	16.92	3.79	0.004	142.17	141.97	144.79	144.69	144.57	144.47	145.42	145.22
Pipe - (41) (STORM)	MH-08 (STORM)	MH-09 (STORM)	24.0	<None>	<None>	183.7	0.00	11.92	19.62	3.79	0.005	141.13	140.14	143.81	143.45	143.59	143.22	145.00	150.00
Pipe - (45) (STORM)	CB-19	MH-12 (STORM)	18.0	<None>	<None>	31.2	1.98	1.98	8.92	4.06	0.005	141.30	141.14	142.78	142.77	142.76	142.75	145.50	145.50
Pipe - (46) (STORM)	CB-18	CB-19	18.0	<None>	<None>	82.7	0.76	0.76	10.37	3.42	0.007	141.88	141.30	142.79	142.79	142.78	142.78	146.00	145.50
Pipe - (47) (STORM)	CB-17	CB-16	18.0	<None>	<None>	117.3	2.74	2.74	10.08	4.85	0.007	142.02	141.25	143.05	142.99	142.97	142.95	145.75	144.50
Pipe - (48) (STORM)	CB-11	MH-10 (STORM)	18.0	<None>	<None>	31.1	0.47	0.47	17.55	0.27	0.020	144.86	144.24	146.62	146.62	146.62	146.61	148.75	148.08
Pipe - (49) (STORM)	CB-13	MH-11 (STORM)	18.0	<None>	<None>	19.5	5.90	5.90	9.01	3.34	0.005	141.95	141.85	146.16	146.12	145.99	145.95	149.50	150.10

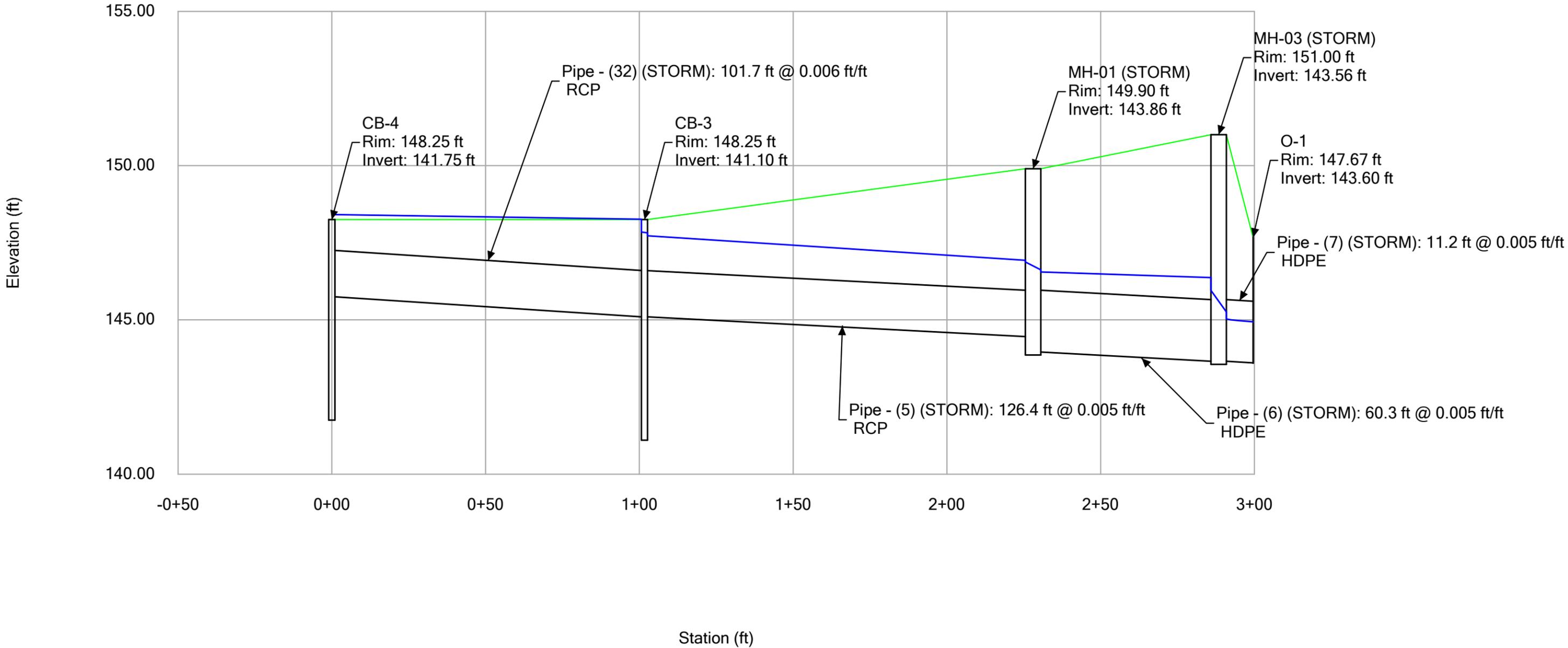
FlexTable: Conduit: DOT Storm Drain Computations

Start Node	Stop Node	Length (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)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)
MH-03 (STORM)	O-1	11.2	(N/A)	(N/A)	3.151	12.096	4.593	14.59	18.90	24.0	6.64	143.66	143.60	0.005
MH-02 (STORM)	MH-11 (STORM)	188.2	(N/A)	(N/A)	1.393	10.696	4.898	6.88	19.78	24.0	2.19	142.38	141.35	0.005
OCS-1D (STORM)	MH-09 (STORM)	28.3	(N/A)	(N/A)	0.000	0.318	7.120	7.75	30.14	24.0	2.47	140.50	140.14	0.013
MH-09 (STORM)	O-4	27.9	(N/A)	(N/A)	0.000	2.794	7.120	19.67	18.69	24.0	6.73	140.14	140.00	0.005
MH-01 (STORM)	MH-03 (STORM)	60.3	(N/A)	(N/A)	3.151	11.882	4.640	14.74	18.90	24.0	4.69	143.96	143.66	0.005
OCS-2A (STORM)	MH-06 (STORM)	256.2	(N/A)	(N/A)	0.000	0.276	7.120	11.92	19.26	24.0	6.45	143.50	142.17	0.005
MH-04 (STORM)	CB-10	86.9	(N/A)	(N/A)	0.350	7.609	6.040	2.13	11.26	18.0	1.21	143.90	143.19	0.008
MH-05 (STORM)	MH-02 (STORM)	351.3	(N/A)	(N/A)	1.393	8.402	5.711	8.02	19.24	24.0	2.55	144.20	142.38	0.005
MH-10 (STORM)	CB-12	56.8	(N/A)	(N/A)	0.768	9.313	5.335	4.13	8.73	18.0	2.34	142.74	142.46	0.005
MH-12 (STORM)	O-3	50.4	(N/A)	(N/A)	1.877	6.530	6.487	12.27	19.23	24.0	6.49	140.64	140.50	0.005
MH-06 (STORM)	MH-07 (STORM)	51.7	(N/A)	(N/A)	0.000	0.937	7.120	11.92	16.92	24.0	3.79	142.17	141.97	0.004
MH-07 (STORM)	MH-08 (STORM)	187.2	(N/A)	(N/A)	0.000	1.165	7.120	11.92	17.86	24.0	3.79	141.97	141.13	0.004
MH-08 (STORM)	MH-09 (STORM)	183.7	(N/A)	(N/A)	0.000	1.987	7.120	11.92	19.62	24.0	3.79	141.13	140.14	0.005
CB-1	CB-2	118.9	(N/A)	(N/A)	0.929	6.000	6.706	6.28	8.31	18.0	3.55	145.50	144.97	0.004
CB-2	MH-01 (STORM)	105.2	(N/A)	(N/A)	1.636	11.185	4.792	7.90	18.59	24.0	2.52	144.47	143.96	0.005
CB-3	MH-01 (STORM)	126.4	(N/A)	(N/A)	1.515	6.626	6.447	9.85	8.82	18.0	5.57	145.10	144.46	0.005
CB-4	CB-3	101.7	(N/A)	(N/A)	0.708	6.000	6.706	4.79	9.93	18.0	2.71	145.75	145.10	0.006
CB-5	CB-2	110.7	(N/A)	(N/A)	0.093	6.000	6.706	0.63	10.42	18.0	0.36	145.75	144.97	0.007
CB-6	CB-7	128.2	(N/A)	(N/A)	0.410	6.000	6.706	2.77	8.70	18.0	1.57	146.20	145.57	0.005
CB-7	CB-8	71.5	(N/A)	(N/A)	0.938	7.362	6.142	5.81	9.12	18.0	3.29	145.57	145.18	0.005
CB-8	MH-05 (STORM)	193.5	(N/A)	(N/A)	1.393	7.725	5.992	8.41	8.83	18.0	4.76	145.18	144.20	0.005
CB-9	MH-04 (STORM)	129.3	(N/A)	(N/A)	0.350	6.000	6.706	2.37	8.44	18.0	1.34	144.50	143.90	0.005
CB-10	MH-10 (STORM)	66.8	(N/A)	(N/A)	0.698	8.809	5.543	3.90	10.20	18.0	2.21	143.19	142.74	0.007
CB-11	MH-10 (STORM)	31.1	(N/A)	(N/A)	0.070	6.000	6.706	0.47	17.55	18.0	0.27	144.86	144.24	0.020
CB-12	CB-13	104.4	(N/A)	(N/A)	0.905	9.716	5.167	4.71	8.76	18.0	2.67	142.46	141.95	0.005
CB-13	MH-11 (STORM)	19.5	(N/A)	(N/A)	1.178	10.357	4.972	5.90	9.01	18.0	3.34	141.95	141.85	0.005
CB-14	CB-15	51.1	(N/A)	(N/A)	0.781	6.000	6.706	5.28	3.00	12.0	6.72	141.75	141.49	0.005
CB-15	CB-16	47.2	(N/A)	(N/A)	0.830	6.127	6.654	5.57	19.06	24.0	5.26	140.99	140.75	0.005
CB-16	MH-12 (STORM)	22.8	(N/A)	(N/A)	1.576	6.403	6.539	10.39	18.72	24.0	6.11	140.75	140.64	0.005
CB-17	CB-16	117.3	(N/A)	(N/A)	0.405	6.000	6.706	2.74	10.08	18.0	4.85	142.02	141.25	0.007
CB-18	CB-19	82.7	(N/A)	(N/A)	0.112	6.000	6.706	0.76	10.37	18.0	3.42	141.88	141.30	0.007
CB-19	MH-12 (STORM)	31.2	(N/A)	(N/A)	0.301	6.403	6.539	1.98	8.92	18.0	4.06	141.30	141.14	0.005
O-2	MH-11 (STORM)	67.6	(N/A)	(N/A)	2.571	12.129	4.586	11.88	18.87	24.0	3.78	141.35	140.94	0.005
UGS-1D	OCS-1D (STORM)	47.0	(N/A)	(N/A)	0.000	0.000	7.120	7.75	0.00	24.0	2.47	140.50	140.50	0.000
UGS-2A	OCS-2A (STORM)	62.7	(N/A)	(N/A)	0.000	0.000	7.120	11.92	0.00	24.0	3.79	143.50	143.50	0.000

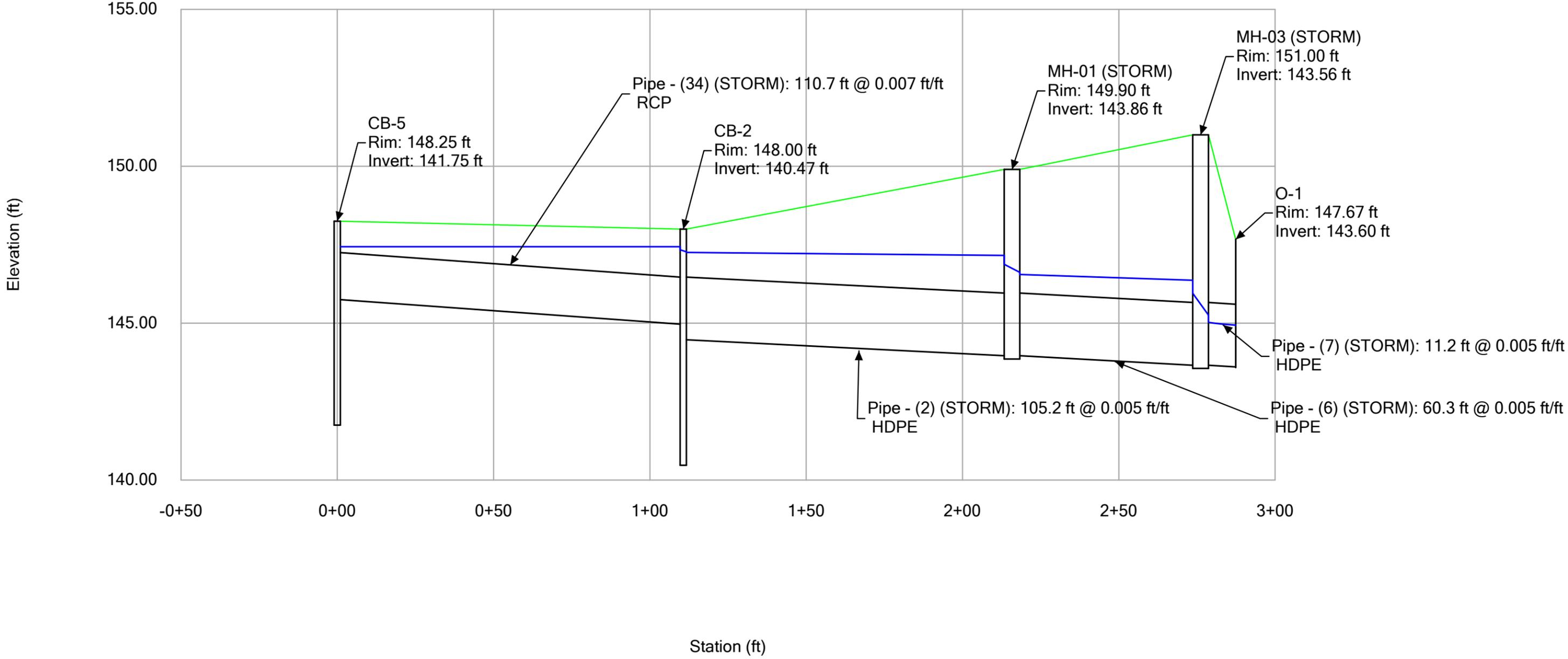
Profile Report
Engineering Profile - CB-1 TO O-1 (C-DAT-1901517-Proposed-Hydraulics.stsw)



Profile Report
Engineering Profile - CB-4 TO O-1 (C-DAT-1901517-Proposed-Hydraulics.stsw)

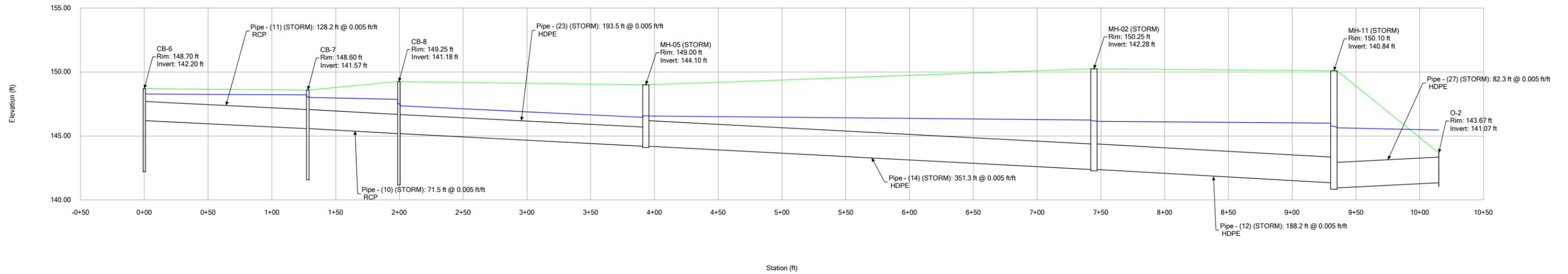


Profile Report
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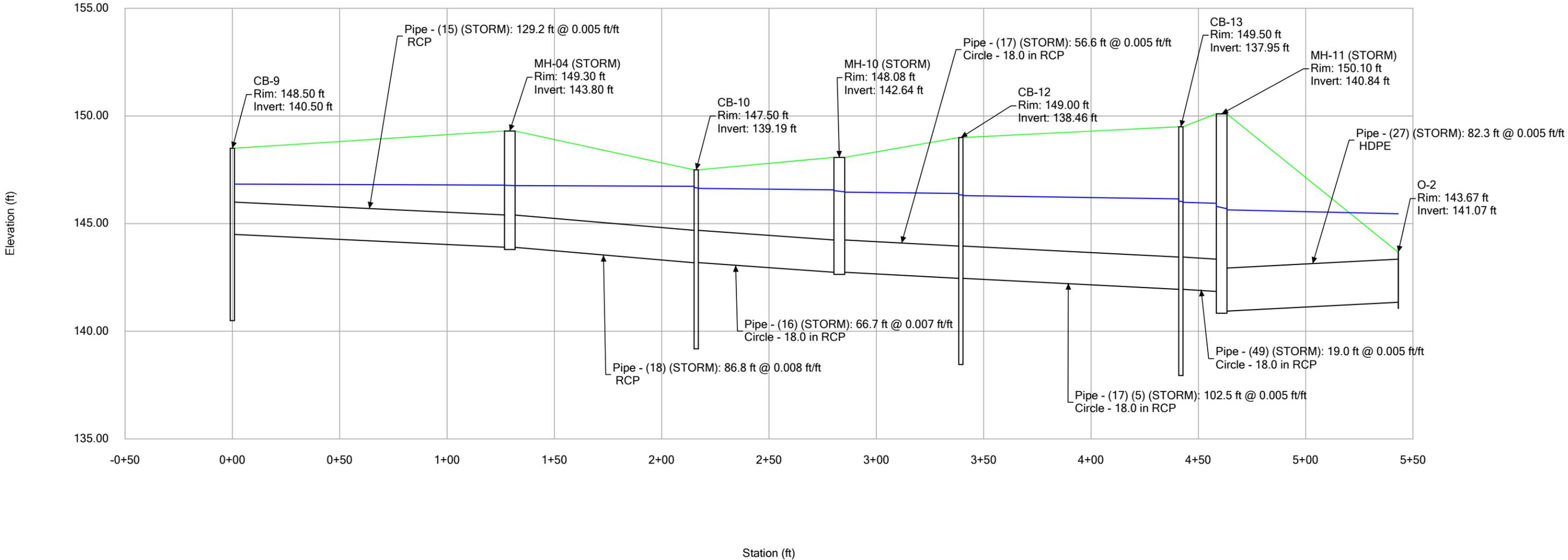
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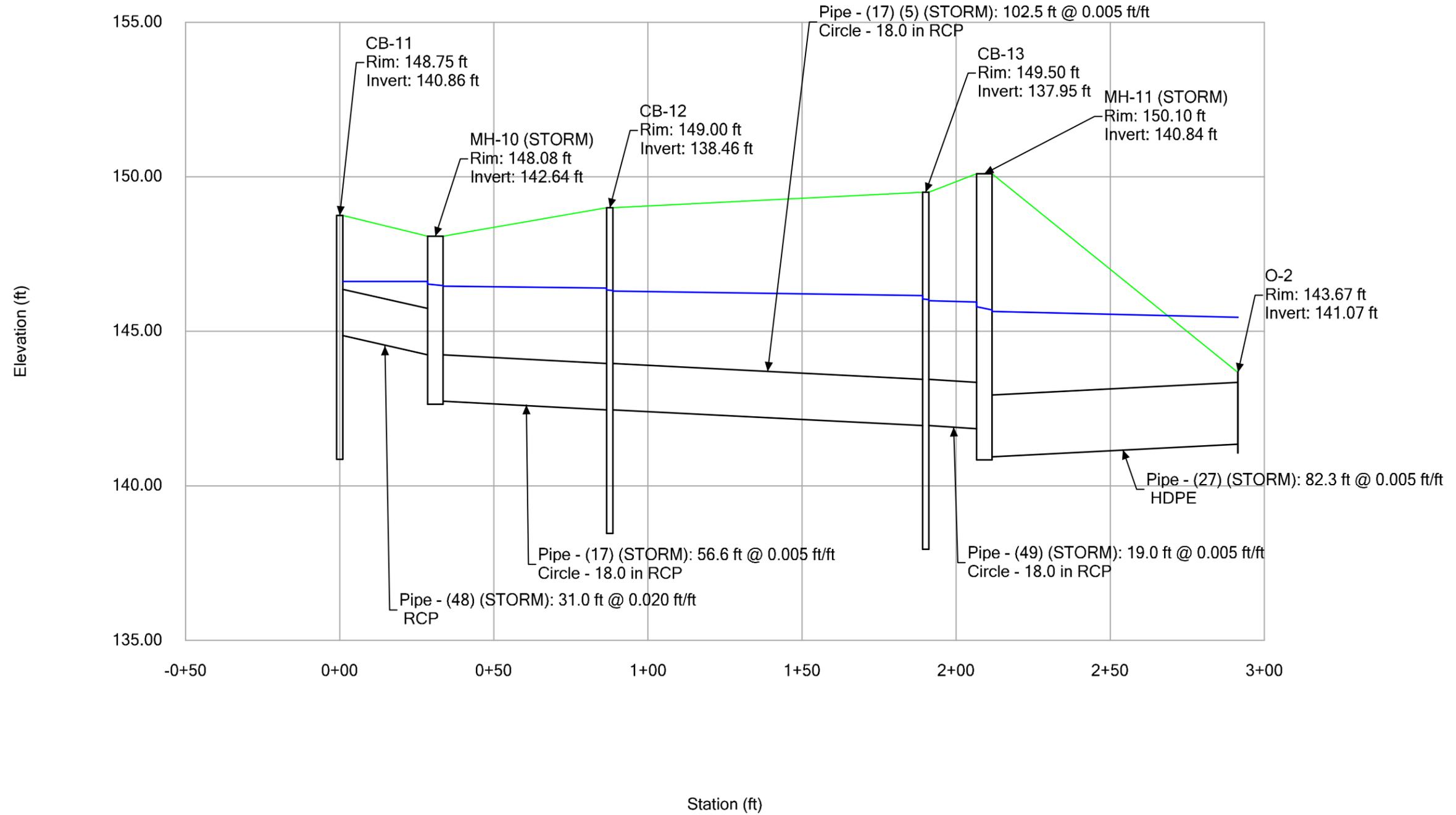


Profile Report

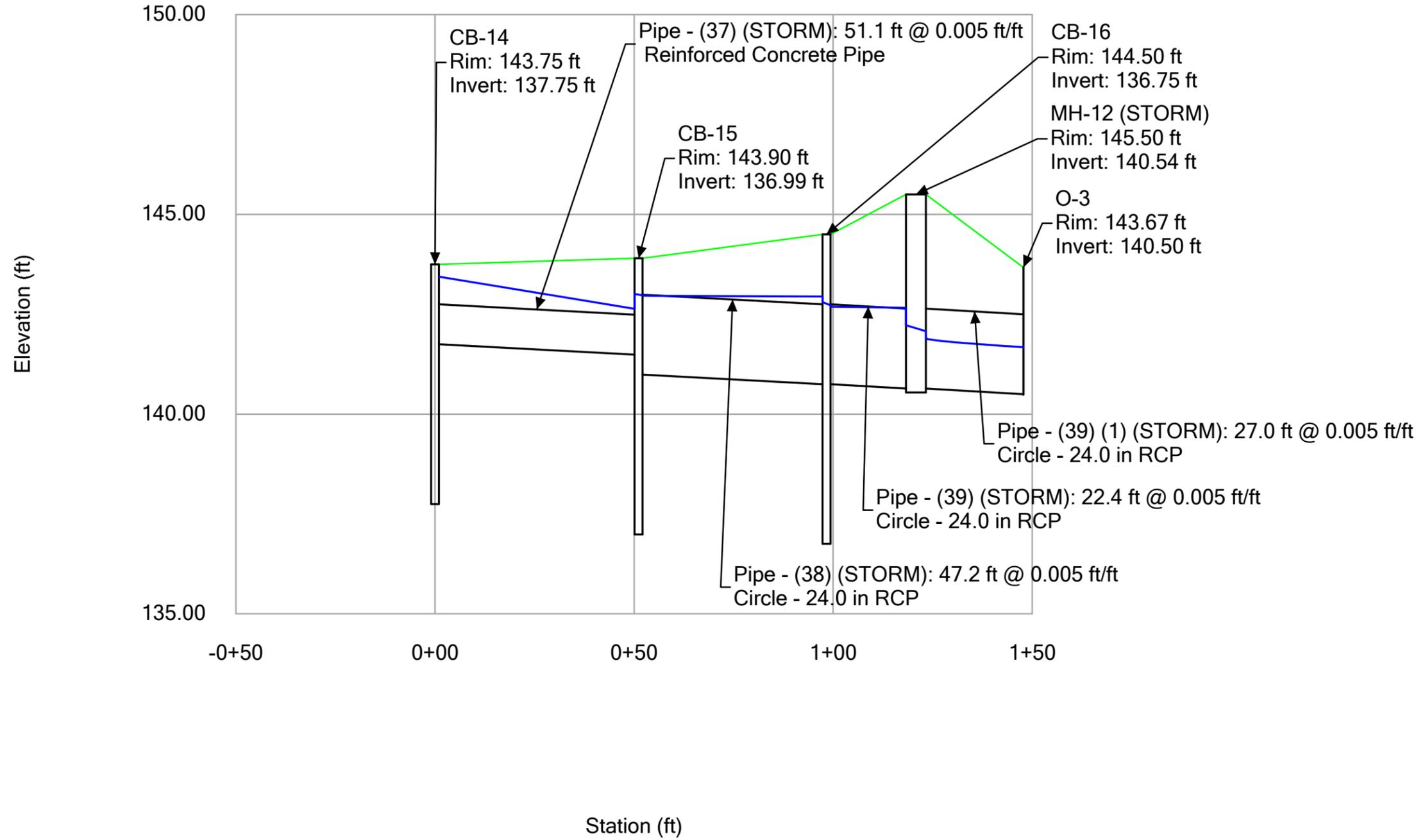
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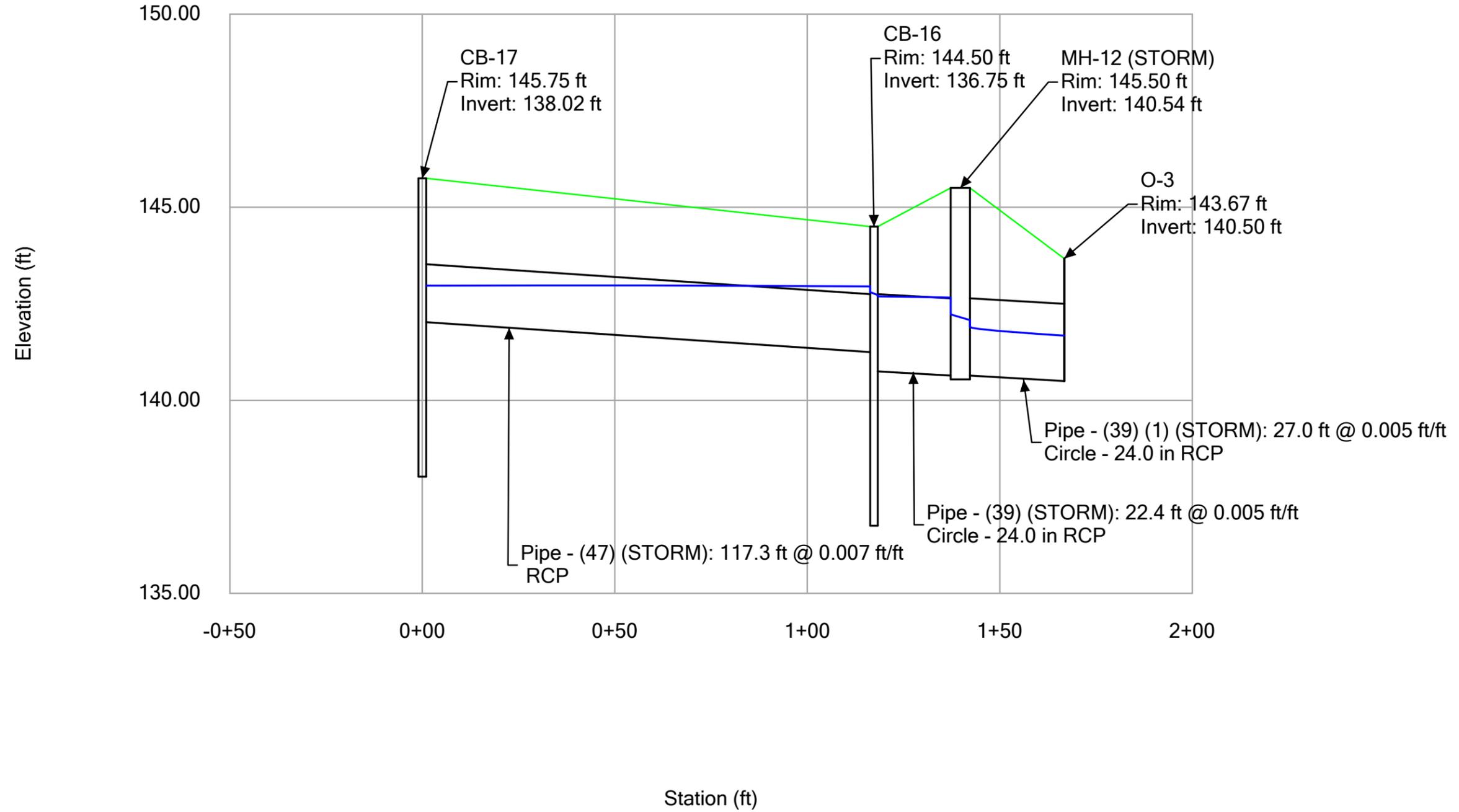
Profile Report
Engineering Profile - CB-11 TO O-2 (C-DAT-1901517-Proposed-Hydraulics.stsw)



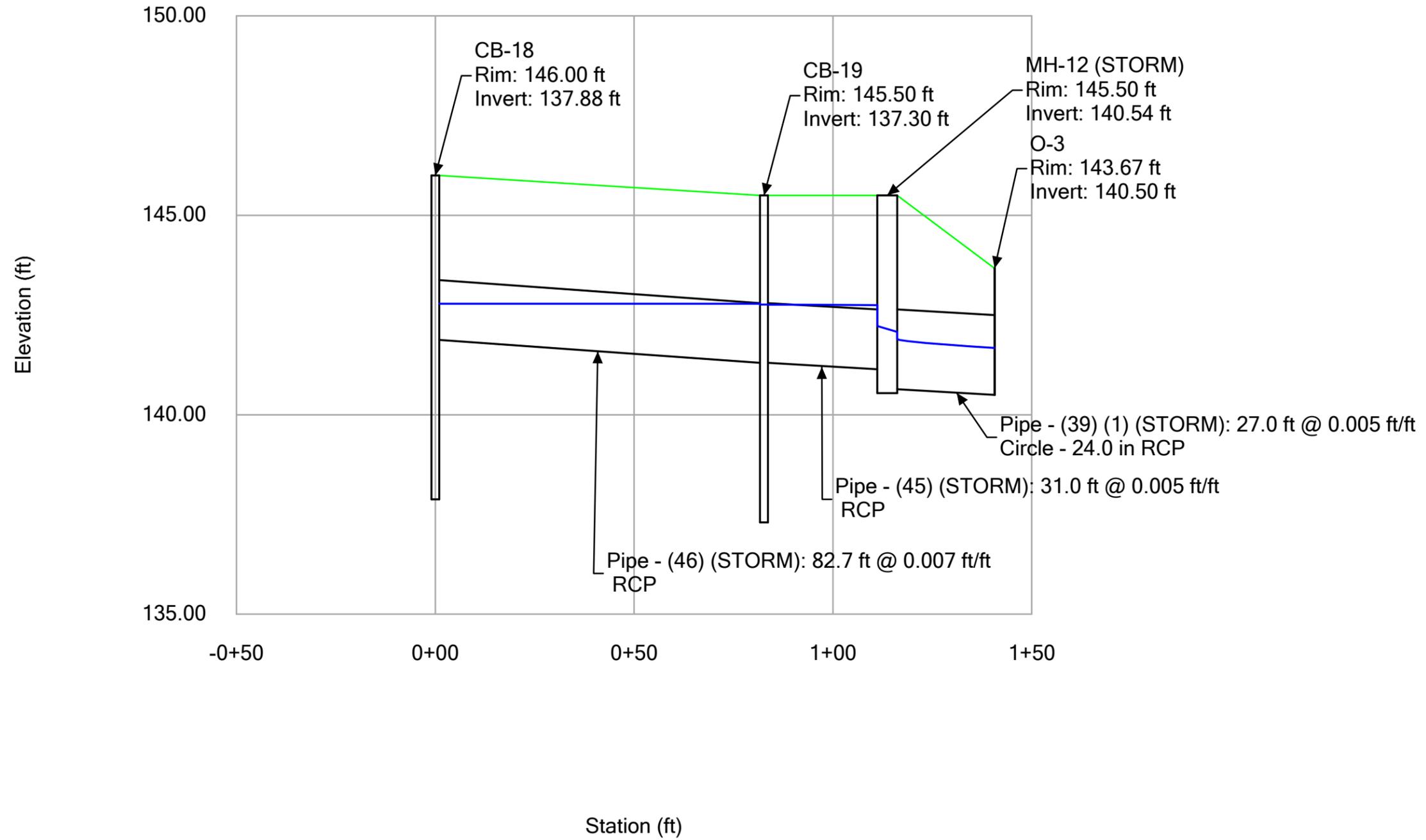
Profile Report
Engineering Profile - CB-14 TO O-3 (C-DAT-1901517-Proposed-Hydraulics.stsw)



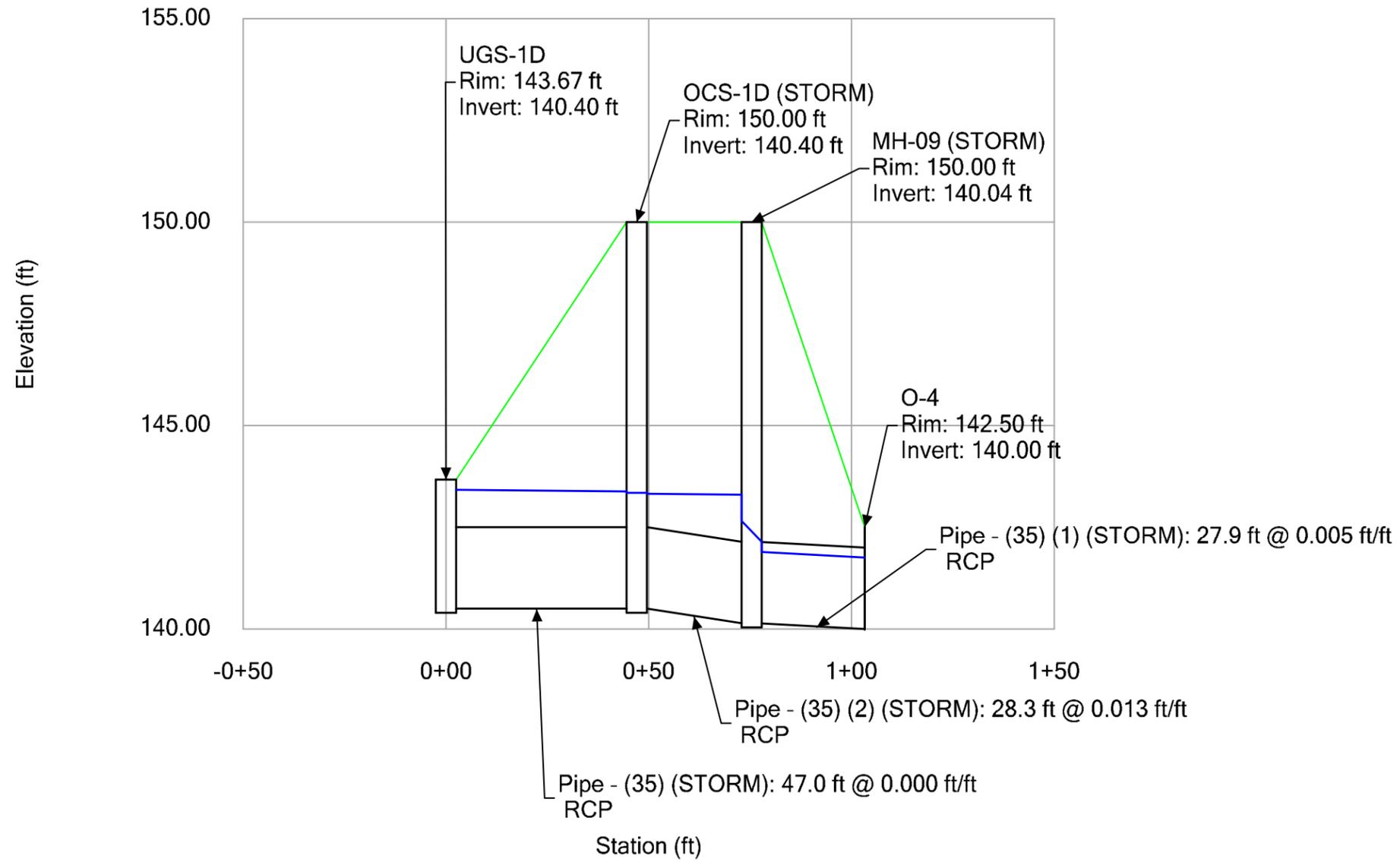
Profile Report
Engineering Profile - CB-17 TO O-3 (C-DAT-1901517-Proposed-Hydraulics.stsw)



Profile Report
Engineering Profile - CB-18 TO O-3 (C-DAT-1901517-Proposed-Hydraulics.stsw)

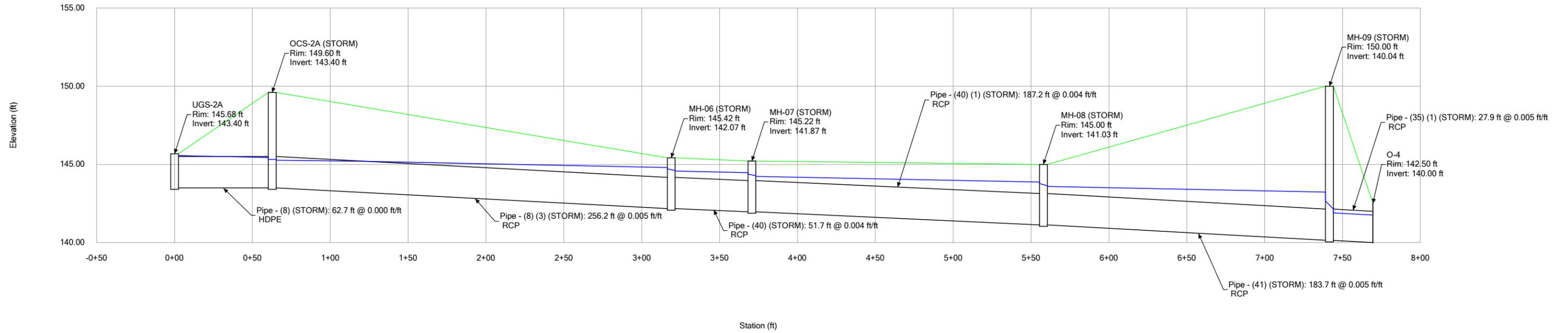


Profile Report
Engineering Profile - UGS-1D TO O-4 (C-DAT-1901517-Proposed-Hydraulics.stsw)



Profile Report

Engineering Profile - UGS-2A TO O-4 (C-DAT-1901517-Proposed-Hydraulics.stsw)



APPENDIX D

WATER QUALITY CALCULATIONS

Water Quality Volume and Groundwater Recharge Calculations

Constructed Stormwater Wetlands Pond Storage Sizing

Scour Hole Protection Sizing Calculations

Water Quality for Drainage Area 1E

PROJECT Proposed Development
DATE 7/13/2020
ADDRESS 100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) = 13771 square feet
Area (A) = 0.32 acres
Area (A) = 0.00049 square miles
Design Precipitation (P) = 0.5 inch
% Impervious Cover (I) = 100.00
Volumetric Runoff Coefficient (R) = 0.950

WQV =	0.013	ac-ft
	545	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area = 11059 square feet
Hydrologic Group A = 0.60 inch
Required Recharge Volume = 553 cu-ft

Water Quality for Drainage Area 1B

PROJECT Proposed Development
DATE 7/13/2020
ADDRESS 100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) = 100339 square feet
Area (A) = 2.30 acres
Area (A) = 0.00360 square miles
Design Precipitation (P) = 0.5 inch
% Impervious Cover (I) = 62.50
Volumetric Runoff Coefficient (R) = 0.613

WQV =	0.059	ac-ft
	2561	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area = 23415 square feet
Hydrologic Group A = 0.60 inch
Required Recharge Volume = 1171 cu-ft

Water Quality for Drainage Area 1D

PROJECT	Proposed Development
DATE	7/13/2020
ADDRESS	100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) =	56696	square feet
Area (A) =	1.30	acres
Area (A) =	0.00203	square miles
Design Precipitation (P) =	0.5	inch
% Impervious Cover (I) =	99.20	
Volumetric Runoff Coefficient (R) =	0.943	

WQV =	0.051	ac-ft
	2227	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area =	13728	square feet
Hydrologic Group A =	0.60	inch
Required Recharge Volume =	686	cu-ft

Water Quality for Drainage Area 2A

PROJECT	Proposed Development
DATE	7/13/2020
ADDRESS	100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) =	152357	square feet
Area (A) =	3.50	acres
Area (A) =	0.00547	square miles
Design Precipitation (P) =	0.5	inch
% Impervious Cover (I) =	93.60	
Volumetric Runoff Coefficient (R) =	0.892	

WQV =	0.130	ac-ft
	5665	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area =	59418	square feet
Hydrologic Group A =	0.60	inch
Required Recharge Volume =	2971	cu-ft

Water Quality for Drainage Area 2B

PROJECT	Proposed Development
DATE	7/13/2020
ADDRESS	100 Industrial Park Road

WATER QUALITY VOLUME (WQV) CALCULATION

Area (A) =	90674	square feet
Area (A) =	2.08	acres
Area (A) =	0.00325	square miles
Design Precipitation (P) =	0.5	inch
% Impervious Cover (I) =	99.10	
Volumetric Runoff Coefficient (R) =	0.942	

WQV =	0.082	ac-ft
	3559	cu-ft

GROUNDWATER RECHARGE CALCULATION

New Impervious Area =	1217	square feet
Hydrologic Group A =	0.60	inch
Required Recharge Volume =	61	cu-ft

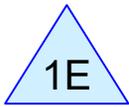
Stormwater Wetland Pond 1E Sizing

PROJECT	Proposed Development
DATE	7/13/2020
ADDRESS	100 Industrial Park Road

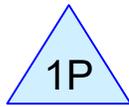
Receiving Areas	WQV (cu-ft)
P1E	545
P1B	2,561
P1D	2,227
P2A	5,665
P2B	3,559
Total	14,557

Constructed Extended Detention Stormwater Wetland Pond Sizing

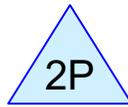
Stormwater Wetland Pond Component	% WQV per MA Stormwater Handbook	Volume Required (cu-ft)	Volume Provided (cu-ft)
Forebay	10%	1,456	1,484
Micropool	10%	1,456	1,502
Low-Marsh	20%	2,911	3,269
High-Marsh	10%	1,456	2,306
Semi-Wet	50%	7,278	25,393
Total	100%	14,557	33,954



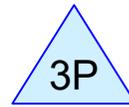
Stormwater Wetland
(Semi-Wet Zone)



Forebay



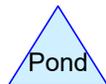
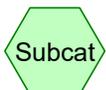
Micropool



Low Marsh



High Marsh



Routing Diagram for 1901517-HYDRO - Wetland Pond
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1901517-HYDRO - Wetland Pond

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

Prepared by {enter your company name here}

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Page 2

Summary for Pond 1E: Stormwater Wetland (Semi-Wet Zone)

Volume	Invert	Avail.Storage	Storage Description
#1	140.00'	25,393 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
140.00	6,787	0	0
141.00	8,071	7,429	7,429
142.00	8,971	8,521	15,950
142.50	9,430	4,600	20,550
143.00	9,940	4,843	25,393

Device	Routing	Invert	Outlet Devices
#1	Primary	140.00'	18.0" Round Culvert L= 72.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0069 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#2	Secondary	140.00'	18.0" Round Culvert L= 71.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 140.00' / 139.50' S= 0.0070 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf
#3	Tertiary	142.50'	20.0' long x 10.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#4	Device 1	140.00'	15.0" Vert. Orifice/Grate C= 0.600
#5	Device 2	140.00'	15.0" Vert. Orifice/Grate C= 0.600
#6	Device 1	142.00'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#7	Device 2	142.00'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

- ↑ 1=Culvert (Controls 0.00 cfs)
 - ↑ 4=Orifice/Grate (Controls 0.00 cfs)
 - ↑ 6=Orifice/Grate (Controls 0.00 cfs)

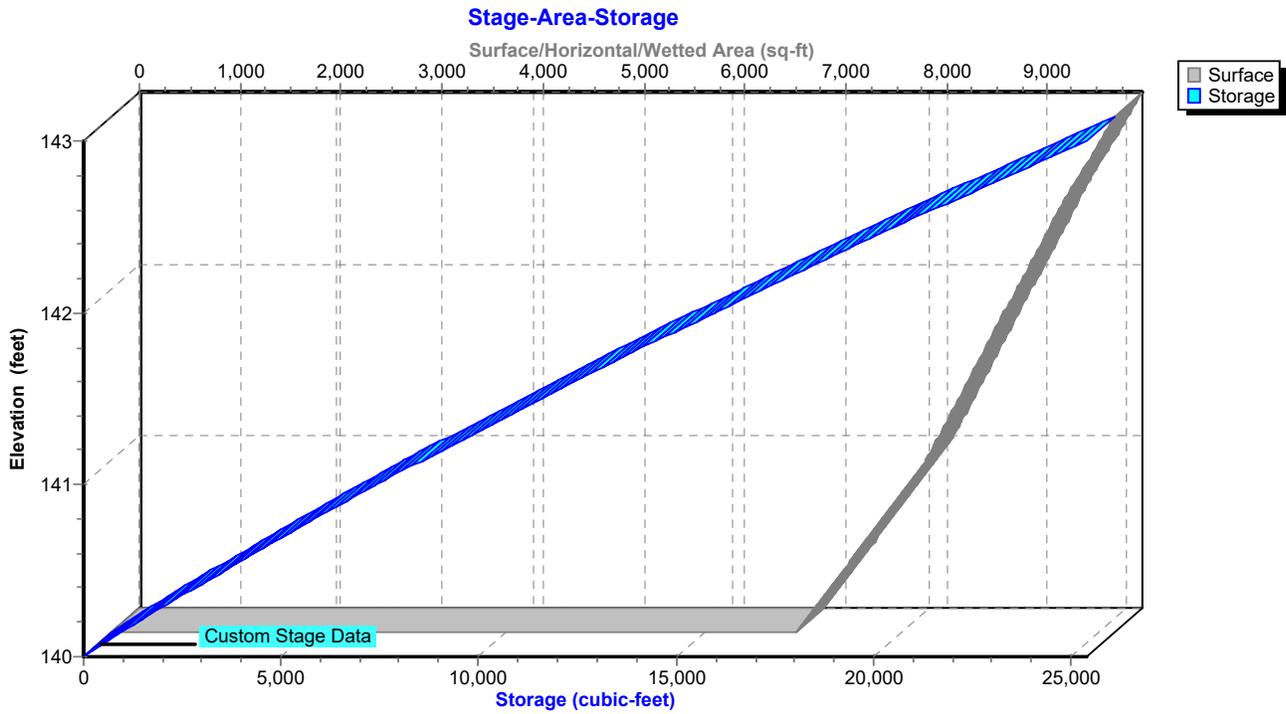
Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

- ↑ 2=Culvert (Controls 0.00 cfs)
 - ↑ 5=Orifice/Grate (Controls 0.00 cfs)
 - ↑ 7=Orifice/Grate (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

- ↑ 3=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 1E: Stormwater Wetland (Semi-Wet Zone)



1901517-HYDRO - Wetland Pond

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

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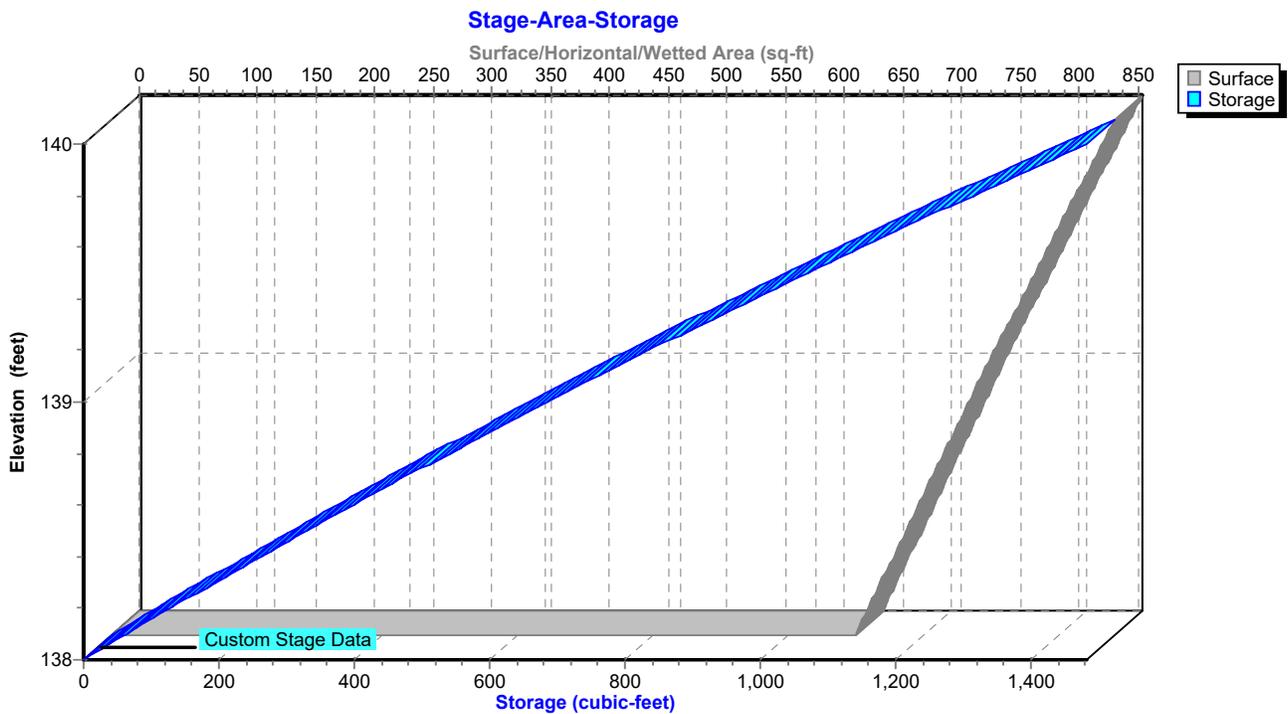
Page 4

Summary for Pond 1P: Forebay

Volume	Invert	Avail.Storage	Storage Description
#1	138.00'	1,484 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
138.00	633	0	0
139.00	740	687	687
140.00	854	797	1,484

Pond 1P: Forebay



1901517-HYDRO - Wetland Pond

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

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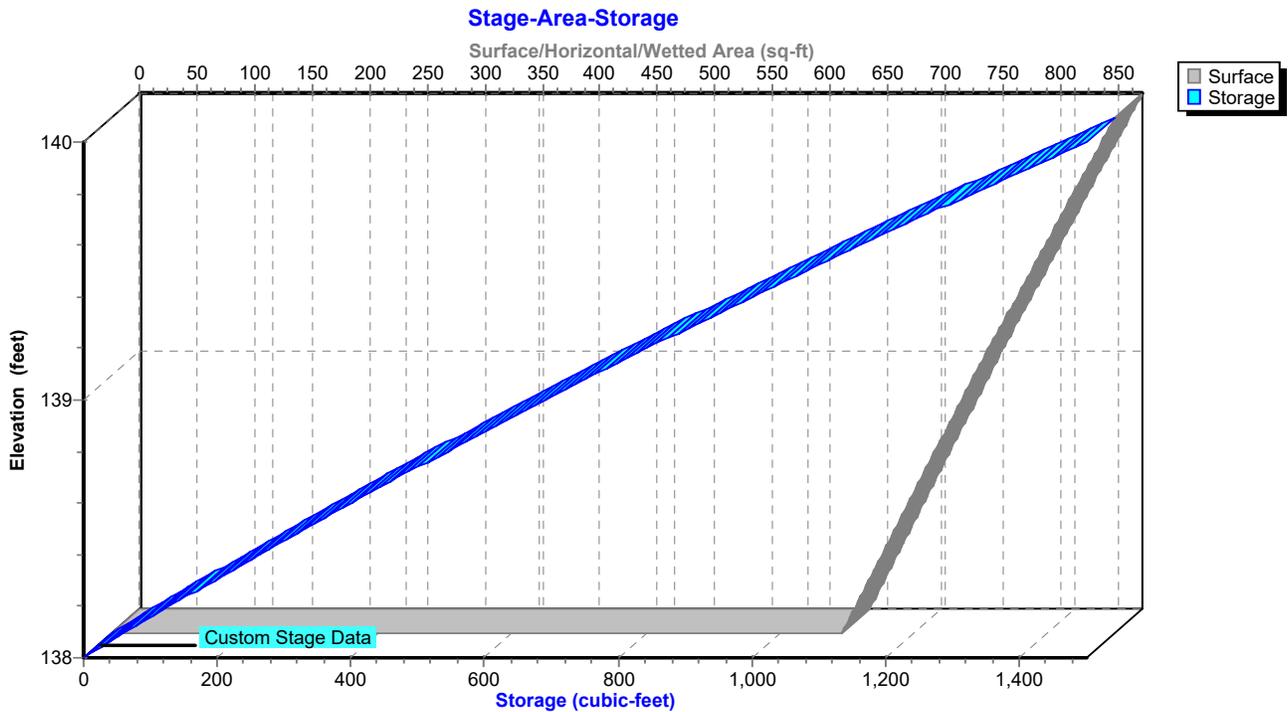
Page 5

Summary for Pond 2P: Micropool

Volume	Invert	Avail.Storage	Storage Description
#1	138.00'	1,502 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
138.00	634	0	0
139.00	749	692	692
140.00	871	810	1,502

Pond 2P: Micropool



1901517-HYDRO - Wetland Pond

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

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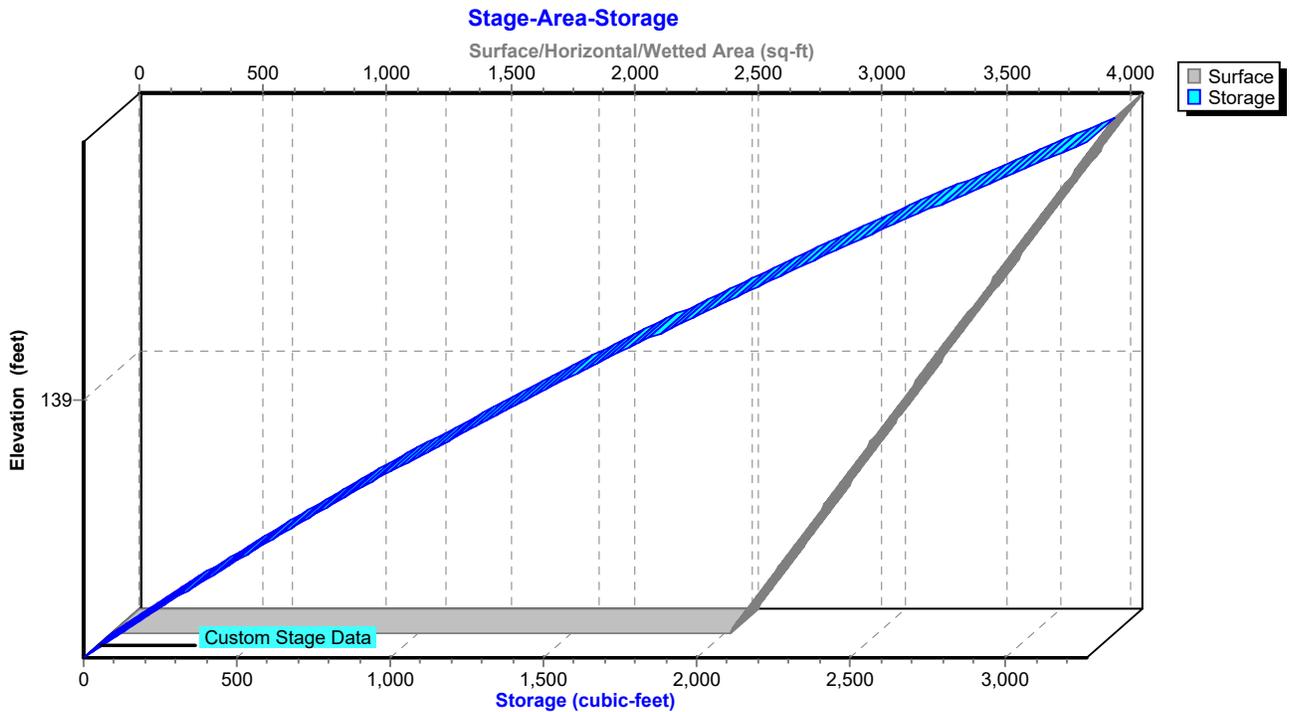
Page 6

Summary for Pond 3P: Low Marsh

Volume	Invert	Avail.Storage	Storage Description
#1	138.50'	3,269 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
138.50	2,495	0	0
139.00	3,265	1,440	1,440
139.50	4,049	1,829	3,269

Pond 3P: Low Marsh



1901517-HYDRO - Wetland Pond

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

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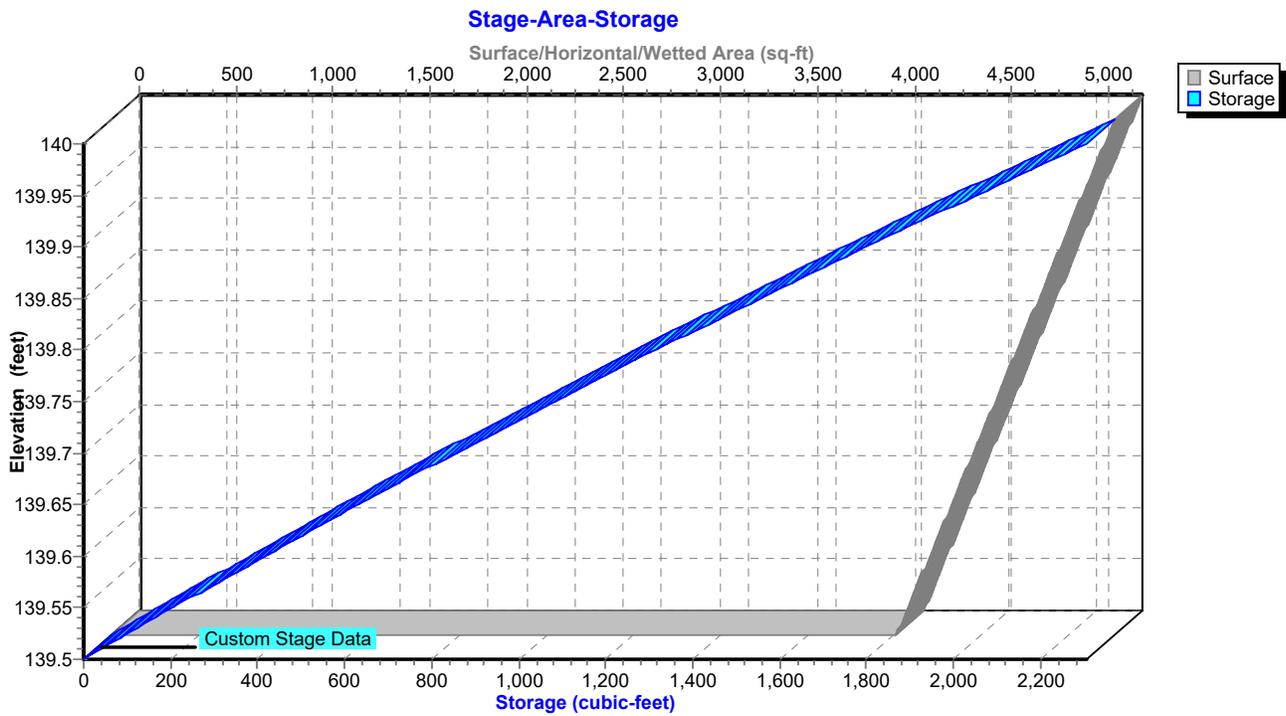
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Page 7

Summary for Pond 4P: High Marsh

Volume	Invert	Avail.Storage	Storage Description
#1	139.50'	2,306 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
139.50	4,049	0	0
140.00	5,175	2,306	2,306

Pond 4P: High Marsh



Scour Hole Outlet Protection

PROJECT NAME: Proposed Development
 LOCATION: 100 Industrial Park Road, Hingham MA
 PREPARED BY: ATK DATE: 5/12/2020
 LAST REVISED BY: ATK DATE: 7/13/2020

Outlet Number	Flow (cfs)	Pipe Diameter Sp (in)	Tailwater Depth TW (ft)	Type	B (ft)	C (ft)	d ₅₀ (ft)	2Sp (ft)	3Sp (ft)	F (ft)	Riprap Type
N/A	12.00	18	1.50	1	7.5	9	0.13	3.0	4.5	0.75	Modified

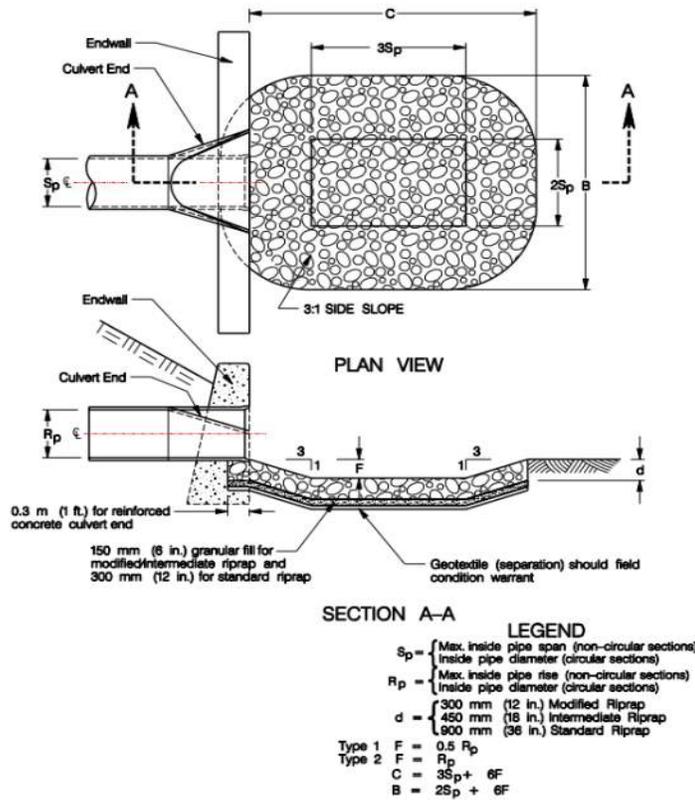


Figure 11-15 Preformed Scour Hole Type 1 and Type 2

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

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 DARK 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, BROWN TO TAN, FINE SAND, SOME SILT, MOST FANT REDDIFORM STAINING PRESENT. [USDA CLASSIFICATION: SANDY 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 REDDIFORM STAINING PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
8.5-10.5	GLACIAL DRIFT (S-5): MEDIUM DENSE, GRAY TO BROWN, FINE SAND, SOME SILT, WE, FEW REDDIFORM STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SANDY LOAM]

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 WE, [USDA CLASSIFICATION: SILT LOAM]
3.0-4.5	GLACIAL DRIFT (S-2B): MEDIUM DENSE, BROWN, FINE TO COARSE SAND, SOME SILT, WE, [USDA CLASSIFICATION: SANDY LOAM]
4.5-8.5	GLACIAL DRIFT (S-3): DENSE, BROWN TO GRAY, FINE TO MEDIUM SAND AND SILT, WE, SEVERAL REDDIFORM STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
8.5-8.5	GLACIAL DRIFT (S-4): MEDIUM DENSE, TAN TO ORANGISH-BROWN, SILT AND FINE TO MEDIUM SAND, TRACE CLAY, WE, SEVERAL REDDIFORM STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SILT LOAM]

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 FEW 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 REDDIFORM 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, 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, GRAY-BROWN TO PINK TO GRAY, WEATHERED BEDROCK PARTICLES/FRAGMENTS, MOST TO WE, BORING TERMINATED AT 6.3 FEET ON AUGER REFUSAL.

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, WE, STRONG RESISTANCE WHEN ADVANCING AUGERS TO 2.5 FEET BGS. [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 PS 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.

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 COARSE SAND, SOME SILT, LITTLE FINE GRAVEL, MOST. [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, WEATHERED BEDROCK FRAGMENTS PRESENT IN SOIL CUTTINGS AND TIP OF SPLIT-SPOON. [USDA CLASSIFICATION: GRAVELLY SANDY LOAM]
4.5-6.3	GLACIAL FILL (S-3): VERY DENSE, GRAY, ONE PIECE OF COARSE GRAVEL PRESENT WITHIN SPLIT-SPOON SAMPLE. [USDA CLASSIFICATION: SANDY LOAM]
6.5-8.5	GLACIAL FILL (S-4): DENSE, TAN TO LIGHT GRAY, FINE TO COARSE SAND, SOME SILT, LITTLE FINE GRAVEL, WE, FANT REDDIFORM STAINING PRESENT. WEATHERED BEDROCK FRAGMENTS PRESENT IN SOIL CUTTINGS AND TIP OF SPLIT-SPOON. [USDA CLASSIFICATION: SANDY LOAM]

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, DARK BROWN TO TAN, FINE TO COARSE SAND, SOME SILT, WE, [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, WEATHERED BEDROCK FRAGMENTS PRESENT IN SOIL CUTTINGS AND TIP OF SPLIT-SPOON. [USDA CLASSIFICATION: SANDY LOAM]
4.5-6.3	GLACIAL FILL (S-3): VERY DENSE, GRAY, ONE PIECE OF COARSE GRAVEL PRESENT WITHIN SPLIT-SPOON SAMPLE. [USDA CLASSIFICATION: SANDY LOAM]
6.5-8.5	GLACIAL FILL (S-4): DENSE, DARK BROWN, ORGANIC SILT, SOME FINE TO COARSE SAND, TRACE FINE GRAVEL, FEW WOOD PARTICLES/FRAGMENTS, VERY FEW ROOTS, WE, [USDA CLASSIFICATION: SILT LOAM]

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]
2.5-3.0	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 WE, [USDA CLASSIFICATION: SANDY LOAM]
3.0-4.5	GLACIAL DRIFT (S-3): DENSE, DARK BROWN TO DARK GRAY, FINE TO COARSE SAND, SOME SILT, WE, [USDA CLASSIFICATION: SANDY LOAM]
4.5-6.5	GLACIAL FILL (S-4): DENSE, DARK BROWN, ORGANIC SILT, SOME FINE TO COARSE SAND, TRACE FINE GRAVEL, FEW WOOD PARTICLES/FRAGMENTS, VERY FEW ROOTS, WE, [USDA CLASSIFICATION: SILT LOAM]
6.5-8.5	GLACIAL FILL (S-5): LOOSE TO MEDIUM DENSE, BROWN FINE TO MEDIUM SAND, LITTLE SILT, WE, FEW REDDIFORM STAINING POCKETS PRESENT. [USDA CLASSIFICATION: LOAMY SAND]

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, TRACE SILT, TRACE FINE GRAVEL, VERY FEW BROCK AND ASPHALT PARTICLES/FRAGMENTS, MOST. [USDA CLASSIFICATION: SANDY LOAM]
2.5-3.0	GLACIAL DRIFT (S-2): MEDIUM DENSE, BROWN TO DARK GRAY, FINE TO COARSE SAND, TRACE SILT, FEW ASPHALT PARTICLES, MOST. [USDA CLASSIFICATION: SANDY LOAM]
3.0-4.5	GLACIAL DRIFT (S-3): MEDIUM DENSE, TAN TO GRAY, FINE TO MEDIUM SAND, TRACE SILT, MOST, VERY FANT REDDIFORM STAINING PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
4.5-6.5	GLACIAL FILL (S-4): LOOSE TO MEDIUM DENSE, TAN, FINE TO MEDIUM SAND, TRACE SILT, MOST TO WE, FEW REDDIFORM STAINING POCKETS PRESENT. [USDA CLASSIFICATION: SANDY LOAM]
6.5-8.5	GLACIAL FILL (S-5): LOOSE TO MEDIUM DENSE, BROWN FINE TO MEDIUM SAND, LITTLE SILT, WE, FEW REDDIFORM STAINING POCKETS PRESENT. [USDA CLASSIFICATION: LOAMY SAND]

DEPTH (IN)	DESCRIPTION
0-3	PAVEMENT
3-25	SOIL HORIZON: FILL OTHER: FRACTURED LEDGE REFUSAL AT 25"

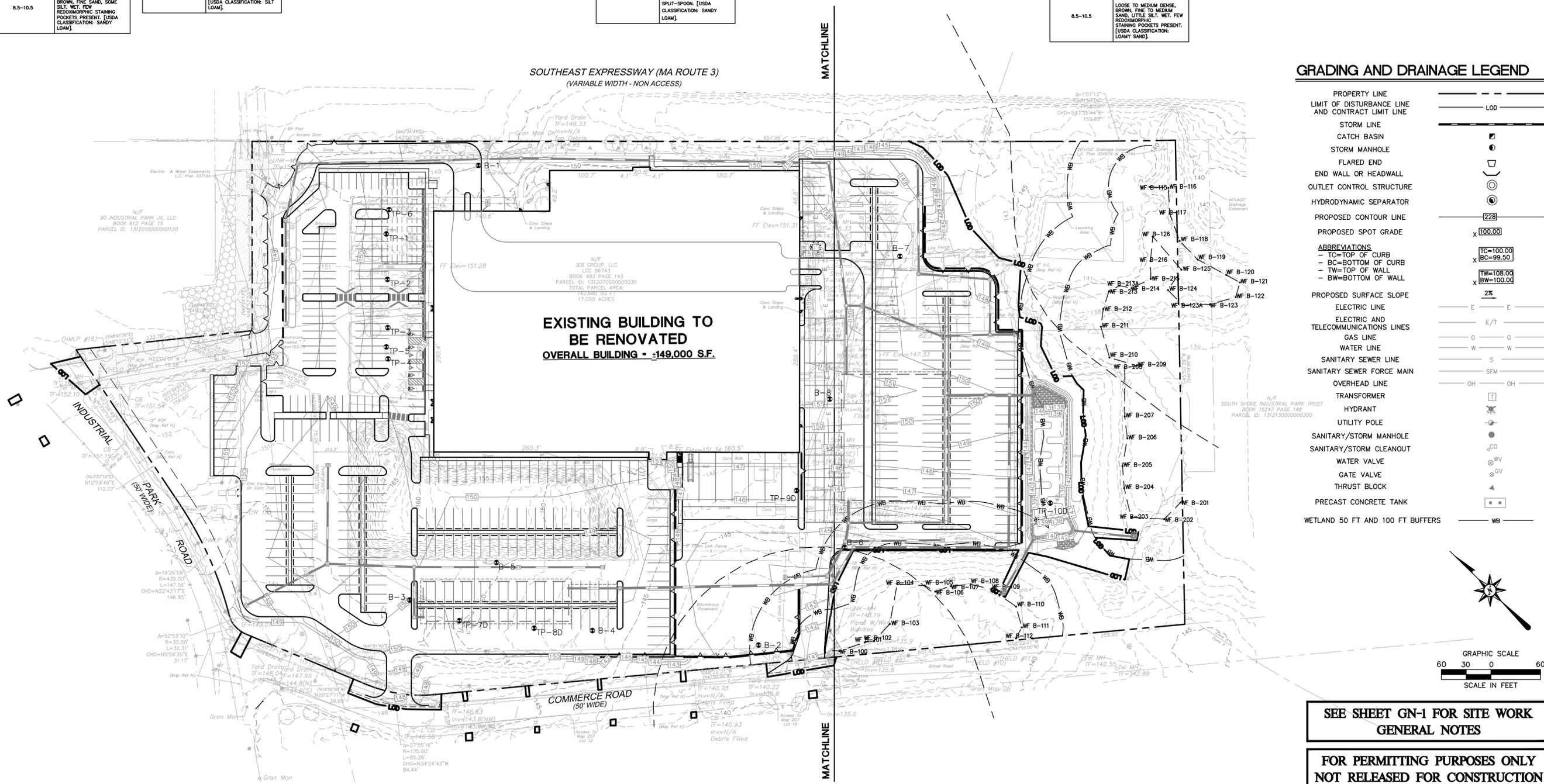
DEPTH (IN)	DESCRIPTION
0-60	FILL
60-103	SOIL HORIZON: C SOIL TEXTURE: MEDIUM SAND SOIL COLOR: 2.5Y/7.0 QHES: LOOSE, SINGLE GRAIN, STRATIFIED, 5% GRAVEL, WEAVING AT 96" ESTIMATED SEASONAL HIGH GROUND WATER AT 96"

DEPTH (IN)	DESCRIPTION
0-3	PAVEMENT
3-28	SOIL HORIZON: FILL OTHER: FRACTURED LEDGE REFUSAL AT 28"

DEPTH (IN)	DESCRIPTION
0-61	FILL AND GRASS COVER REFUSAL AT 61"

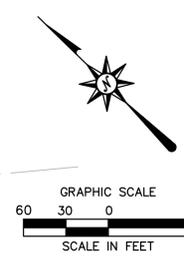
SOUTHEAST EXPRESSWAY (MA ROUTE 3)
(VARIABLE WIDTH - NON ACCESS)

EXISTING BUILDING TO BE RENOVATED
OVERALL BUILDING - 3149,000 S.F.



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
- ABBREVIATIONS
- TC=TOP OF CURB
- BC=BOTTOM OF CURB
- TW=TOP OF WALL
- BW=BOTTOM OF WALL
- PROPOSED SURFACE SLOPE
- ELECTRIC LINE
- ELECTRIC AND TELECOMMUNICATIONS LINES
- GAS LINE
- WATER LINE
- SANITARY SEWER LINE
- SANITARY SEWER FORCE MAIN
- OVERHEAD LINE
- TRANSFORMER
- HYDRANT
- UTILITY POLE
- SANITARY/STORM MANHOLE
- SANITARY/STORM CLEANOUT
- WATER VALVE
- GATE VALVE
- THRUST BLOCK
- PRECAST CONCRETE TANK
- WETLAND 50 FT AND 100 FT BUFFERS



SEE SHEET GN-1 FOR SITE WORK
GENERAL NOTES

FOR PERMITTING PURPOSES ONLY
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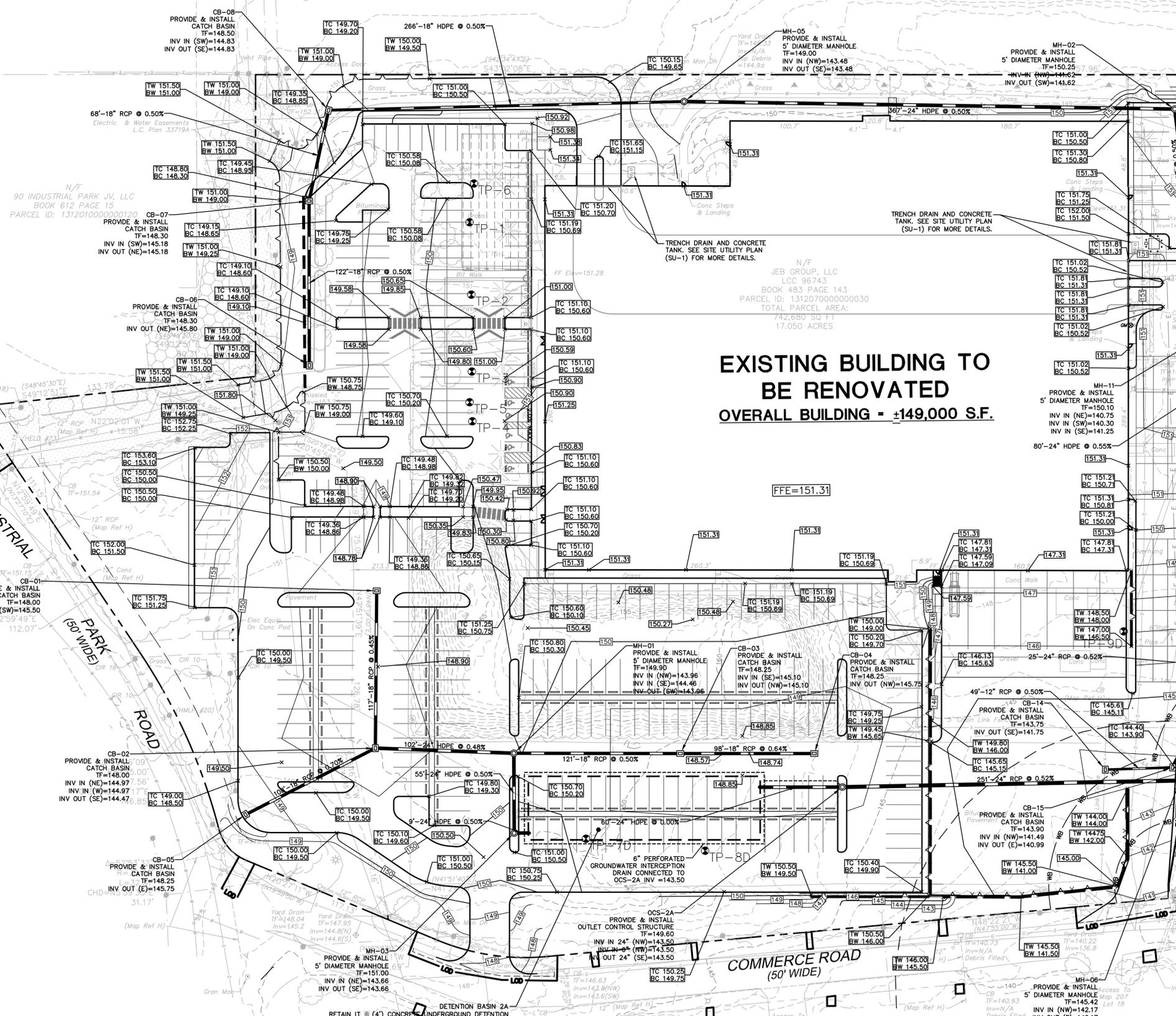
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SOUTHEAST EXPRESSWAY (MA ROUTE 3)
(VARIABLE WIDTH - NON ACCESS)

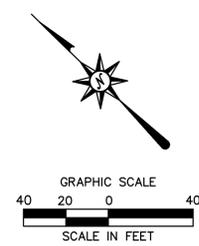
GRADING AND DRAINAGE LEGEND

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	BC=99.50
- TW=TOP OF WALL	TW=108.00
- BW=BOTTOM OF WALL	BW=100.00
PROPOSED SURFACE SLOPE	2%
ELECTRIC LINE	E
ELECTRIC AND TELECOMMUNICATIONS LINES	E/T
GAS LINE	G
WATER LINE	W
SANITARY SEWER LINE	S
SANITARY SEWER FORCE MAIN	SFM
OVERHEAD LINE	OH
TRANSFORMER	⊕
HYDRANT	⊕
UTILITY POLE	⊕
SANITARY/STORM MANHOLE	⊕
SANITARY/STORM CLEANOUT	⊕
WATER VALVE	⊕
GATE VALVE	⊕
THRUST BLOCK	⊕
PRECAST CONCRETE TANK	⊕
WETLAND 50 FT AND 100 FT BUFFERS	WB



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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Desc. _____
Date _____
No. _____

1.	06/07/2020	Reviewed per Staff and Commission Comments
2.	07/13/2020	Reviewed per Planning and Peer Review Comments

Designed _____ A.T.K.
Drawn _____ A.T.K.
Reviewed _____
Scale 1"=40'
Project No. 190151701
Date 03/06/2020
CAD File: GD190151701

GRADING AND DRAINAGE PLAN

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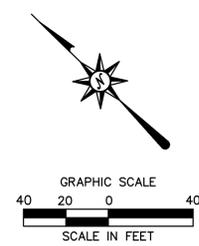
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GRADING AND DRAINAGE LEGEND

PROPERTY LINE	---
LIMIT OF DISTURBANCE LINE AND CONTRACT LIMIT LINE	--- LOD ---
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	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	⊙
PRECAST CONCRETE TANK	⊙
WETLAND 50 FT AND 100 FT BUFFERS	WB

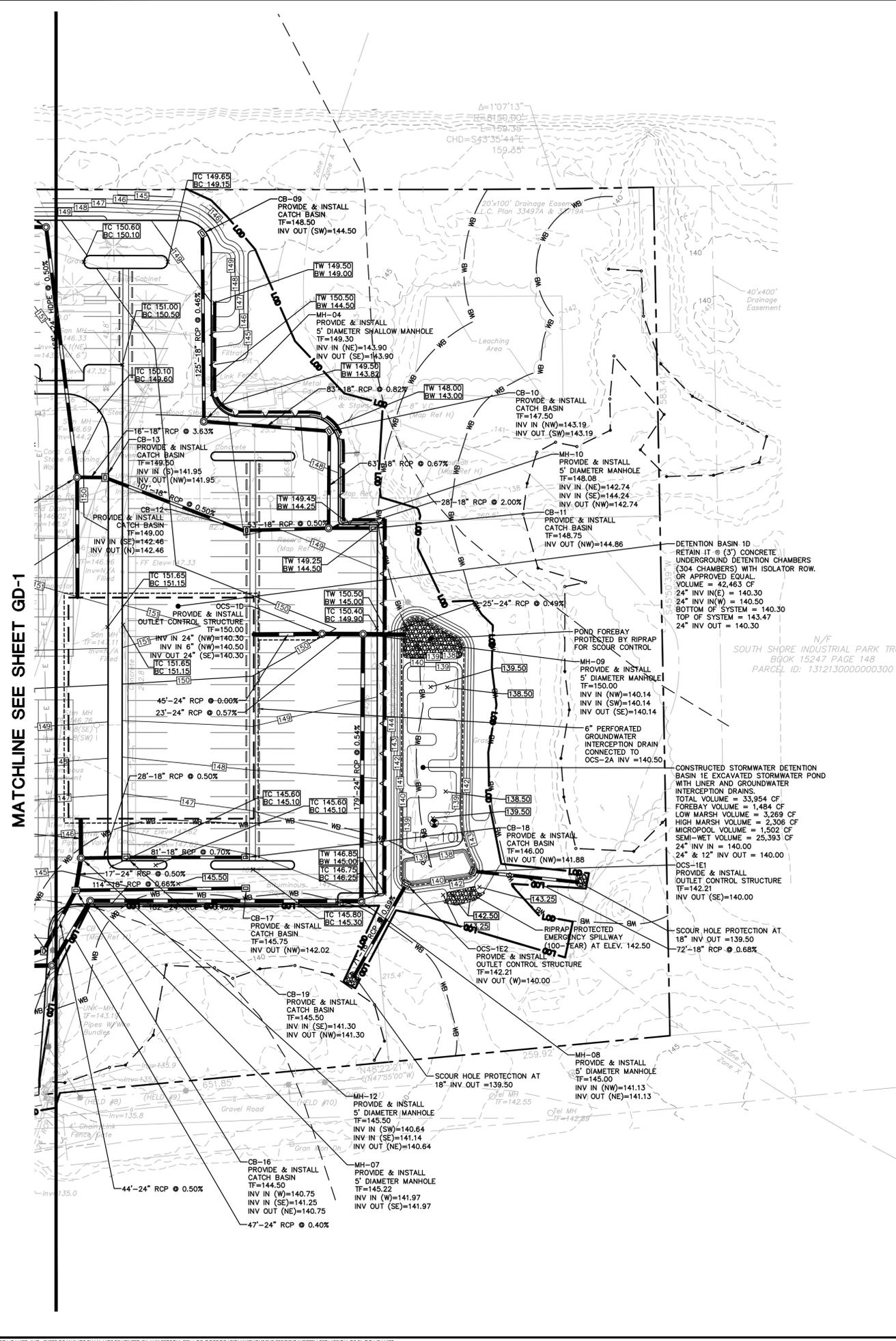
NOTES:

- IN REGARD TO THE CONSTRUCTED STORMWATER WETLAND; FROM 310 CMR: DEPARTMENT OF ENVIRONMENTAL PROTECTION, SECTION 10.02(2)(b)(3)(c) "NOTWITHSTANDING THE PROVISIONS OF 310 CMR 10.02(1) AND (2)(A) AND (B), STORMWATER MANAGEMENT SYSTEMS DESIGNED, CONSTRUCTED, INSTALLED, OPERATED, MAINTAINED, AND/OR IMPROVED AS DEFINED IN 310 CMR 10.04 IN ACCORDANCE WITH THE STORMWATER MANAGEMENT STANDARDS AS PROVIDED IN THE STORMWATER MANAGEMENT POLICY (1996) OR 310 CMR 10.05(6)(k) THROUGH (O) DO NOT BY THEMSELVES CONSTITUTE AREAS SUBJECT TO PROTECTION UNDER M.G.L. C. 131, § 40 OR BUFFER ZONE PROVIDED THAT:
 - THE SYSTEM WAS DESIGNED, CONSTRUCTED, INSTALLED, AND/OR IMPROVED AS DEFINED IN 310 CMR 10.04 ON OR AFTER NOVEMBER 18, 1996; AND
 - IF THE SYSTEM WAS CONSTRUCTED IN AN AREA SUBJECT TO PROTECTION UNDER M.G.L. C. 131, § 40 OR BUFFER ZONE, THE SYSTEM WAS DESIGNED, CONSTRUCTED, AND INSTALLED IN ACCORDANCE WITH ALL APPLICABLE PROVISIONS IN 310 CMR 10.00."
- IN REGARD TO THE CONSTRUCTED STORMWATER WETLAND; FROM 310 CMR: DEPARTMENT OF ENVIRONMENTAL PROTECTION, SECTION 10.02(3) "NOTWITHSTANDING THE PROVISIONS OF 310 CMR 10.02(1) AND (2), THE MAINTENANCE OF A STORMWATER MANAGEMENT SYSTEM CONSTRUCTED AND/OR IMPROVED AS DEFINED IN 310 CMR 10.04 FROM NOVEMBER 18, 1996 THROUGH JANUARY 1, 2008, IN ACCORDANCE WITH THE STORMWATER MANAGEMENT STANDARDS, AS PROVIDED IN THE MASSACHUSETTS STORMWATER POLICY, ISSUED BY THE DEPARTMENT ON NOVEMBER 18, 1996 OR ON OR AFTER JANUARY 2, 2008, IN ACCORDANCE WITH THE STORMWATER MANAGEMENT STANDARDS AS PROVIDED IN 310 CMR 10.05(6)(k) THROUGH (O) IS NOT SUBJECT TO REGULATION UNDER M.G.L. C. 131, § 40 PROVIDED THAT:
 - IF THE SYSTEM WAS CONSTRUCTED IN AN AREA SUBJECT TO PROTECTION UNDER M.G.L. C. 131, § 40 OR ASSOCIATED BUFFER ZONE, THE SYSTEM WAS CONSTRUCTED IN ACCORDANCE WITH ALL APPLICABLE PROVISIONS OF 310 CMR 10.00;
 - THE WORK TO MAINTAIN THE STORMWATER MANAGEMENT SYSTEM IS LIMITED TO MAINTENANCE OF A STORMWATER MANAGEMENT SYSTEM AS DEFINED IN 310 CMR 10.04; AND
 - SUCH WORK UTILIZES BEST PRACTICAL MEASURES TO AVOID AND MINIMIZE IMPACTS TO WETLAND RESOURCE AREA OUTSIDE THE FOOTPRINT OF THE STORMWATER MANAGEMENT SYSTEM.



**SEE SHEET GN-1 FOR SITE WORK
GENERAL NOTES**

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July 13, 2020 9:10am online C:\Users\atkins\OneDrive\Documents\GD190151701.dwg
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PROPOSED DEVELOPMENT
100 INDUSTRIAL PARK ROAD
HINGHAM, MASSACHUSETTS

Disc. Revised per Staff and Commission Comments
Date 07/12/2020
No. 1. Revised per Planning and Permit Review Comments
2. 07/15/2020

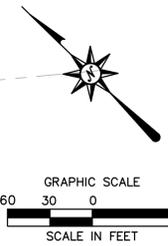
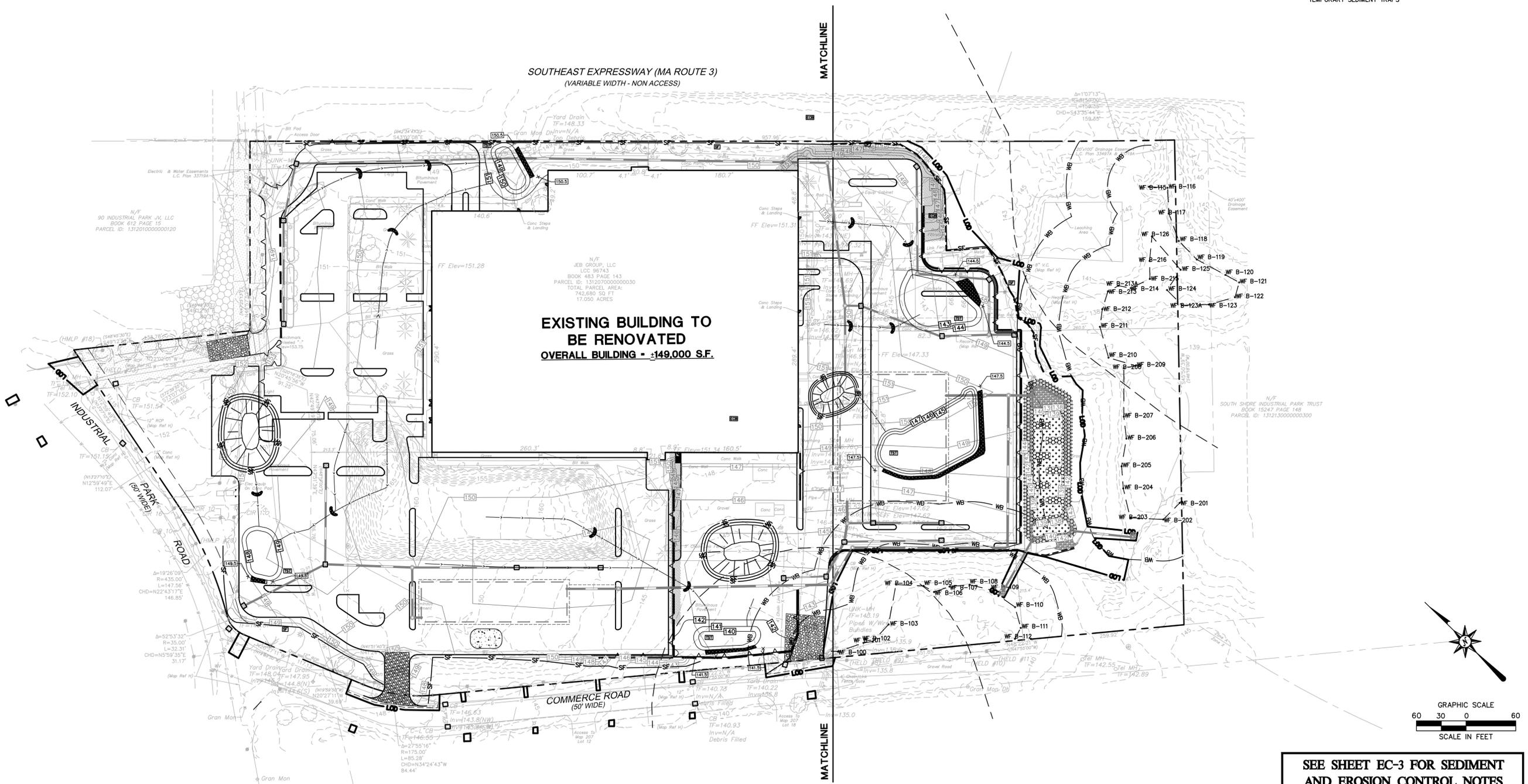
Designed P.G.M.
Drawn P.G.M.
Reviewed
Scale 1"=60'
Project No. 1901517
Date 03/06/2020

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 COMPOST FILTER SOCKS (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 50 FT AND 100 FT BUFFER	
RIP RAP SPILLWAY WITH WASHED AGGREGATE AT TEMPORARY SEDIMENT TRAPS	



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

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PLOT DATE: 07/15/2020 10:45:00 AM

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

EROSION CONTROL LEGEND:

CONTROL MEASURE	ILLUSTRATION
SILT SACK AT CATCH BASINS	
STONE CHECK DAM	
SILT FENCE	
SILT FENCE WITH COMPOST FILTER SOCKS (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 50 FT AND 100 FT BUFFER	
RIP RAP SPILLWAY WITH WASHED AGGREGATE AT TEMPORARY SEDIMENT TRAPS	

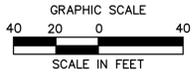


355 Research Parkway
Meriden, CT 06450
(203) 630-1406
(203) 630-2615 Fax

PROPOSED DEVELOPMENT
100 INDUSTRIAL PARK ROAD
HINGHAM, MASSACHUSETTS

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

MATCHLINE SEE SHEET EC-2



SEE SHEET EC-3 FOR SEDIMENT AND EROSION CONTROL NOTES

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

REVISIONS

No.	Date	Description
1.	07/12/2020	Revised per Staff and Commission Comments
2.	07/13/2020	Revised per Planning and Permit Review Comments

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-1

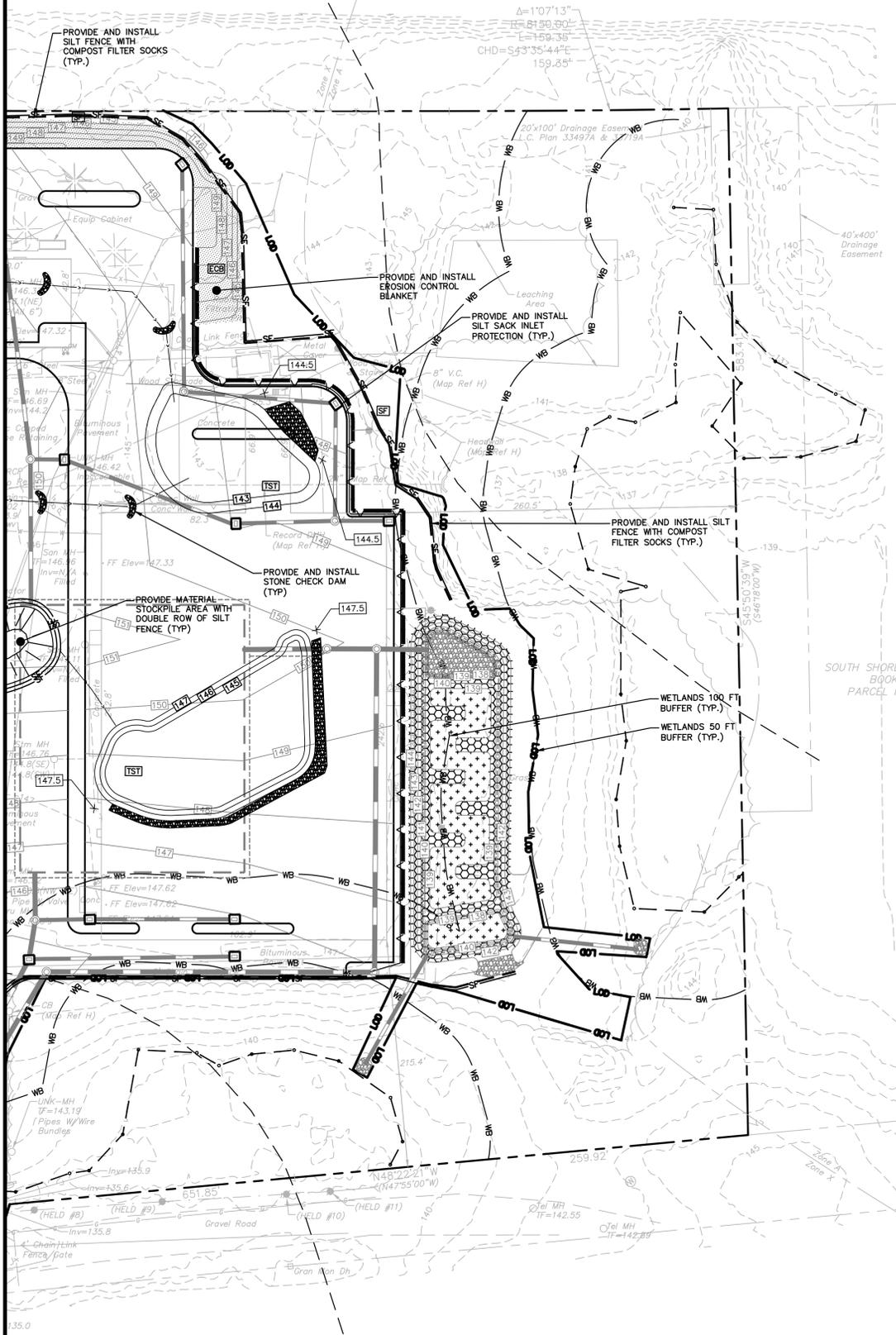
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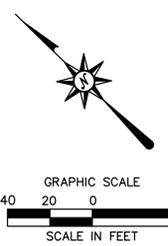
MATCHLINE SEE SHEET EC-1



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

EROSION CONTROL LEGEND:

CONTROL MEASURE	ILLUSTRATION
SILT SACK AT CATCH BASINS	
STONE CHECK DAM	
SILT FENCE	
SILT FENCE WITH COMPOST FILTER SOCKS (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 50 FT AND 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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355 Research Parkway
 Meriden, CT 06450
 (203) 630-1406
 (203) 630-2615 Fax

PROPOSED DEVELOPMENT
 100 INDUSTRIAL PARK ROAD
 HINGHAM, MASSACHUSETTS

REVISIONS

No.	Date	Description
1.	07/13/2020	Revised per Staff and Commission Comments
2.	07/13/2020	Revised per Staff and Commission Comments

Designed P.G.M.
 Drawn P.G.M.
 Reviewed
 Scale 1"=40'
 Project No. 1901517
 Date 03/06/2020
 CAD File: EC190151701

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:

- 1. 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.
2. 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.
3. 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.
4. CLEAR AND GRUB SITE. STOCKPILE CHIPS, STOCKPILE TOPSOIL. INSTALL SEDIMENT AND EROSION CONTROLS AT STOCKPILES.
5. SELECTIVE BUILDING AND SITE DEMOLITION AND REMOVAL. PAVEMENT REMOVAL.
6. INSTALL SILT FENCE, CONSTRUCT DIVERSION SWALES AND SEDIMENT TRAPS. COMMENCE INSTALLATION OF STORM DRAINAGE SYSTEM.
7. 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.
8. CONSTRUCTION STAKING OF ALL BUILDING CORNERS, UTILITIES, ACCESS DRIVES, AND PARKING AREAS.
9. ROUGH GRADING AND FILLING OF SUBGRADES AND SLOPES.
10. 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.
11. 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.
12. CONTINUE INSTALLATION OF STORM DRAINAGE AS SUBGRADE ELEVATIONS ARE ACHIEVED.
13. 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.
14. INSTALL UTILITIES. COMPLETE STORM DRAINAGE SYSTEM.
15. INSTALL SITE LIGHTING.
16. COMPLETE GRADING TO SUBGRADES AND CONSTRUCT PARKING AREA SUBGRADE.
17. CONSTRUCT CURBS, PAVEMENT STRUCTURE AND SIDEWALKS.
18. CONDUCT FINE GRADING.
19. PAVE PARKING AREAS AND DRIVEWAYS
20. FINAL FINE GRADING OF SLOPE AND NON-PAVED AREAS.
21. 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).
22. LANDSCAPE ISLANDS, INTERIOR NON-PAVED AREAS, AND PERIMETER AREAS.
23. INSTALL SIGNING AND PAVEMENT MARKINGS
24. CLEAN STORM DRAINAGE PIPE STRUCTURES, DETENTION SYSTEMS AND WATER QUALITY DEVICES OF DEBRIS AND SEDIMENT.
25. 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
1. 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.
2. 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.
3. 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.
4. 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

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

FILLING OPERATIONS

- 1. 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.
2. 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.
3. 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.

- 1. 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

- 1. 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.
2. 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.
3. 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.
4. 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

- I. SILTATION FENCE
A. DIG A SIX INCH TRENCH ON THE UPHILL SIDE OF THE DESIGNATED FENCE LINE LOCATION.
B. POSITION THE POST AT THE BACK OF THE TRENCH (DOWNHILL SIDE), AND HAMMER THE POST AT LEAST 1.5 FEET INTO THE GROUND.
C. LAY THE BOTTOM SIX INCHES OF THE FABRIC INTO THE TRENCH TO PREVENT UNDERMINING BY STORM WATER RUN-OFF.
D. BACKFILL THE TRENCH AND COMPACT.
II. COMPOST FILTER SOCKS
A. PLACE THE FILTER SOCKS BEHIND THE SILT FENCE AT THE BOTTOM END OF SLOPE.
B. FILL AND COMPACT FILTER SOCKS WITH COMPOST OR VEGETATION MATERIAL.
C. PLACE THE FILTER MEDIA ON THE SIDE OF THE SILT FENCE.
D. IF NECESSARY, INSERT 2" X 2" X 36" WOODEN STAKES THROUGH THE CENTER OF THE FILTER SOCK EVERY 10'. MAKE SURE THAT 1" OF THE WOODEN STAKE IS BELOW THE GROUND SURFACE.

OPERATION AND MAINTENANCE OF SEDIMENT AND EROSION CONTROL MEASURES

- I. SILTATION FENCE
A. 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.
B. SEDIMENT DEPOSITS SHALL BE REMOVED FROM BEHIND THE FENCE WHEN THEY REACH A MAXIMUM HEIGHT OF ONE FOOT.
II. COMPOST FILTER SOCKS
A. ALL FILTER SOCKS SHALL BE INSPECTED AS A MINIMUM WEEKLY OR AFTER EACH RAINFALL. ALL DETERIORATED MATERIAL AND DAMAGED WOODEN STAKES SHALL BE REPLACED AND PROPERLY REPOSITIONED IN ACCORDANCE WITH THIS PLAN.
B. DEPOSITS SHALL BE REMOVED AND CLEANED OUT IF HALF OF THE ORIGINAL HEIGHT OF THE FILTER SOCKS BECOME FILLED WITH SEDIMENT.
III. SEDIMENT BASINS/SEDIMENT TRAPS
A. 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.
B. ALL SEDIMENT BASINS AND/OR SEDIMENT TRAPS SHALL BE INSPECTED FOLLOWING EACH RAINFALL. REPAIR OF SLOPES SHALL BE PROMPTLY MADE AS NEEDED.
C. 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.
D. 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

- 1. COMPOST FILTER SOCKS 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.
2. CULVERT DISCHARGE AREAS WILL BE PROTECTED WITH RIP RAP CHANNELS. ENERGY DISSIPATORS WILL BE INSTALLED AS SHOWN ON THESE PLANS AND AS NECESSARY.
3. CATCH BASINS WILL BE PROTECTED WITH SILT SACKS THROUGHOUT THE CONSTRUCTION PERIOD AND UNTIL ALL DISTURBED AREAS ARE THOROUGHLY STABILIZED.
4. 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.
5. SEDIMENT AND EROSION CONTROL MEASURES WILL BE INSTALLED PRIOR TO DEMOLITION AND/OR CONSTRUCTION WHENEVER POSSIBLE.
6. 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.
7. 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.
8. 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.
9. 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

- 1. 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.
2. 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.
3. 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.
4. 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
5. 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.
6. 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.
7. 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.
8. 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.
9. 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 LIMB TRIMMING SHOULD BE DONE BEFORE CONSTRUCTION BEGINS IN THAT AREA; FENCING SHALL BE MAINTAINED AND REPAIRED DURING CONSTRUCTION.

- 10. 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, COMPOST FILTER SOCKS, 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.
11. 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.
12. 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.
13. 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.
14. 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.
15. 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.
16. 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.
17. MAINTAIN EXISTING PAVED AREAS FOR CONSTRUCTION STAGING FOR AS LONG AS POSSIBLE.
18. 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.
19. EXCAVATED MATERIAL FROM TEMPORARY SILT TRAPS MUST BE STOCKPILED ON UPHILL SIDE OF SILT FENCE.
20. INSTALL SILT FENCE ACCORDING TO MANUFACTURER'S INSTRUCTION, PARTICULARLY, BURY LOWER EDGE OF FABRIC INTO GROUND. SILT FENCE SHALL BE TENCATE ENVIROFENCE, PROPEX GEOTEX OR EQUIVALENT APPROVED BY THE CIVIL ENGINEER. FILTER FABRIC USED SHALL BE TENCATE 140N OR 170N, OR APPROVED EQUIVALENT. SEE SPECIFICATIONS FOR FURTHER INFORMATION.
21. INSTALL COMPOST FILTER SOCKS ACCORDING TO MANUFACTURER'S INSTRUCTIONS, PARTICULARLY, PLACE THE FILTER SOCKS BEHIND THE SILT FENCE AND PLACE THE FILTER MEDIA ON THE SIDE OF THE SILT FENCE. IF NECESSARY, PLACE 2" X 2" X 36" WOODEN STAKES THROUGH THE CENTER OF THE FILTER SOCKS EVERY 10'. MAKE SURE THAT 1" OF THE WOODEN STAKE IS BELOW THE GROUND SURFACE. FILTER SOCK MATERIAL AND MEDIA SHALL BE FROM FILTREXX OR APPROVED EQUAL AS DETERMINED BY THE CIVIL ENGINEER. SEE SPECIFICATIONS FOR FURTHER DETAILS.
22. 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.
23. 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.
24. DIRECT ALL DEWATERING PUMP DISCHARGE TO A SEDIMENT CONTROL DEVICE SUCH AS TEMPORARY PITS, SEDIMENT TRAP, SEDIMENT BASINS OR GRASS FILTERS WITHIN THE APPROVED LIMIT OF DISTURBANCE. DISCHARGE TO STORM DRAINAGE SYSTEM OR SURFACE WATERS FROM SEDIMENT CONTROLS SHALL BE CLEAR.
25. 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.
26. 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 COMPOST FILTER SOCKS AND SILT FENCE WHEN LEVEL REACHES HALF THE HEIGHT OF THE FILTER SOCK OR ONE FOOT AT SILT FENCE. DISPOSE OF SEDIMENT LEGALLY EITHER ON OR OFF SITE.
27. 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.
28. 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.
29. 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.
30. 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.
31. 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.
32. BLOCK END OF STORM SEWERS IN EXPOSED TRENCHES WITH BOARDS AND SANDBAGS AT THE END OF EACH WORKING DAY WHEN RAIN IS EXPECTED.
33. 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.
34. 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.



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PROPOSED DEVELOPMENT
100 INDUSTRIAL PARK ROAD
HINGHAM, MASSACHUSETTS

Revised per Staff and Commission Comments
Revised per Staff and Commission Comments
Date: 05/12/2020
Date: 07/12/2020

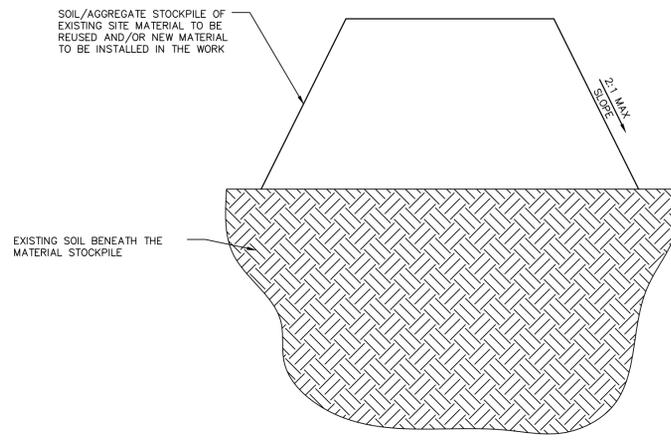
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Designed P.G.M.
Drawn P.G.M.
Reviewed
Scale NONE
Project No. 1901517
Date 03/04/2020
CAD File: EC190151701

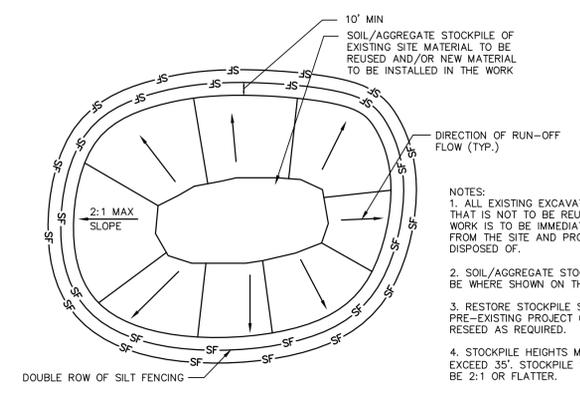
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SEDIMENT AND EROSION CONTROL NOTES
Sheet No.

FOR PERMITTING PURPOSES ONLY
NOT RELEASED FOR CONSTRUCTION

EC-3

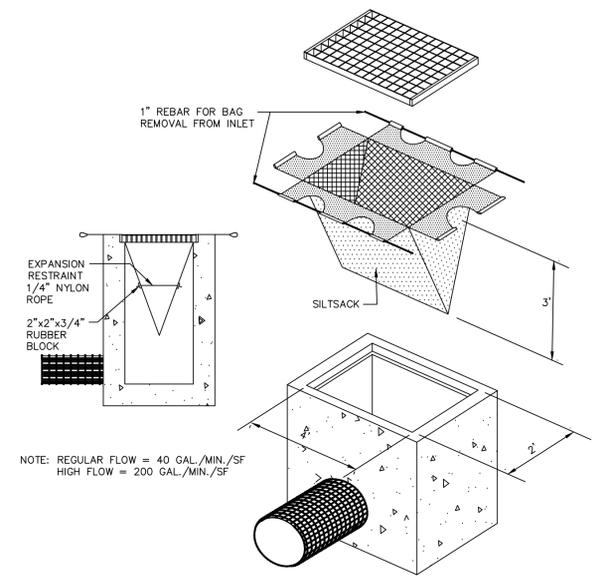
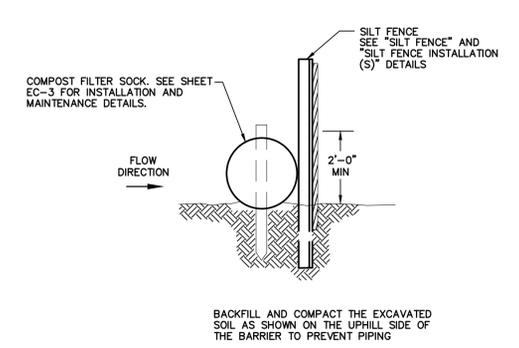


MATERIALS STOCKPILE DETAIL
N.T.S. BLEC-006



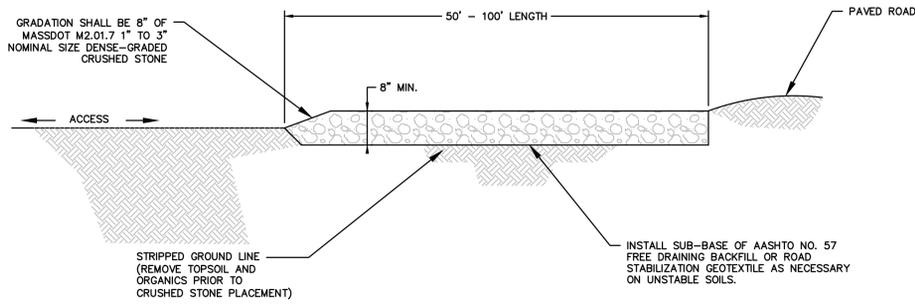
NOTES:
1. ALL EXISTING EXCAVATED MATERIAL THAT IS NOT TO BE REUSED IN THE WORK IS TO BE IMMEDIATELY REMOVED FROM THE SITE AND PROPERLY DISPOSED OF.
2. SOIL/AGGREGATE STOCKPILE SITES TO BE WHERE SHOWN ON THE DRAWINGS.
3. RESTORE STOCKPILE SITES TO PRE-EXISTING PROJECT CONDITION AND RESEED AS REQUIRED.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

FILTER SOCK WITH SILT FENCE BACKING
N.T.S.

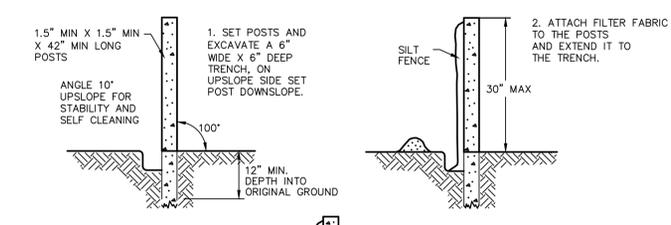


SILTSACK DETAIL
N.T.S. BLEC-005

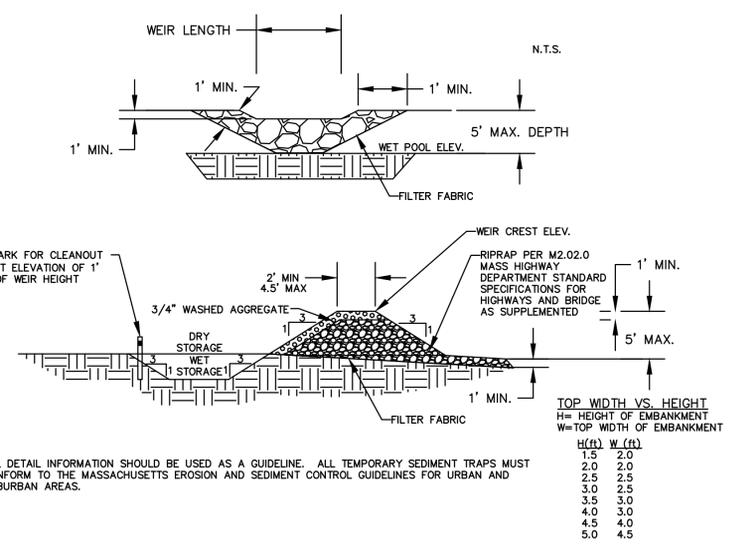
NOTE: REGULAR FLOW = 40 GAL./MIN./SF
HIGH FLOW = 200 GAL./MIN./SF



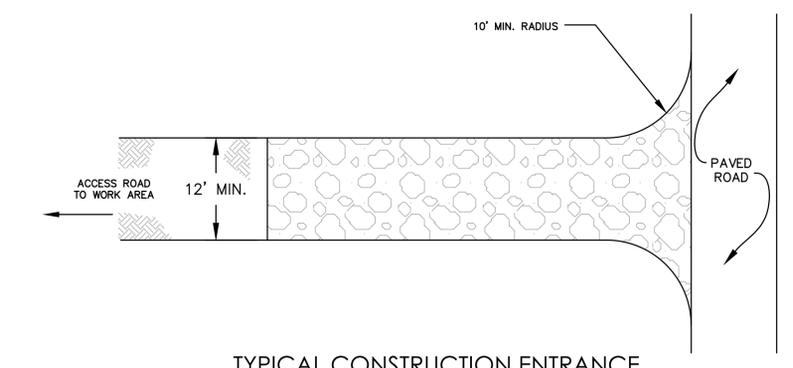
TYPICAL CONSTRUCTION ENTRANCE
N.T.S.



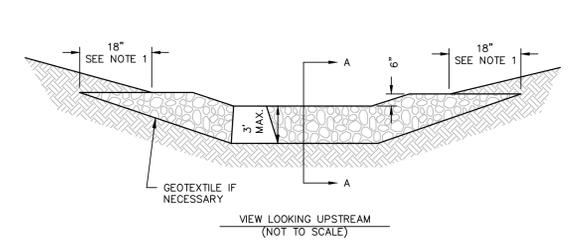
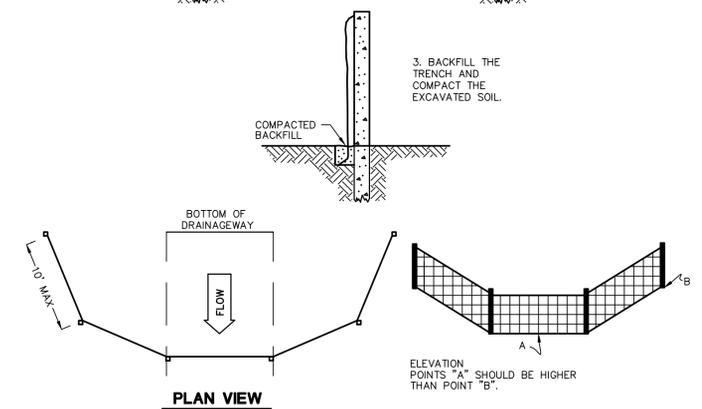
SILT FENCE BARRIER
N.T.S.



TEMPORARY SEDIMENT TRAP
N.T.S. BLEC-002

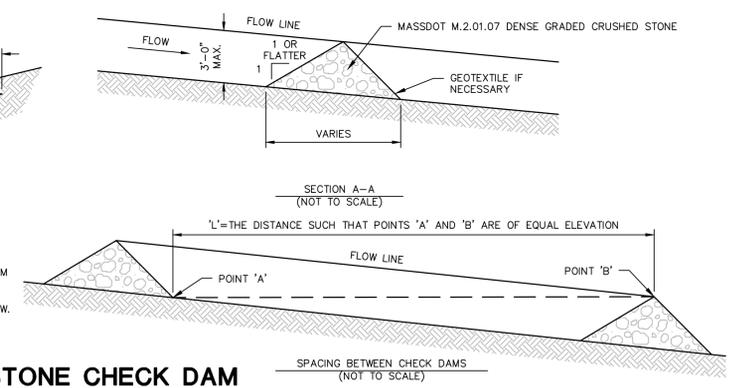


NON-ENGINEERED TEMPORARY DIVERSION SWALE DETAIL
N.T.S.



NOTES:
1) KEY STONE INTO THE DITCH BANKS AND EXTEND INTO THE ABUTMENTS A MINIMUM OF 18" TO PREVENT FLOW FROM FLANKING THE CHECK DAM.
2) THE MINIMUM DESIGN CAPACITY SHALL CONVEY A 2 YEAR - 24 HOUR PEAK FLOW.

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

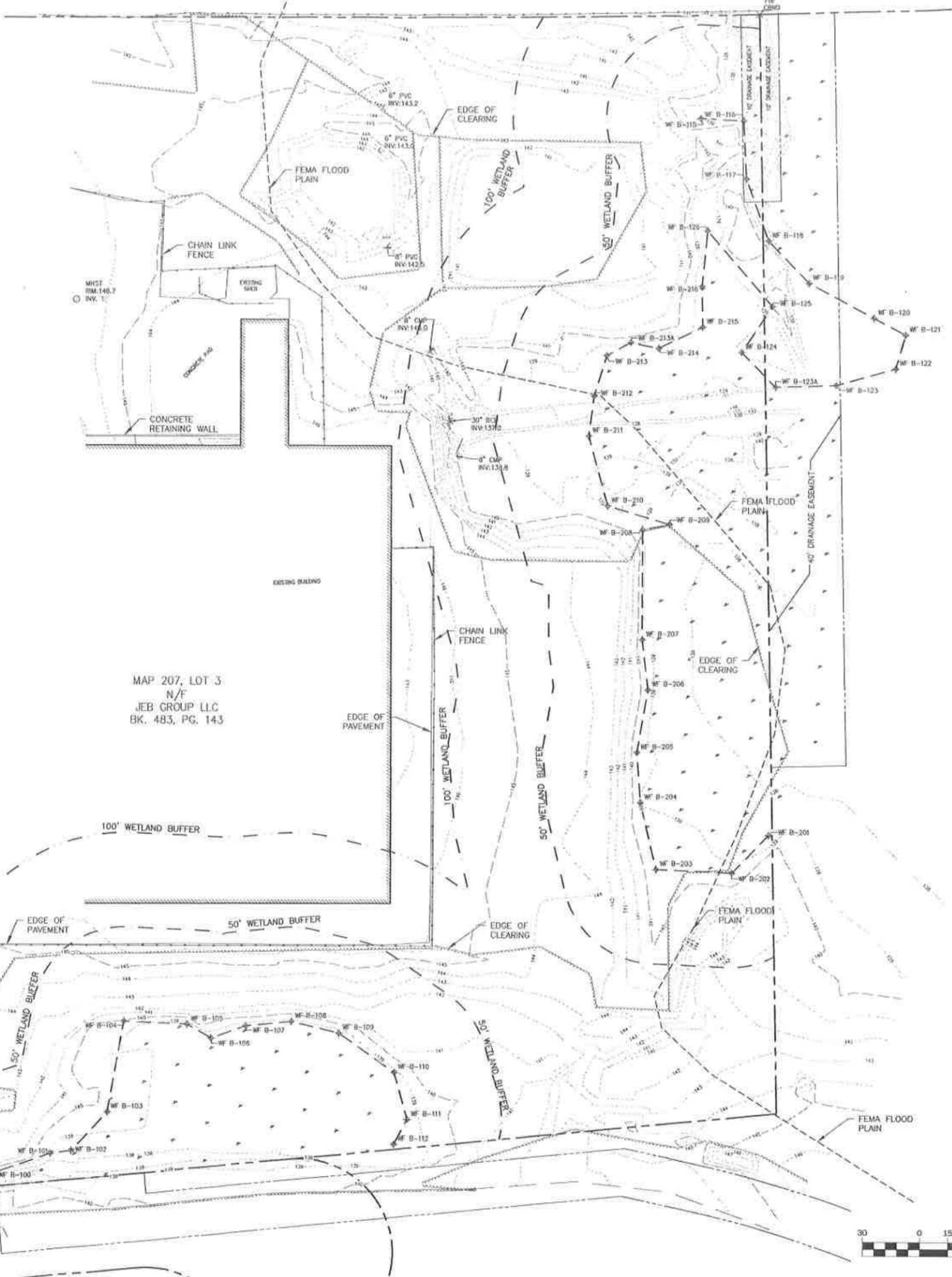
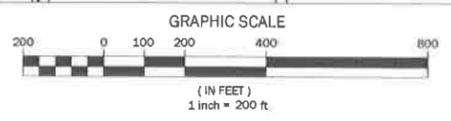
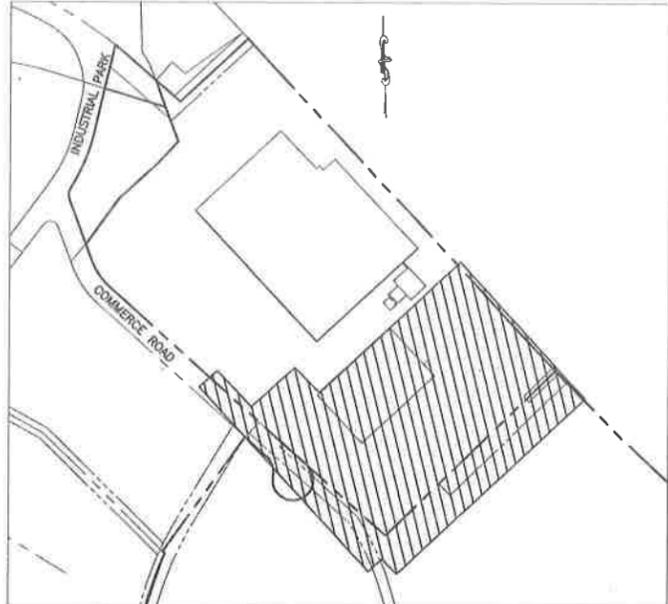
REVISIONS

No.	Date	Desc.
1.	07/12/2020	Revised per Staff and Commission Comments
2.	07/13/2020	Revised per Staff and Commission Comments

Designed	P.G.M.
Drawn	P.G.M.
Reviewed	
Scale	NONE
Project No.	1901517
Date	03/06/2020
CAD File:	EC190151701

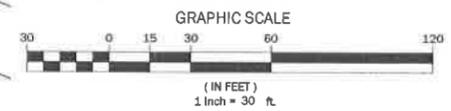
Title
SEDIMENT AND EROSION CONTROL DETAILS

Sheet No.



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

COMMERCE ROAD
(PUBLIC - 50' WIDE)



BEALS ASSOCIATES, INC.
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 BOUNDARILS 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

APPENDIX F

STORMWATER SYSTEM OPERATION AND MAINTENANCE MANUAL

Operation and Maintenance Manual and Inspection Guide Sheets
OM-1 – Operations & Management Site Plan

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**

May 12, 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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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. The Underground Detention Systems detain stormwater to maintain down stream flow patterns without flooding and provide isolation rows for pre-treatment of suspended solids. The Constructed Stormwater Wetland treat the water quality volume prior to discharge to the downstream wetlands to remove harmful chemicals and at least 80% of the total suspended solids (TSS).

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.

Trench Drains

There are two trench drains proposed on site at the vehicle entry and exist of the building. These drains are each to be connected to 1,000 precast concrete tanks. This tank will require pumping and proper disposal of any pumped substance when the tanks are 3/4 full (or more frequently as needed). The integrity of the tank and trench drains shall be inspected at the time of pumping.

Underground Detention System

For the first year of operation following construction the isolator row on the underground detention system will be inspected, and cleaned if needed, 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 the chambers 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 system. Accumulated sediment and/or oils/floatables shall be removed by vacuum "Vactor" type of maintenance equipment and disposed of legally off-site. At the same time the 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. A detailed maintenance logbook shall be kept for the system. 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.

Constructed Stormwater Wetland Pond

The constructed stormwater wetland pond shall be checked for and cleaned of trash, excessive sediment, other debris and erosion. Maintain the native 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 as well as specific items listed below.

Proponents must carefully observe the constructed stormwater wetland system over time. In the first three years after construction, inspect the constructed stormwater wetlands twice a year during both the growing and non-growing seasons. The sediment forebay should be cleaned at least once a year, or more frequently if needed.

Regular inspection/maintenance for the stormwater wetland pond includes the following items:

- The types and distribution of the dominant wetland plants in the marsh;
- The presence and distribution of planted wetland species;
- The presence and distribution of invasive wetland species (invasives must be removed);
- Indications that other species are replacing the planted wetland species;
- Percentage of standing water that is unvegetated (excluding the sediment forebay and micropool);
- The maximum elevation and the vegetative condition in the semi-wet zone;
- Stability of the original depth zones and the micro-topographic features; and

- Accumulation of sediment in the forebay and micropool; and survival rate of plants (dead plants must be replanted).

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 indicated.

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		
* Stormwater Wetland Pond		
APRIL:		
*Catch Basin/Yard Drain		
* Subsurface Detention System		
* Stormwater Wetland Pond		
Shrub Fertilization		
Lawn Limbing (if necessary)		
AUGUST:		
*Catch Basin/Yard Drain		
* Subsurface Detention System		
* Stormwater Wetland Pond		
OCTOBER:		
* Subsurface Detention System		
* Stormwater Wetland Pond		
Tree and Lawn Fertilization		
DECEMBER:		
*Catch Basin/Yard Drain		
* Subsurface Detention System		

*NOTE: Use appropriate guidelines found in this plan to conduct the inspection/cleaning.

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		
*Stormwater Wetland Pond		
Shrub Fertilization		
Lawn Limbing (if necessary)		
AUGUST:		
*Catch Basin/Yard Drain		
OCTOBER:		
* Subsurface Detention System		
Tree and Lawn Fertilization		
*Stormwater Wetland Pond		
DECEMBER:		
*Catch Basin/Yard Drain		

*NOTE: Use appropriate guidelines found in this plan to conduct the inspection/cleaning.

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							

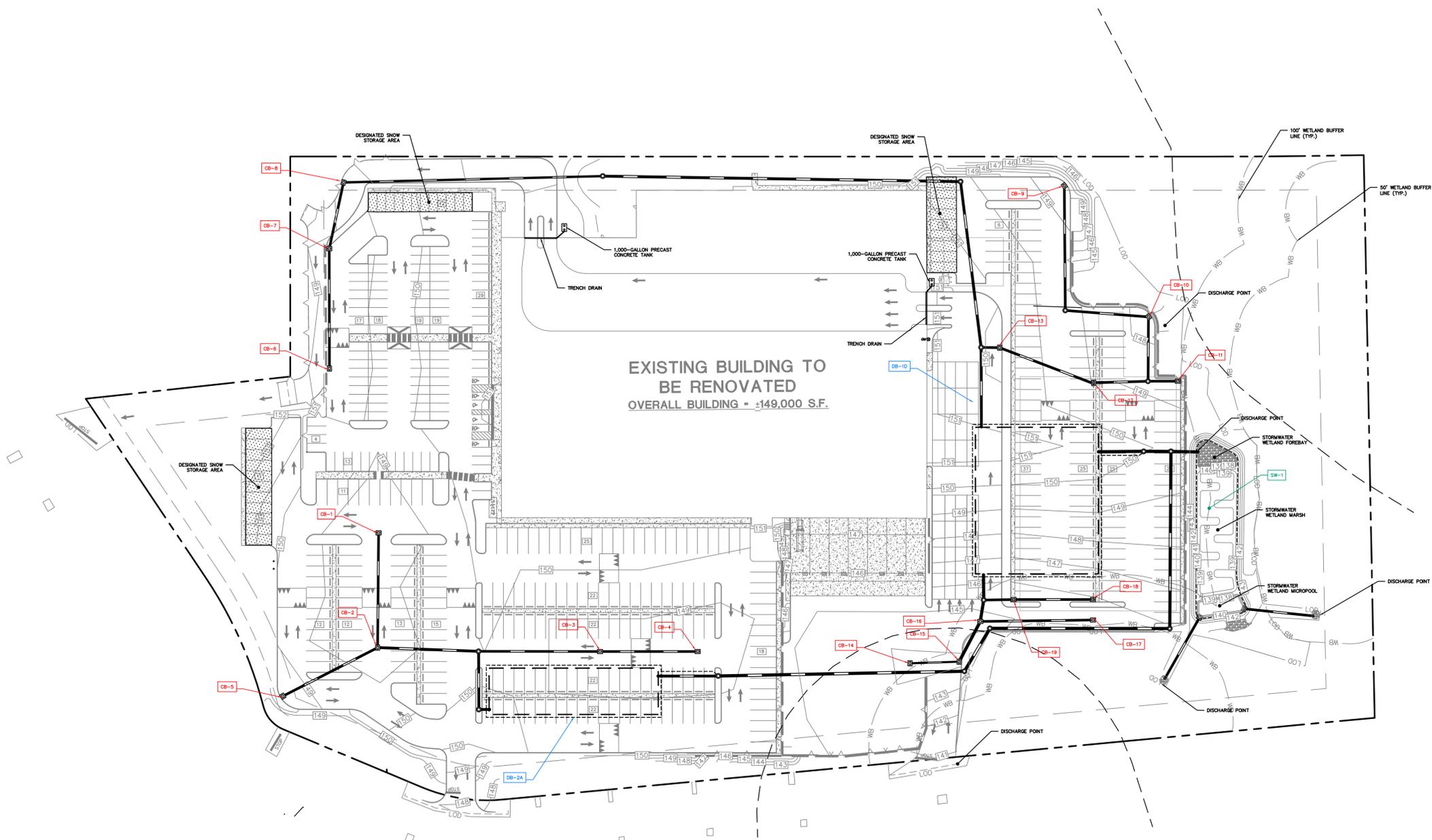
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent							
	Fair	Poor	Yes	No	Yes	No		
	Excellent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

OPERATION AND MAINTENANCE SCHEDULE

BMP ID	BMP TYPE	INSPECTION/MAINTENANCE SCHEDULE
CB-XX	CATCH BASIN	INSPECT THREE TIMES PER YEAR MINIMUM. CLEAN THREE TIMES PER YEAR AND WHEN SEDIMENT BUILDUP IS GREATER THAN OR EQUAL TO 50% OF THE SLUMP DEPTH. SEE OPERATION AND MAINTENANCE MANUAL FOR SPECIFIC REQUIREMENTS.
DP-X	SUBSURFACE DETENTION BASIN	INSPECT ONCE EVERY SIX MONTHS. CLEAN ONCE EVERY SIX MONTHS AND WHEN SEDIMENT BUILDUP REACHES A SPECIFIC LIMIT IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. SEE OPERATION AND MAINTENANCE MANUAL FOR SPECIFIC REQUIREMENTS.
SW-1	STORMWATER WETLAND	INSPECT TWO TIMES PER YEAR MINIMUM. CLEAN TWO TIMES PER YEAR AND WHEN TRASH, EXCESSIVE SEDIMENT AND/OR OTHER DEBRIS ARE IN THE WETLAND. SEE OPERATION AND MAINTENANCE MANUAL FOR SPECIFIC REQUIREMENTS.



**SEE SHEET GN-1 FOR SITE WORK
GENERAL NOTES**

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

July 13, 2020 7:58pm outline C:\Users\141\1901517\DWG\OM190151701.dwg
P:\Projects\1901517\1901517.dwg
2020 BL COMPANIES, INC. THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF BL COMPANIES.

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



This Stage1 report was originally delivered on our web-based **GeoReport®** platform.

For more interactive features, please view your project online at client.terracon.com.

REPORT TOPICS

SITE CHARACTERISTICS	3
PLANNED CONSTRUCTION	7
PREVIOUS SITE USAGE	8
CONCEPTUAL GEOTECHNICAL MODEL	9
TERRACON EXPLORATION PLAN	11
INFORMATION SOURCES	13
METHOD	14
CONFIDENCE ESTIMATE	14
LIMITATIONS	14

PREPARED BY:



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

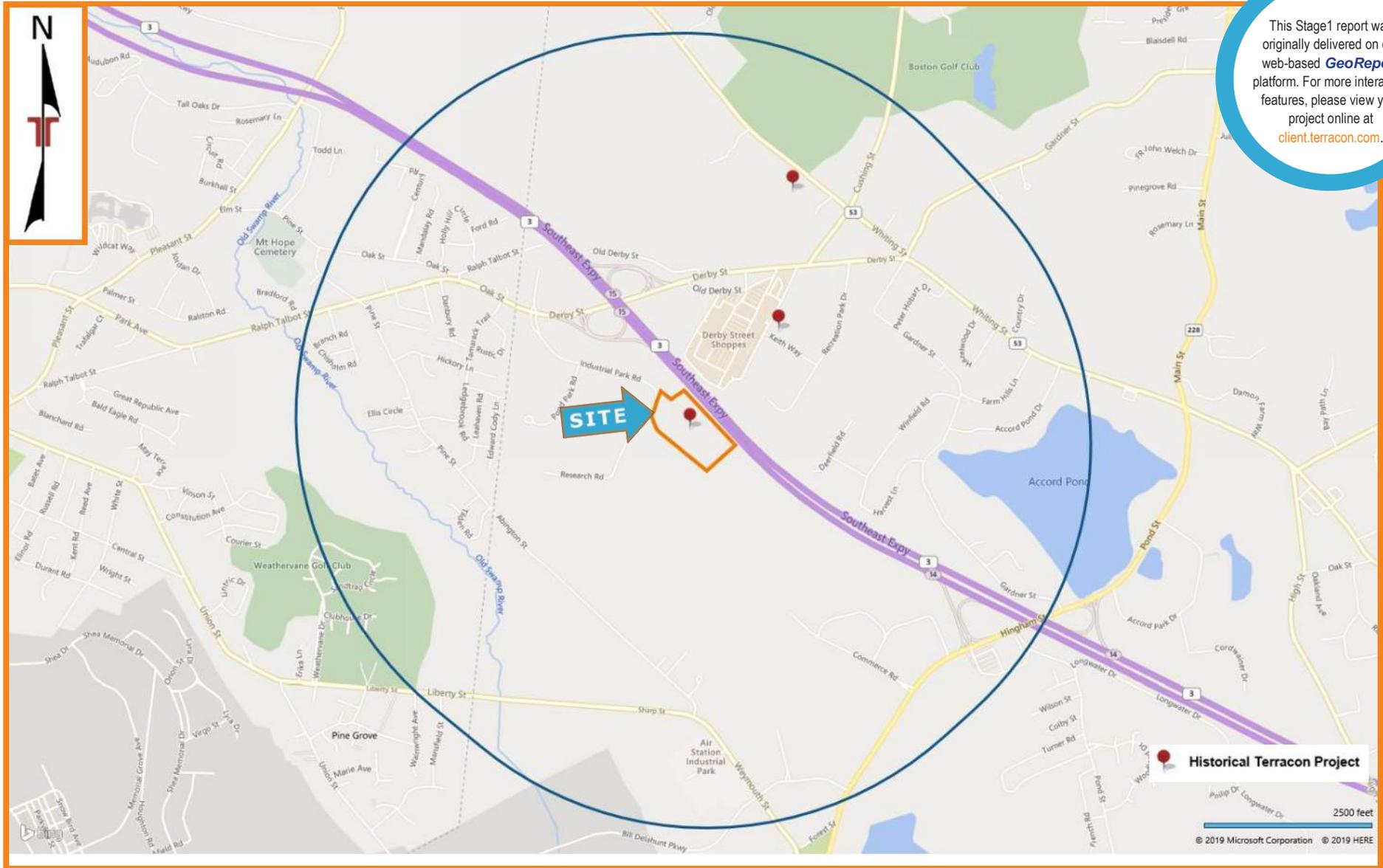
Carl W. Thunberg, P.E.
Senior Geotechnical Engineer
carl.thunberg@terracon.com

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



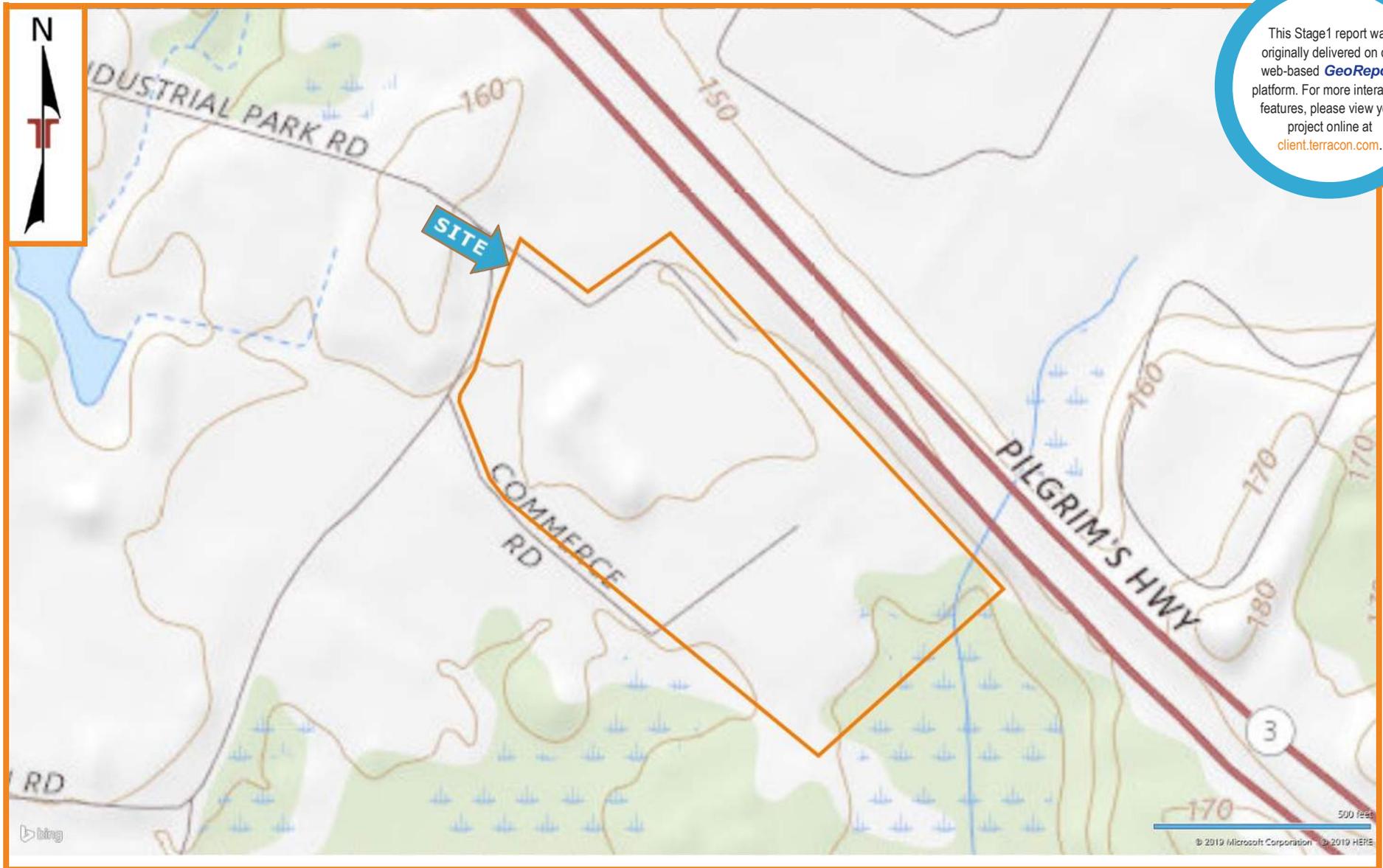
See [INFORMATION SOURCES](#) for a detailed list of sources used to generate this figure.

SITE AERIAL



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



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

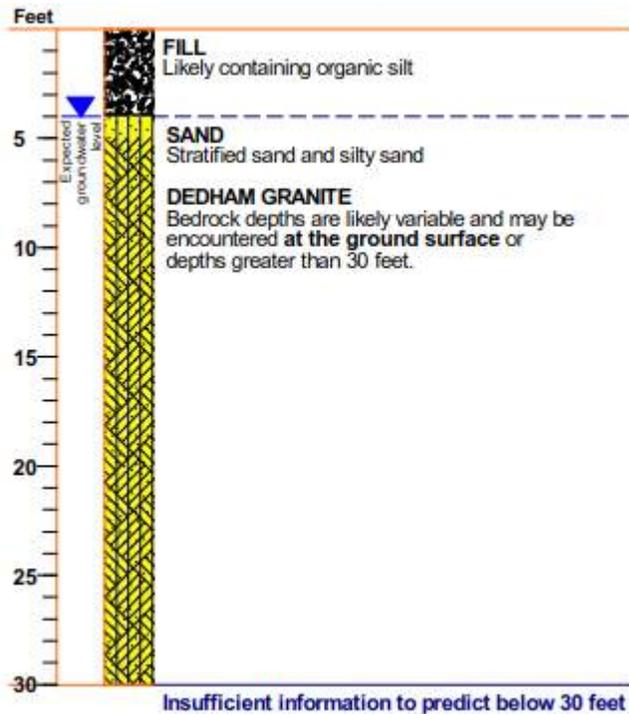
The use of these readily available aerial imagery resources, while helpful to understand previous site usage, should not be considered suitable for detecting any prior site usage that may have affected the site subsurface conditions. These images are widely spaced in time, and a more comprehensive review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

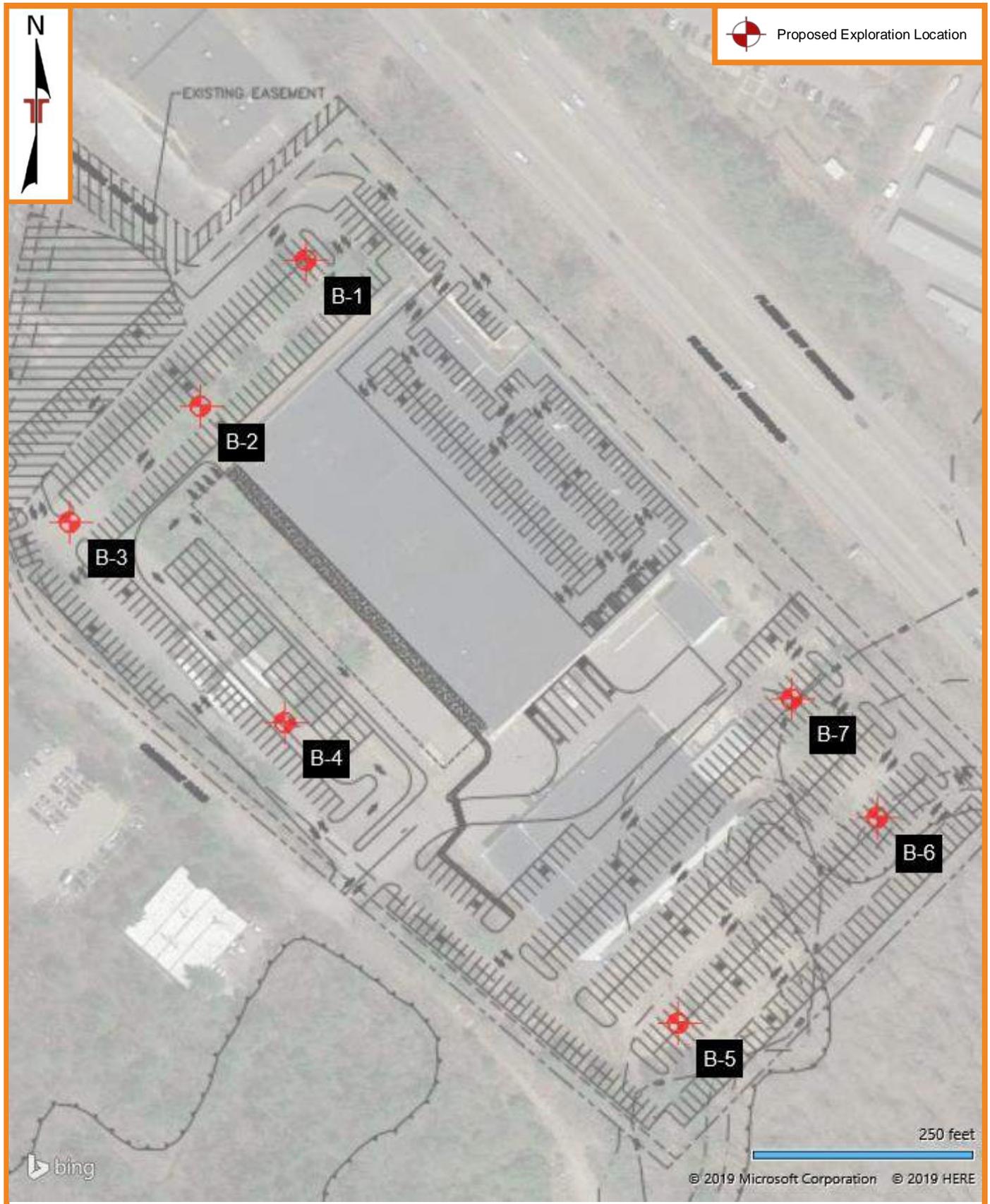
- In order to characterize the subsurface conditions, we recommend exploratory borings and a geophysical survey of the site. Exploratory Standard Penetration Test (SPT) borings will provide the necessary sampling and testing to provide design parameter recommendations.
- Test pits may be warranted to 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

Boring No.: **B-1**
 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 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			138.5 / 10.5	Boring terminated at 10.5 feet.	1
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	

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-2
 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.: (+/-) 142
 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	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	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

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

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					
4				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					
6				51					
				50/4"		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		145.5 / 0.5 BASE COARSE	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 WEATHERED BEDROCK	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].		
4				50/3"		142.5 / 3.5	Boring terminated at 3.5 feet on auger refusal.	1	
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	

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-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].		
4				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%].		
6				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].		
8				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	

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-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
 Driller: N. Stutterd Hammer Type: Automatic Hammer
 Nobis Rep.: K. Kocia Hammer Hoist: Automatic Datum: NAVD 88
 Ground Surface Elev.: (+/-) 145

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	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].	
5				6		GLACIAL DRIFT 140.0 / 5.0	S-3: Very dense, gray, One piece of coarse gravel present within split-spoon sample.		
6	S-3	1	5-7	33				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].	
7				30					
8	S-4	18	7-9	18		136.0 / 9.0	Boring terminated at 9 feet.		
9				32					
10				34					
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-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	Approximately 5.6-inches of asphalt.		
2	S-1	17	1-3	15		BASE COARSE	Base coarse consisted of fine to coarse SAND, some fine to coarse Gravel, trace Silt; approximately 3-inches in thickness.		
3				22					
4				15					
5	S-2	11	3-5	10		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].		
6				19					
7				7					
8	S-3	11	5-7	3		140.7 / 5.3	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].		
9				16		GLACIAL DRIFT	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].		
10				33					
11	S-4	21	7-9	40		GLACIAL DRIFT WITH ORGANICS	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					
13				16					
14				15					
15							Boring terminated at 9 feet.	1	

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

NOTES:
 1) Boring backfilled with spoils, 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-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
 Driller: N. Stutterd Hammer Type: Automatic Hammer
 Nobis Rep.: K. Kocia Hammer Hoist: Automatic Datum: NAVD 88
 Ground Surface Elev.: (+/-) 147

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.		Graphic	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					
11						136.5 / 10.5	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

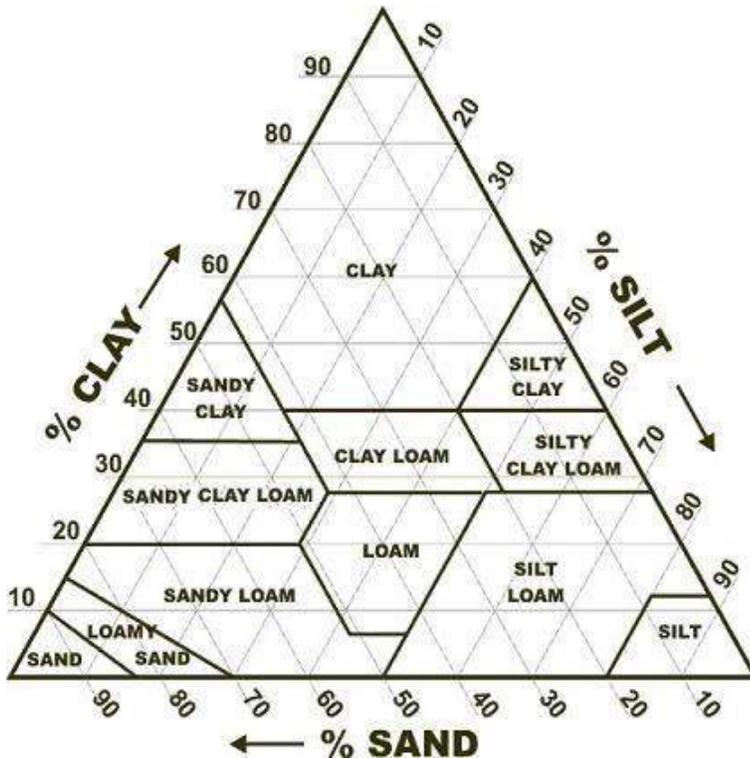
Client: Nobis Engineering, Inc.	Project No: GTX-311163	
Project: 100 Industrial Park Way		
Location: Hingham, MA	Sample Type: jar	Tested By: ckg
Boring ID: B-1	Test Date: 01/17/20	Checked By: emm
Sample ID: S-3	Test Id: 538530	
Depth : 4.5-6.5 ft		
Test Comment: ---		
Visual Description: Moist, dark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

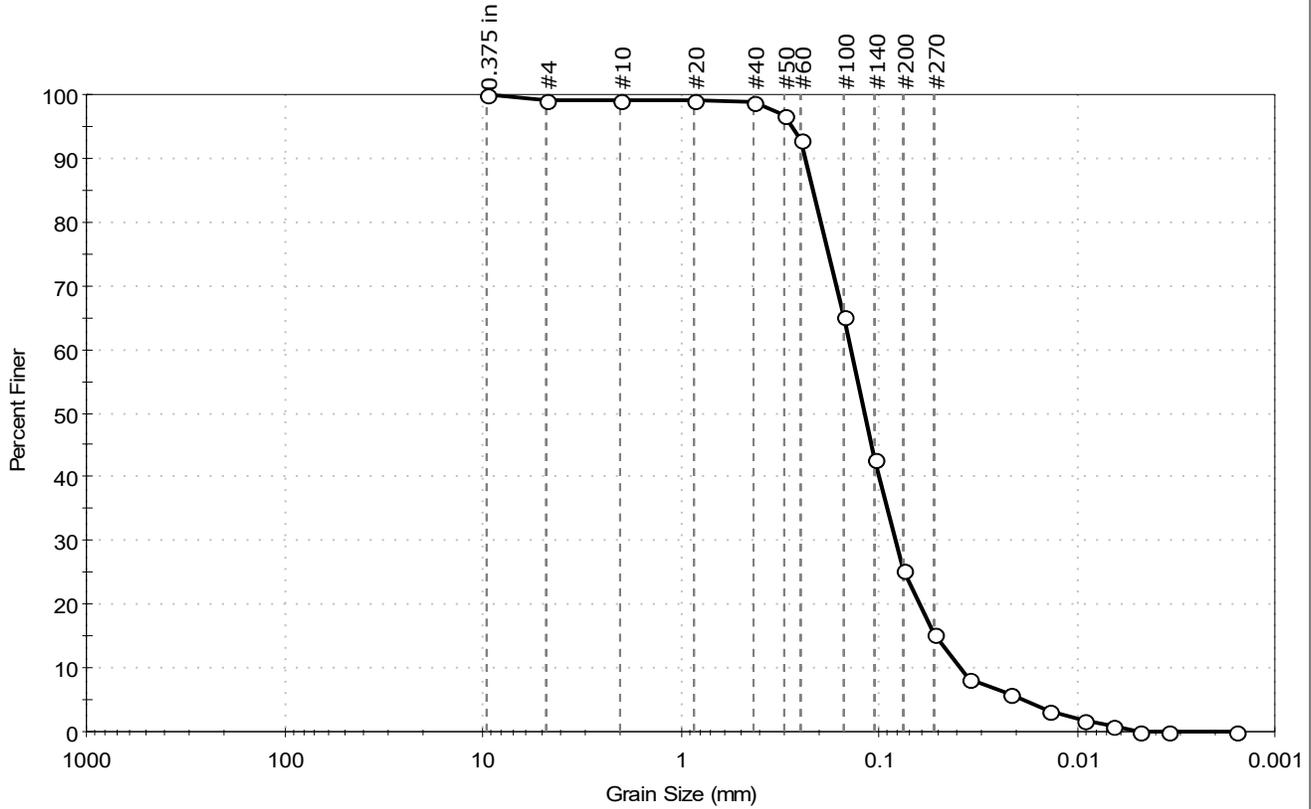
- Sand: material passing 2.0 mm and retained on 0.05 mm diameter
- Silt: material passing 0.05 mm and retained on 0.002 mm diameter
- Clay: material passing 0.002 mm diameter





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))

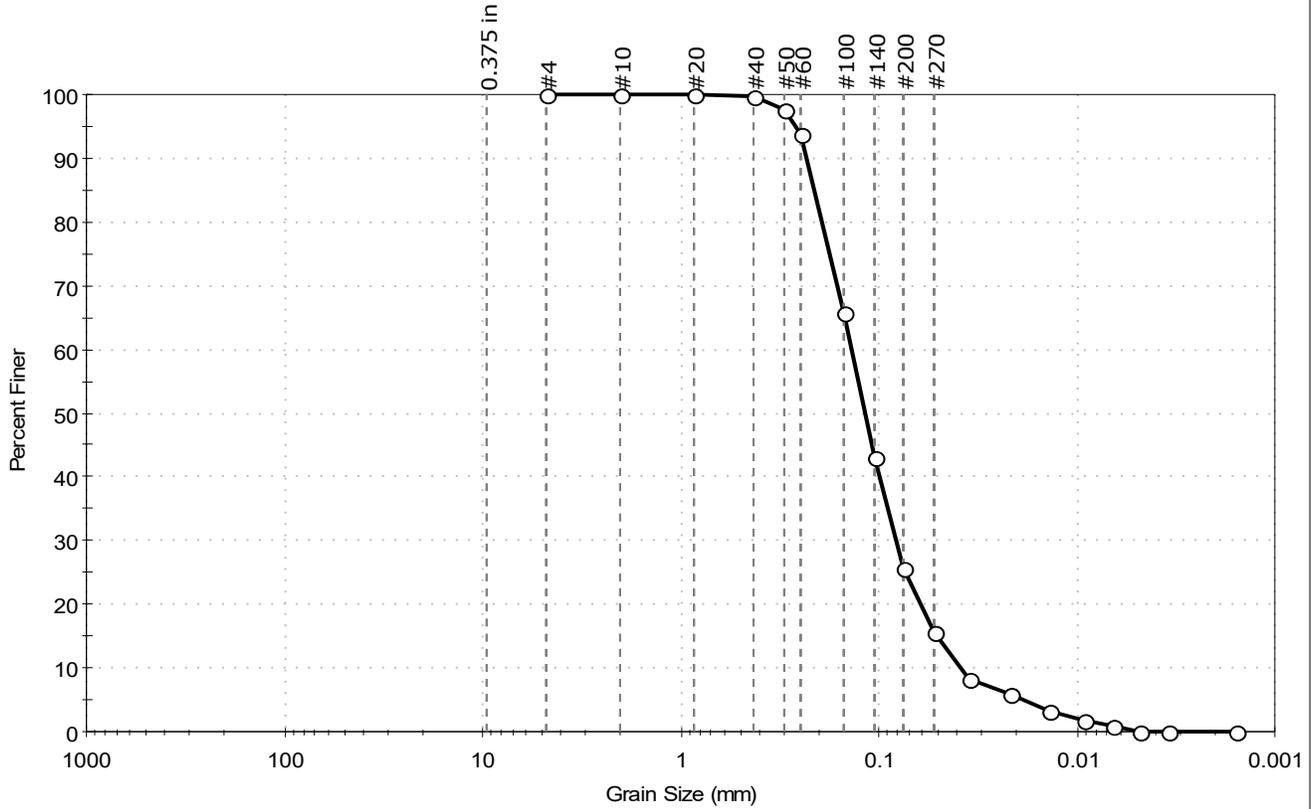
Sample/Test Description

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

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 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

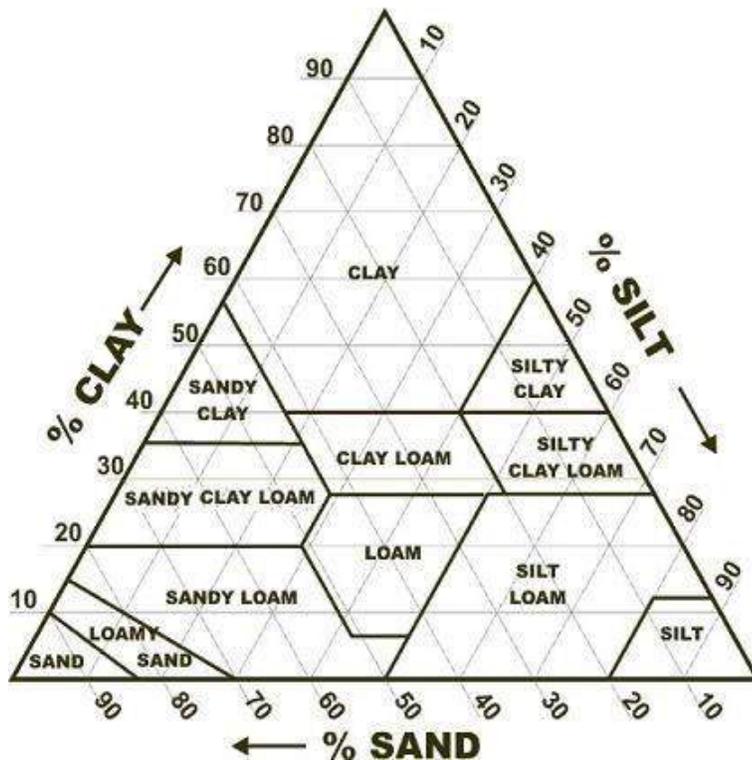
Boring ID	Sample ID	Depth	Sand, %	Silt, %	Clay, %	Classification
B-2	S-3	4.5-6.5 ft	55	42	3	Sandy Loam

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

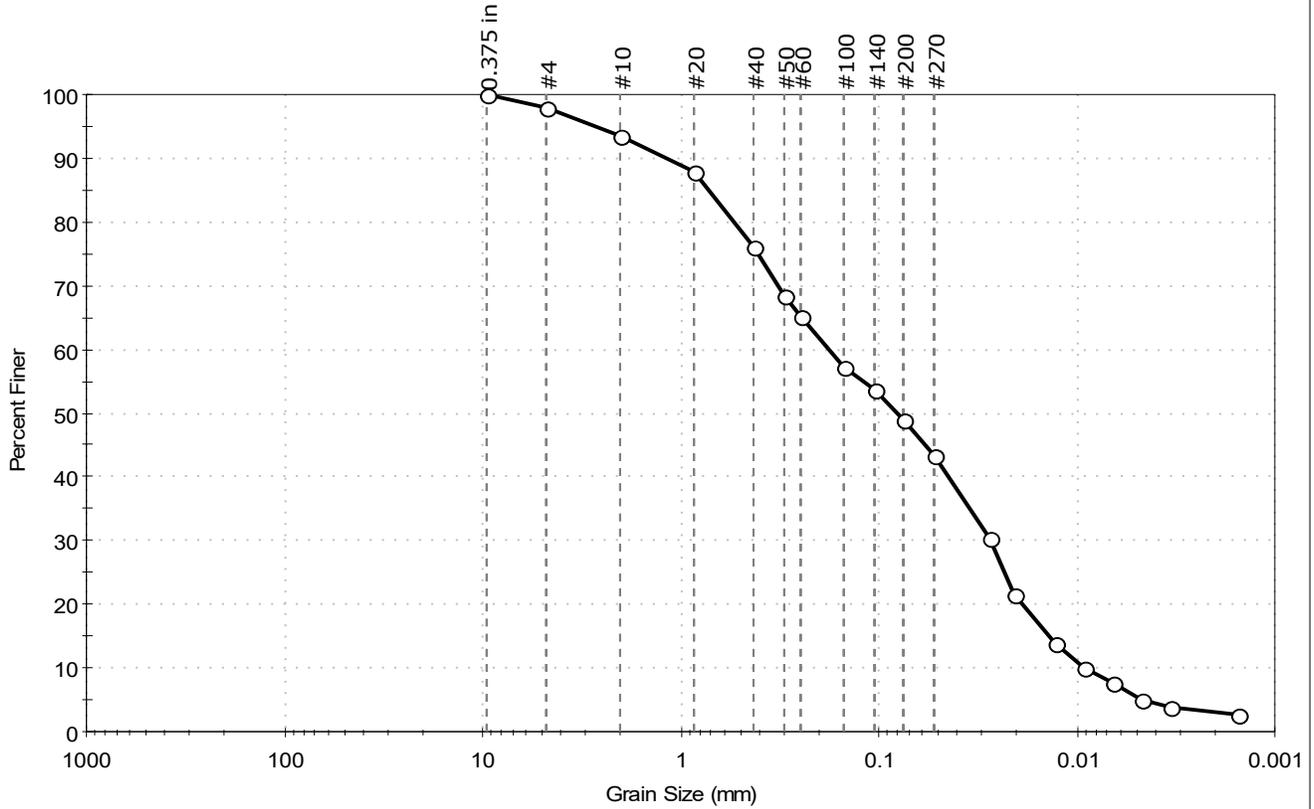
Clay: material passing 0.002 mm diameter





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

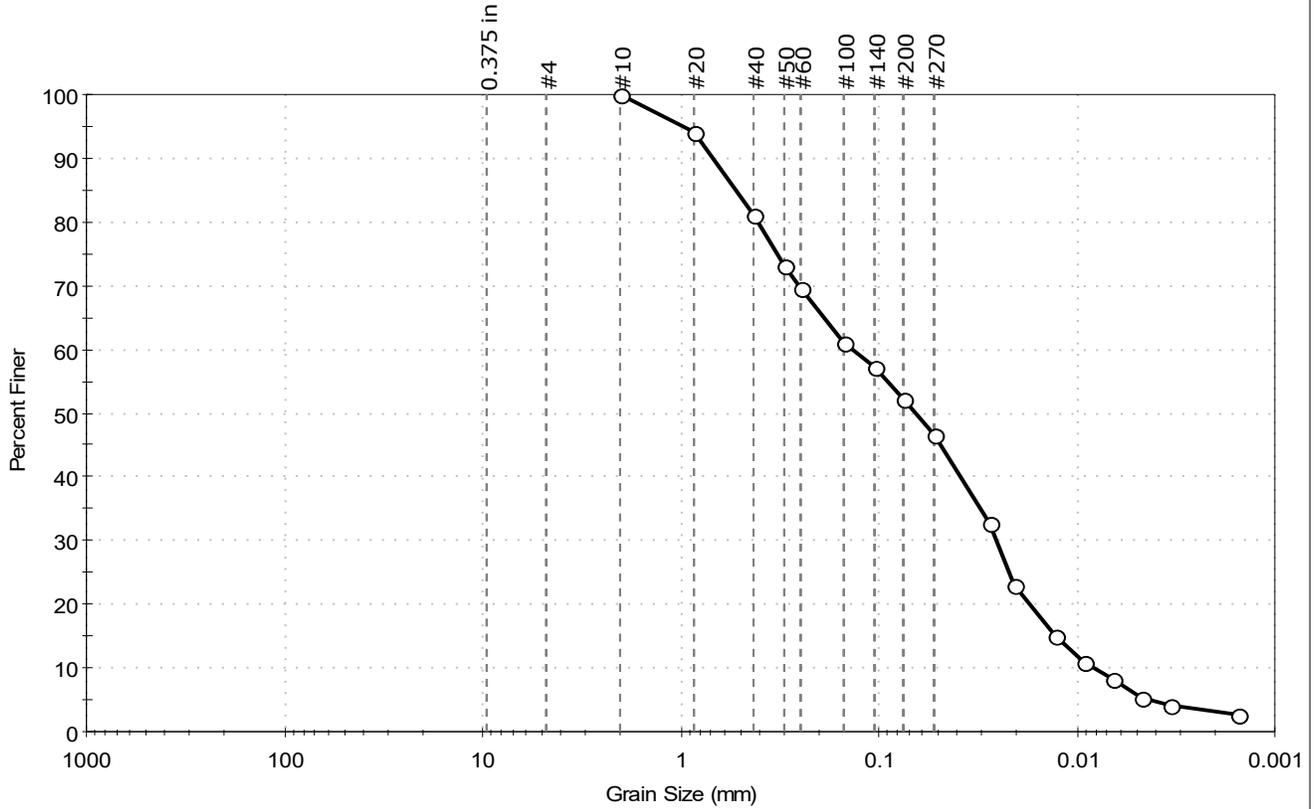
Est. Specific Gravity : 2.65

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))

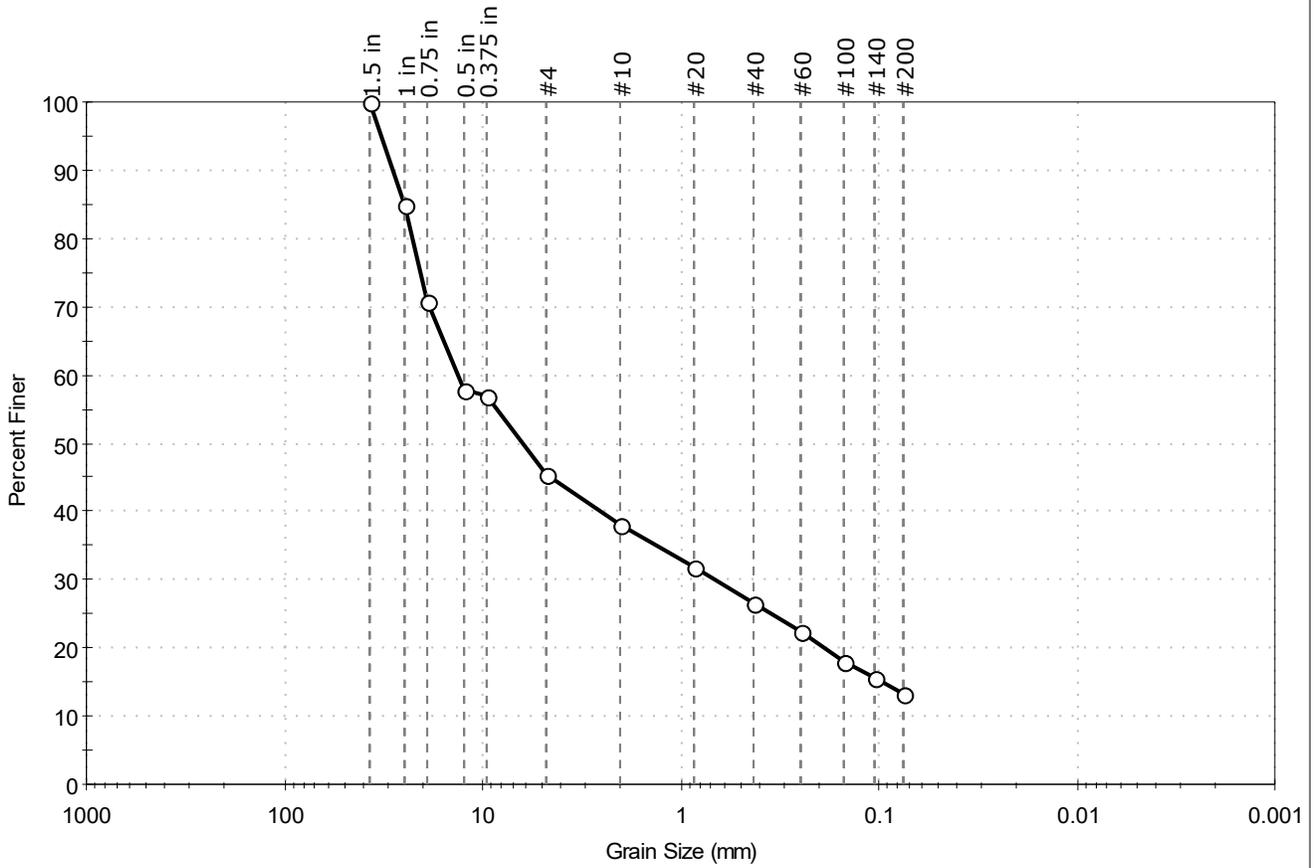
Sample/Test Description

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		

Coefficients	
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

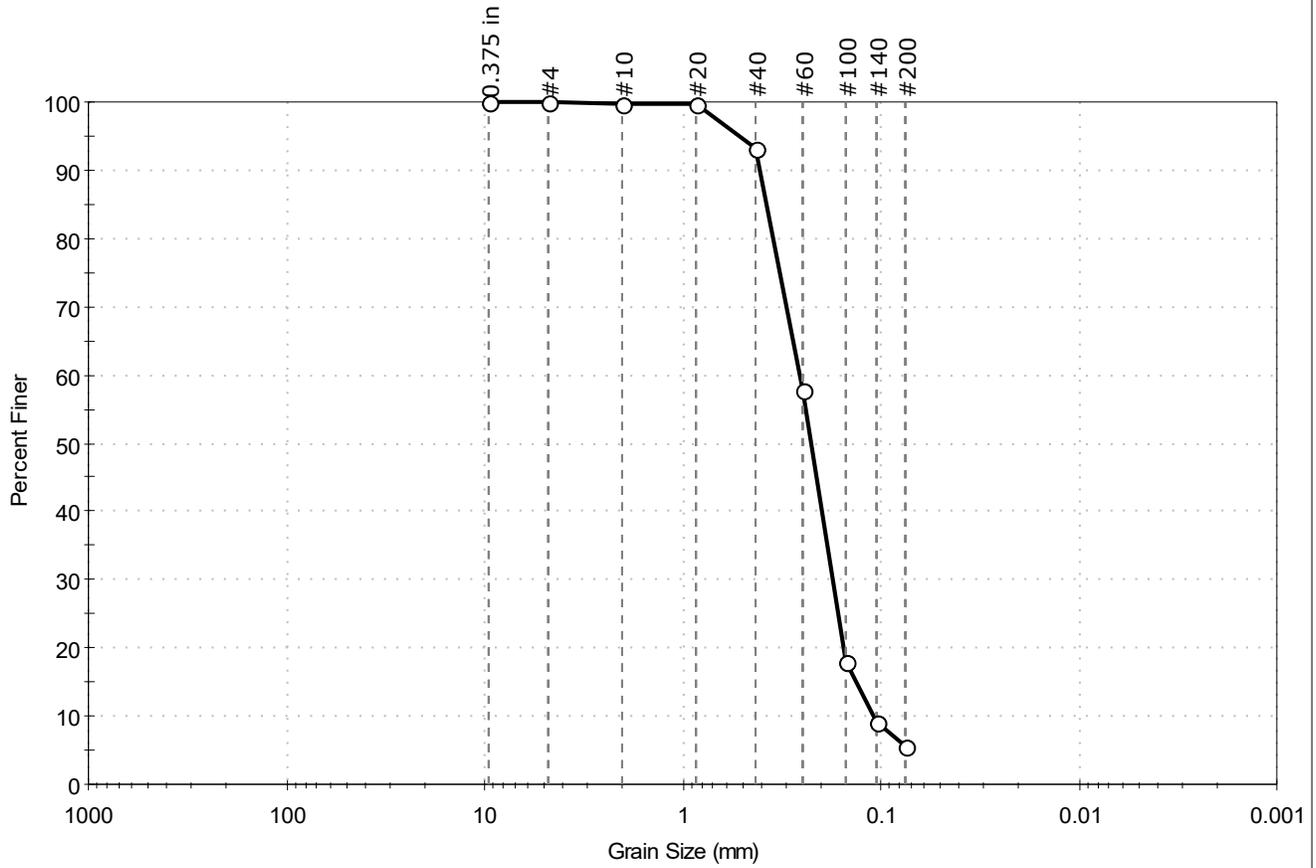
Classification	
ASTM	N/A
AASHTO	Stone Fragments, Gravel and Sand (A-1-a (0))

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		

Coefficients

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

Classification

ASTM	N/A
AASHTO	Fine Sand (A-3 (1))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

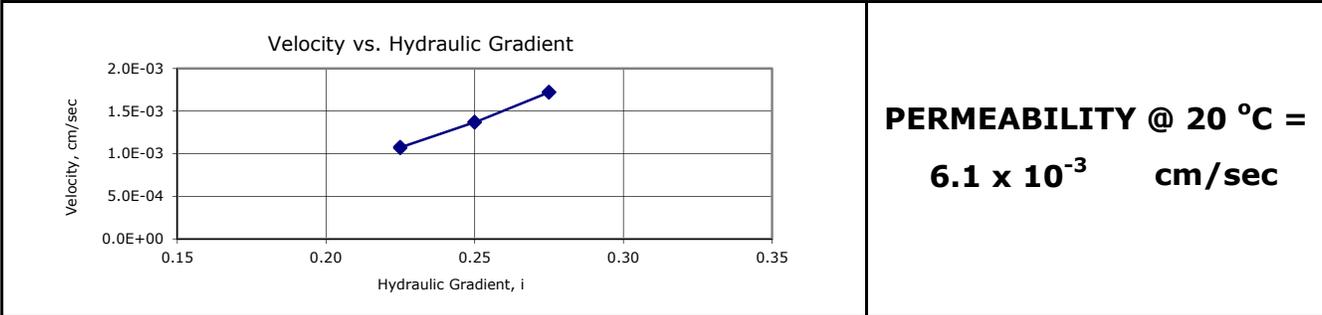


Client:	Nobis Engineering, Inc.		
Project Name:	100 Industrial Park Way		
Project Location:	Hingham, MA		
GTX #:	311163		
Start Date:	01/16/20	Tested By:	jlw
End Date:	01/17/20	Checked By:	emm
Boring #:	B-1		
Sample #:	Auger Cuttings		
Depth:	2-4 ft + -		
Visual Description:	Moist, olive brown silty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

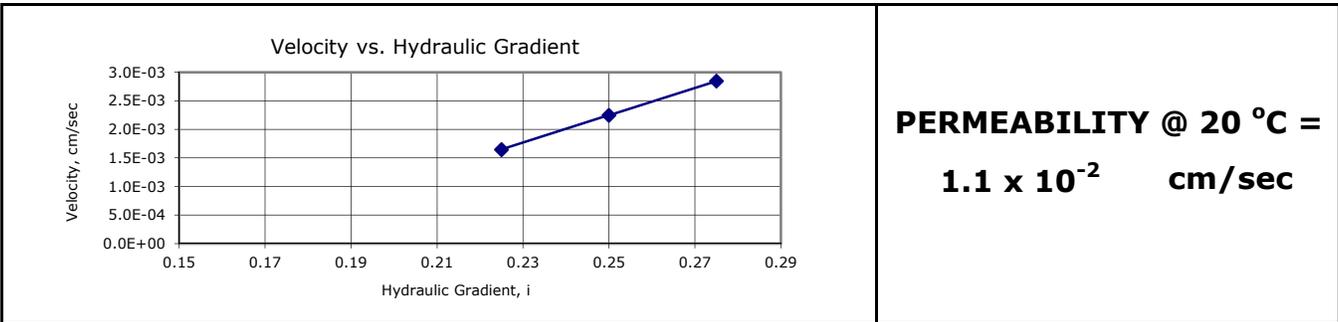


Client:	Nobis Engineering, Inc.		
Project Name:	100 Industrial Park Way		
Project Location:	Hingham, MA		
GTX #:	311163		
Start Date:	01/17/20	Tested By:	jlw
End Date:	01/17/20	Checked By:	emm
Boring #:	B-8		
Sample #:	Auger Cuttings		
Depth:	1-6 ft + -		
Visual Description:	Moist, olive brown silty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

APPENDIX H

EARTHWORK ANALYSIS

EM-1 – Earthwork Management Plan
Cut/Fill Report

Cut/Fill Report

Generated: 2020-07-13 10:32:11
By user: aklose
Drawing: G:\JOBS19\14\1901517\DWG\G:\JOBS19\14\1901517\DWG\XC190151702-Earthwork.dwg

Volume Summary							
Name	Type	Cut Factor	Fill Factor	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Cut Fill	full	1.00	1.00	405274.05	19480.86	15703.88	3776.98<Cut>

Totals				
	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Total	405274.05	19480.86	15703.88	3776.98<Cut>

* Value adjusted by cut or fill factor other than 1.0