

# **Glen Drive Water Treatment Plant Stormwater Management Report**

Lynnfield Center Water District  
Lynnfield, Massachusetts

July 7, 2023



# Glen Drive Water Treatment Plant Stormwater Management Report

## 1.0 Existing Conditions

Lynnfield Center Water District (LCWD) is proposing to upgrade the existing Glen Drive Pumping Station, adding a water treatment plant (WTP) to provide removal of iron, manganese, and PFAS from the raw water. The existing pumping station is located on an extension of Glen Drive, approximately 600 feet east of a cul-de-sac marking the end of a residential neighborhood on Glen Drive. The site is occupied by an existing pump station and clear well. Existing site grades range from approximately EL. 78.0 (NAVD88) on the north end of the site to approximately EL. 92.0 on the south end of the site. The site is surrounded by undeveloped wooded land on all sides. Wetlands are located to the north of the site. Under existing conditions, stormwater sheet flows to natural low points in the topography. The total modeled area is 3.77 ac and has existing impervious area of 0.19 ac. **Figure 1** shows the existing conditions drainage area map.

## 2.0 Proposed Conditions

Under proposed conditions, a new filter building to house greensand filter pressure vessels and granular activation carbon (GAC) vessels will be constructed. Ancillary structures include HVAC equipment, radon treatment, tight tank, and emergency generator. Proposed site improvements include a new paved access driveway, septic system, and two settling and one infiltration lagoon located to the north of Glen Drive.

The project is located outside wetland resource areas and the 100-foot buffer zone; therefore, a filing of a Notice of Intent with the Conservation Commission is not required. The Town requires application for a stormwater permit under its stormwater management bylaw when a project that disturbs an acre of land or more has stormwater discharges that ultimately drain to the Town's municipal storm drain system (MS4). This project does not discharge to the Town's MS4 and therefore, the stormwater permit is not required. This project is required to obtain a Special Permit from the Zoning Board of Appeals for special uses or activities within the Groundwater Protection District because the new impervious area is greater than 2,500 sf. Groundwater recharge from the stormwater runoff needs to be provided in a manner that does not degrade groundwater quality. To meet this requirement, stormwater management at the site was designed to be consistent with the Massachusetts Stormwater Standards.

Three infiltration basins are proposed to provide peak rate attenuation, water quality treatment and groundwater recharge. Under proposed conditions, the total modeled area is 3.49 ac with an impervious area of 0.49 ac. The overall reduction in the modelled area is due to the removal of the lagoons from the stormwater management design because all precipitation that falls within the lagoons will remain in the lagoons and will not contribute stormwater runoff to the infiltration basin. **Figure 2** shows the proposed conditions drainage area map.

### 3.0 Drainage Analysis

CDM Smith performed drainage analyses for the Glen Drive WTP site for existing and proposed conditions. The drainage analyses determined peak rates of runoff during 2-, 10-, 25-, and 100-year, 24-hour storm events using HydroCAD, version 10.2. This computer model simulates stormwater runoff flows through drainage areas and stormwater management facilities and is based on the Soil Conservation Service (SCS) Method.

Following is a summary of the methodology and assumptions used to perform the drainage analyses.

- Precipitation data for standard storms used in the models were taken from National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 10. The estimated precipitation depths during the 2-, 10-, 25-, and 100-year 24-hour storms are 3.31, 5.22, 6.41, and 8.25 inches, respectively (see **Appendix A**).
- The Natural Resources Conservation Service's (NRCS) Web Soil Survey was consulted to determine the hydrologic soil groups (HSG) for the site. The NRCS has classified the site as "Hinckley loamy sand" and assigned HSG "A" to this soil. On November 29, 2021, CDM Smith advanced two borings at the WTP site. The soil was generally classified as silty sand with gravel. In Boring B-1, which is the vicinity of the proposed filter building, groundwater was encountered at elevation 75.3 ft. In Boring B-2, which is the vicinity of the proposed lagoons, groundwater was encountered at elevation 70.1 ft. Two soil samples from Boring B-2 were analyzed to determine placement on the (United States Department of Agriculture) USDA soil triangle. One sample was classified as "sandy loam", while the other sample was classified as "loamy sand." For the recharge calculations, the more conservative classification of "sandy loam" was used. Based on Table 2.3.3 in Volume 3, Chapter 1 of *Massachusetts Stormwater Handbook*, "sandy loam" has an infiltration rate of 1.02 inches/hour. **Appendix B** provides soils information from Web Soil Survey and the geotechnical field exploration program.
- The project site was modeled as six drainage areas for existing conditions and as five drainage areas for proposed conditions. The drainage areas are shown on **Figures 1** and **2**. For comparing existing and proposed conditions there are three design points: On-Site/Western Basin, South/Eastern Basin, and Northern Wetland.
- Curve Numbers (CNs) for the different land uses on the site were selected based on HSG "A" soils. Land uses included grass cover, woods, gravel, pavement, buildings, and equipment pads. Weighted CNs were calculated in HydroCAD.
- Times of concentration (Tc) were based on the Velocity Method in the NRCS National Engineering Handbook (May 2010). A minimum Tc of 6 minutes was used for all drainage areas.

HydroCAD was used to generate peak rates of runoff for existing and proposed conditions. **Table 3-1** provides a summary of modeling results for existing and proposed conditions at the Glen Drive WTP at each design point. As this table shows, peak rates of runoff for proposed conditions are equal to or less than existing conditions for all storm events at each design point. **Table 3-2** provides a comparison of the existing and proposed peak rates of runoff for the entire project site and shows

that proposed peak rates of runoff are equal to or less than existing conditions for all storm events. The HydroCAD modeling input and output can be found in **Appendix C**.

**Table 3-1  
Glen Drive Water Treatment Plant – LCWD, Lynnfield, Massachusetts  
HydroCAD Modeling Results by Design Point**

Storm Event	Existing Conditions	Proposed Conditions
	Peak Rate of Runoff (cfs)	Peak Rate of Runoff (cfs)
<b>DP: On-Site/Western Basin</b>		
2-Year, 24-Hour	0.1	0.0
10-Year, 24-Hour	0.4	0.0
25-Year, 24-Hou	0.5	0.0
100-Year, 24-Hour	1.0	0.0
<b>DP: South/Eastern Basin</b>		
2-Year, 24-Hour	0.0	0.0
10-Year, 24-Hour	0.0	0.0
25-Year, 24-Hou	0.0	0.0
100-Year, 24-Hour	0.2	0.1
<b>DP: Northern Wetland</b>		
2-Year, 24-Hour	0.0	0.0
10-Year, 24-Hour	0.0	0.0
25-Year, 24-Hou	0.2	0.1
100-Year, 24-Hour	0.9	0.4

**Table 3-2  
Glen Drive Water Treatment Plant – LCWD, Lynnfield, Massachusetts  
Combined HydroCAD Modeling Results**

Storm Event	Existing Conditions	Proposed Conditions
	Peak Rate of Runoff (cfs)	Peak Rate of Runoff (cfs)
2-Year, 24-Hour	0.1	0.0
10-Year, 24-Hour	0.4	0.0
25-Year, 24-Hou	0.8	0.1
100-Year, 24-Hour	2.1	0.5

The site was also analyzed for compliance with the recharge volume (Rv) and water quality volume (WQv) requirements in the *Massachusetts Stormwater Handbook*. Since the soils at the location of the WTP are located on HSG “A” soils, the recharge target depth factor of 0.6 inches was used. The total corresponding Rv is 1,130 cf. Since the project site is located within a groundwater recharge district, the water quality volume is based on 1.0 inch times the total impervious area, with a total corresponding WQv of 1,510 cf. Storage for the Rv and WQv for the WTP is provided in the three infiltration basins.

The drawdown times of the water in the infiltration basins were calculated using the total storage volume provided within the infiltration basin below the spillway and the total available bottom surface area of the infiltration basin. The drawdown calculations indicate that stormwater will infiltrate within the required 72 hours, based on the infiltration rate of 1.02 inches per hour.

**Table 3-3** summarizes the impervious area tributary to each stormwater management facility, the calculated required Rv and WQv, and the total storage volume provided in the gravel infiltration trenches, porous asphalt, and pervious concrete. As shown in this table, the infiltration basins provide sufficient storage volume to meet the total adjusted required Rv and WQv for the site. **Appendix D** provides the Rv, WQv, and drawdown calculations.

**Table 3-3**  
**Summary of Overall Impervious Area, Rv and WQv**  
**Glen Drive Water Treatment Plant**

<i>Stormwater Management Facility</i>	<i>Impervious Area (sf)</i>	<i>Recharge Volume (cf)</i>	<i>Water Quality Volume (cf)</i>	<i>Volume Provided (cf)</i>
Eastern Basin	7,160	360	600	860
Western Basin	8,550	430	710	3,610
WQ Basin	4,070	340	200	2,240
Total	19,780	1,130	1,510	6,710

For new development projects, stormwater management systems must be designed to remove 80 percent of the average annual load (post-construction conditions) of Total Suspended Solids (TSS). The infiltration basins will provide 80 percent TSS removal. Pretreatment is provided in the sediment forebays associated with the infiltration basins. The TSS worksheets and calculations are provided in **Appendix E**.

An operation and maintenance plan for the infiltration basins is provided in **Appendix F**.

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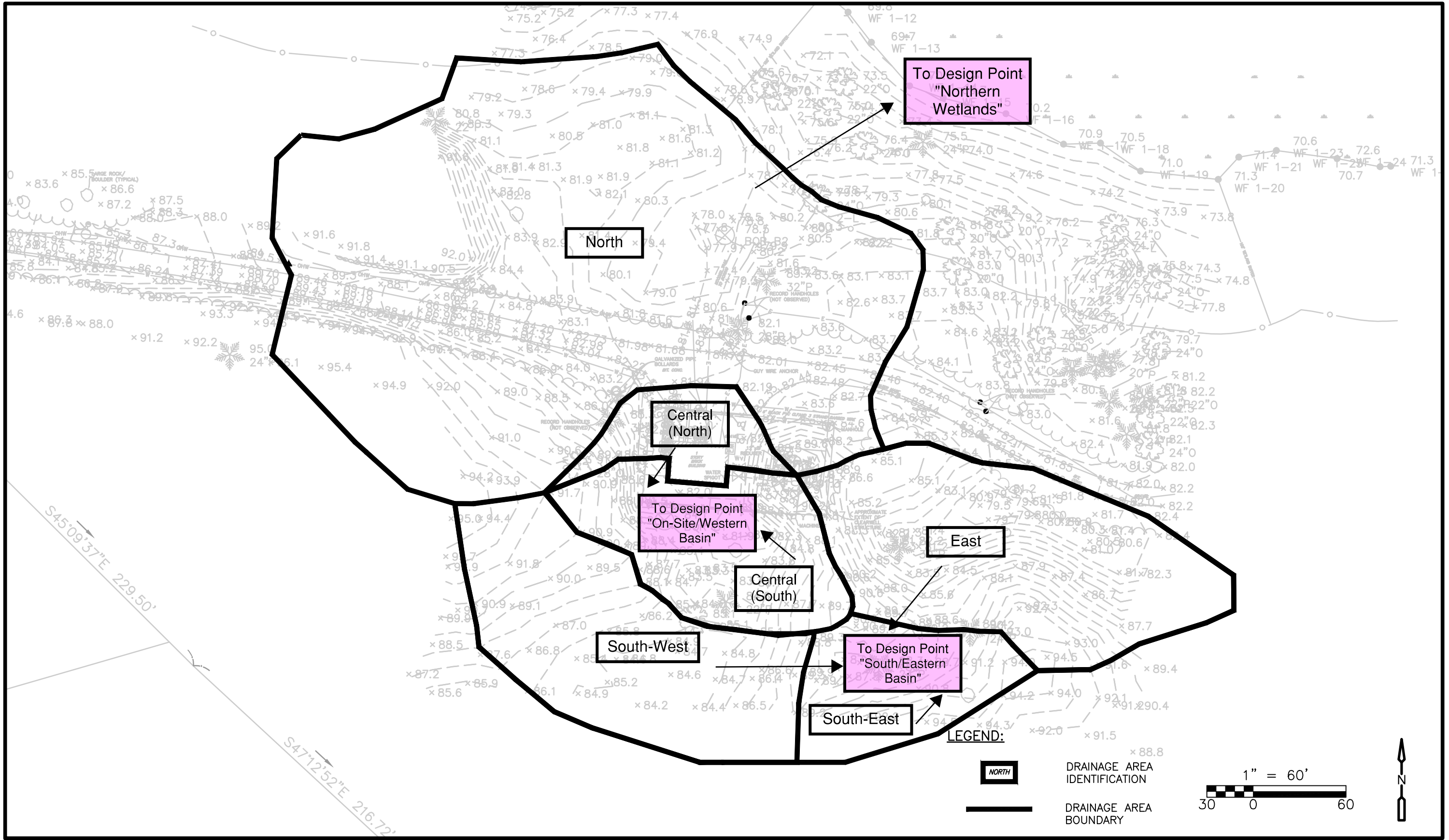


FIGURE 1 - EXISTING CONDITIONS DRAINAGE AREA MAP  
GLEN DRIVE WATER TREATMENT PLANT  
LYNNFIELD, MA  
JULY, 2023





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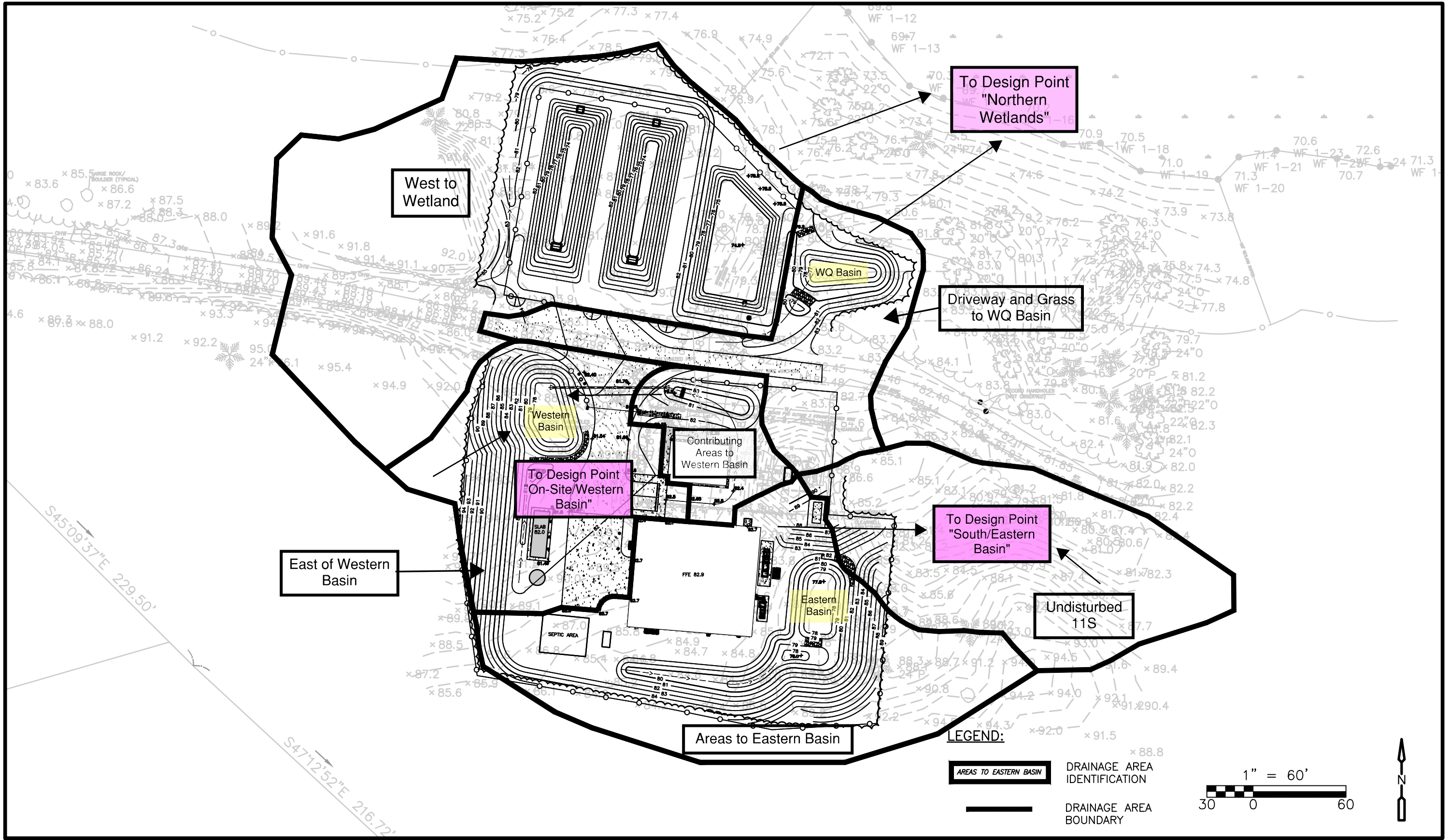


FIGURE 2 - PROPOSED CONDITIONS DRAINAGE AREA MAP  
GLEN DRIVE WATER TREATMENT PLANT  
LYNNFIELD, MA  
JULY, 2023



# Appendix A

## Rainfall Data





NOAA Atlas 14, Volume 10, Version 3  
 Location name: Lynnfield, Massachusetts, USA\*  
 Latitude: 42.5596°, Longitude: -71.0559°  
 Elevation: 103.57 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

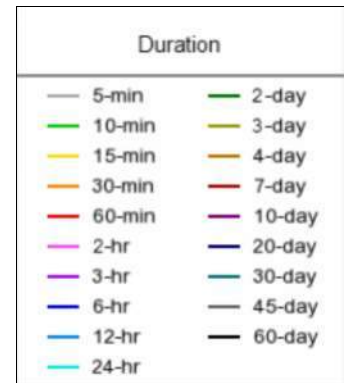
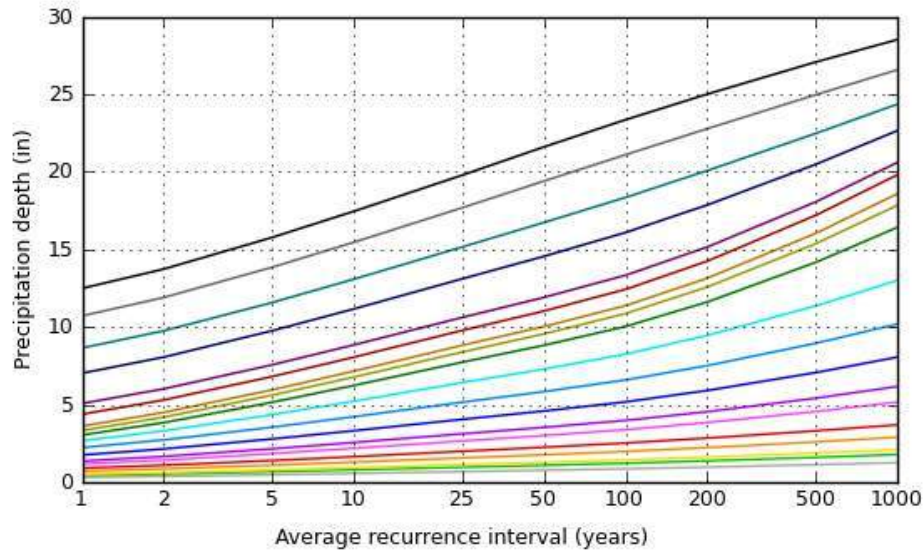
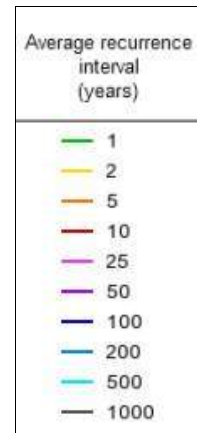
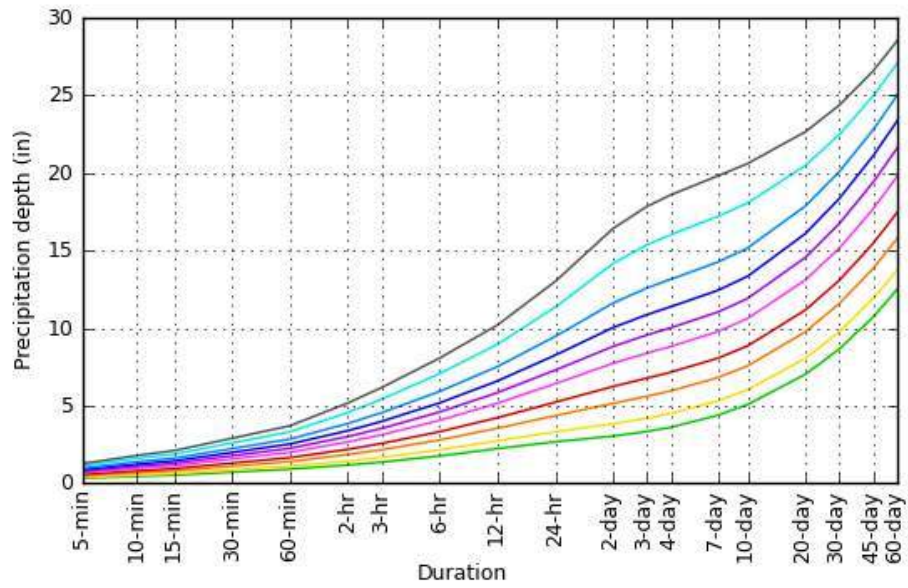
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.311 (0.241-0.390)	0.374 (0.290-0.470)	0.477 (0.368-0.602)	0.563 (0.432-0.713)	0.681 (0.507-0.903)	0.769 (0.561-1.04)	0.862 (0.613-1.22)	0.969 (0.652-1.39)	1.13 (0.730-1.68)	1.26 (0.796-1.91)
10-min	0.441 (0.342-0.553)	0.530 (0.410-0.666)	0.676 (0.522-0.852)	0.797 (0.611-1.01)	0.964 (0.718-1.28)	1.09 (0.795-1.48)	1.22 (0.869-1.72)	1.38 (0.924-1.97)	1.60 (1.03-2.38)	1.78 (1.13-2.70)
15-min	0.519 (0.402-0.650)	0.624 (0.483-0.783)	0.796 (0.614-1.00)	0.939 (0.721-1.19)	1.14 (0.845-1.51)	1.28 (0.936-1.74)	1.44 (1.02-2.03)	1.62 (1.09-2.32)	1.88 (1.22-2.79)	2.10 (1.33-3.18)
30-min	0.713 (0.553-0.894)	0.858 (0.664-1.08)	1.10 (0.845-1.38)	1.29 (0.992-1.64)	1.56 (1.16-2.07)	1.77 (1.29-2.40)	1.98 (1.41-2.79)	2.23 (1.50-3.20)	2.59 (1.68-3.86)	2.90 (1.83-4.39)
60-min	0.908 (0.703-1.14)	1.09 (0.846-1.37)	1.40 (1.08-1.76)	1.65 (1.26-2.09)	1.99 (1.48-2.64)	2.25 (1.65-3.05)	2.53 (1.80-3.56)	2.84 (1.91-4.08)	3.31 (2.14-4.92)	3.70 (2.34-5.61)
2-hr	1.17 (0.916-1.46)	1.43 (1.11-1.78)	1.84 (1.43-2.30)	2.18 (1.69-2.75)	2.66 (1.99-3.51)	3.00 (2.22-4.07)	3.38 (2.44-4.78)	3.85 (2.59-5.49)	4.55 (2.96-6.73)	5.16 (3.28-7.78)
3-hr	1.36 (1.07-1.69)	1.66 (1.30-2.07)	2.15 (1.68-2.68)	2.56 (1.99-3.21)	3.12 (2.35-4.11)	3.53 (2.62-4.77)	3.98 (2.89-5.62)	4.54 (3.07-6.46)	5.41 (3.52-7.97)	6.17 (3.92-9.25)
6-hr	1.75 (1.39-2.16)	2.15 (1.69-2.65)	2.79 (2.19-3.45)	3.32 (2.59-4.13)	4.05 (3.08-5.31)	4.59 (3.42-6.16)	5.18 (3.77-7.27)	5.91 (4.01-8.35)	7.06 (4.61-10.3)	8.06 (5.14-12.0)
12-hr	2.23 (1.77-2.73)	2.73 (2.17-3.34)	3.54 (2.81-4.36)	4.22 (3.32-5.22)	5.15 (3.94-6.70)	5.84 (4.38-7.78)	6.59 (4.82-9.17)	7.52 (5.12-10.5)	8.95 (5.86-13.0)	10.2 (6.52-15.1)
24-hr	2.67 (2.14-3.25)	3.31 (2.65-4.03)	4.35 (3.48-5.32)	5.22 (4.14-6.42)	6.41 (4.94-8.30)	7.29 (5.51-9.67)	8.25 (6.09-11.4)	9.46 (6.48-13.2)	11.4 (7.46-16.4)	13.0 (8.35-19.1)
2-day	3.04 (2.45-3.67)	3.84 (3.10-4.64)	5.15 (4.14-6.25)	6.24 (4.98-7.61)	7.73 (6.00-9.98)	8.82 (6.73-11.7)	10.0 (7.49-13.9)	11.6 (7.98-16.1)	14.2 (9.34-20.3)	16.4 (10.6-23.9)
3-day	3.33 (2.70-4.01)	4.19 (3.40-5.05)	5.60 (4.53-6.78)	6.77 (5.44-8.24)	8.38 (6.54-10.8)	9.56 (7.32-12.6)	10.9 (8.14-15.0)	12.6 (8.66-17.3)	15.4 (10.1-21.9)	17.8 (11.5-25.9)
4-day	3.61 (2.94-4.33)	4.50 (3.66-5.41)	5.95 (4.82-7.18)	7.16 (5.76-8.68)	8.82 (6.90-11.3)	10.0 (7.70-13.2)	11.4 (8.54-15.7)	13.2 (9.07-18.1)	16.0 (10.6-22.8)	18.6 (12.0-26.9)
7-day	4.38 (3.59-5.23)	5.30 (4.34-6.34)	6.81 (5.55-8.16)	8.06 (6.53-9.72)	9.78 (7.68-12.4)	11.0 (8.50-14.4)	12.4 (9.35-17.0)	14.3 (9.87-19.5)	17.2 (11.4-24.3)	19.8 (12.8-28.5)
10-day	5.07 (4.17-6.04)	6.02 (4.95-7.17)	7.56 (6.19-9.04)	8.85 (7.20-10.6)	10.6 (8.36-13.4)	11.9 (9.19-15.4)	13.3 (10.0-18.1)	15.2 (10.5-20.6)	18.1 (12.0-25.4)	20.6 (13.4-29.5)
20-day	7.03 (5.83-8.30)	8.06 (6.68-9.54)	9.76 (8.05-11.6)	11.2 (9.15-13.3)	13.1 (10.4-16.3)	14.6 (11.2-18.5)	16.1 (12.0-21.3)	17.9 (12.5-24.1)	20.5 (13.7-28.6)	22.7 (14.7-32.2)
30-day	8.65 (7.21-10.2)	9.76 (8.12-11.5)	11.6 (9.60-13.7)	13.1 (10.8-15.6)	15.2 (12.0-18.7)	16.7 (12.9-21.1)	18.4 (13.6-23.9)	20.1 (14.1-26.9)	22.5 (15.1-31.2)	24.4 (15.9-34.5)
45-day	10.7 (8.97-12.6)	11.9 (9.96-14.0)	13.9 (11.5-16.3)	15.5 (12.8-18.3)	17.7 (14.0-21.7)	19.4 (15.0-24.2)	21.1 (15.6-27.1)	22.8 (16.1-30.4)	25.0 (16.8-34.4)	26.6 (17.4-37.5)
60-day	12.5 (10.5-14.6)	13.7 (11.5-16.1)	15.8 (13.2-18.5)	17.5 (14.5-20.6)	19.8 (15.7-24.1)	21.6 (16.7-26.8)	23.4 (17.3-29.8)	25.0 (17.7-33.2)	27.1 (18.3-37.2)	28.5 (18.6-40.1)

<sup>1</sup> 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.

[Back to Top](#)

PF graphical

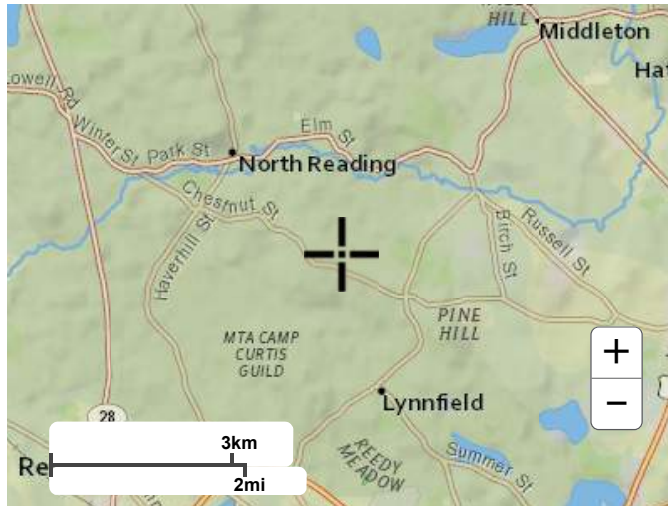
PDS-based depth-duration-frequency (DDF) curves  
 Latitude: 42.5596°, Longitude: -71.0559°



[Back to Top](#)

## Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

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Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

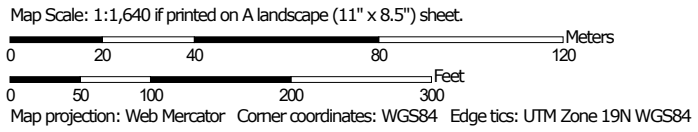
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# **Appendix B**

## **Geotechnical Information**



Soil Map—Essex County, Massachusetts, Southern Part  
(LCWD - Glen Drive)






## MAP LEGEND




















### Area of Interest (AOI)






Area of Interest (AOI)

### Soils

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

### Special Point Features






-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

### Water Features

-  Streams and Canals

### Transportation

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

### Background

-  Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Essex County, Massachusetts, Southern Part  
Survey Area Data: Version 19, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

## Map Unit Legend

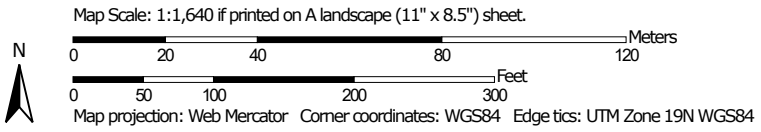
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	1.2	11.9%
242C	Hinckley loamy sand, 8 to 15 percent slopes	7.6	74.2%
242D	Hinckley loamy sand, 15 to 25 percent slopes	1.4	14.0%
<b>Totals for Area of Interest</b>		<b>10.3</b>	<b>100.0%</b>


































Hydrologic Soil Group—Essex County, Massachusetts, Southern Part  
(LCWD - Glen Drive)



Soil Map may not be valid at this scale.



## MAP LEGEND

<b>Area of Interest (AOI)</b>		 C
Area of Interest (AOI)		 C/D
		 D
		 Not rated or not available
<b>Soils</b>		
<b>Soil Rating Polygons</b>		
 A		
 A/D		
 B		
 B/D		
 C		
 C/D		
 D		
 Not rated or not available		
<b>Soil Rating Lines</b>		
 A		
 A/D		
 B		
 B/D		
 C		
 C/D		
 D		
 Not rated or not available		
<b>Soil Rating Points</b>		
 A		
 A/D		
 B		
 B/D		
<b>Water Features</b>		
 Streams and Canals		
<b>Transportation</b>		
 Rails		
 Interstate Highways		
 US Routes		
 Major Roads		
 Local Roads		
<b>Background</b>		
 Aerial Photography		

## MAP INFORMATION

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

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

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

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

Soil Survey Area: Essex County, Massachusetts, Southern Part  
Survey Area Data: Version 19, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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



## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	B/D	1.2	11.9%
242C	Hinckley loamy sand, 8 to 15 percent slopes	A	7.6	74.2%
242D	Hinckley loamy sand, 15 to 25 percent slopes	A	1.4	14.0%
<b>Totals for Area of Interest</b>			<b>10.3</b>	<b>100.0%</b>

### 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

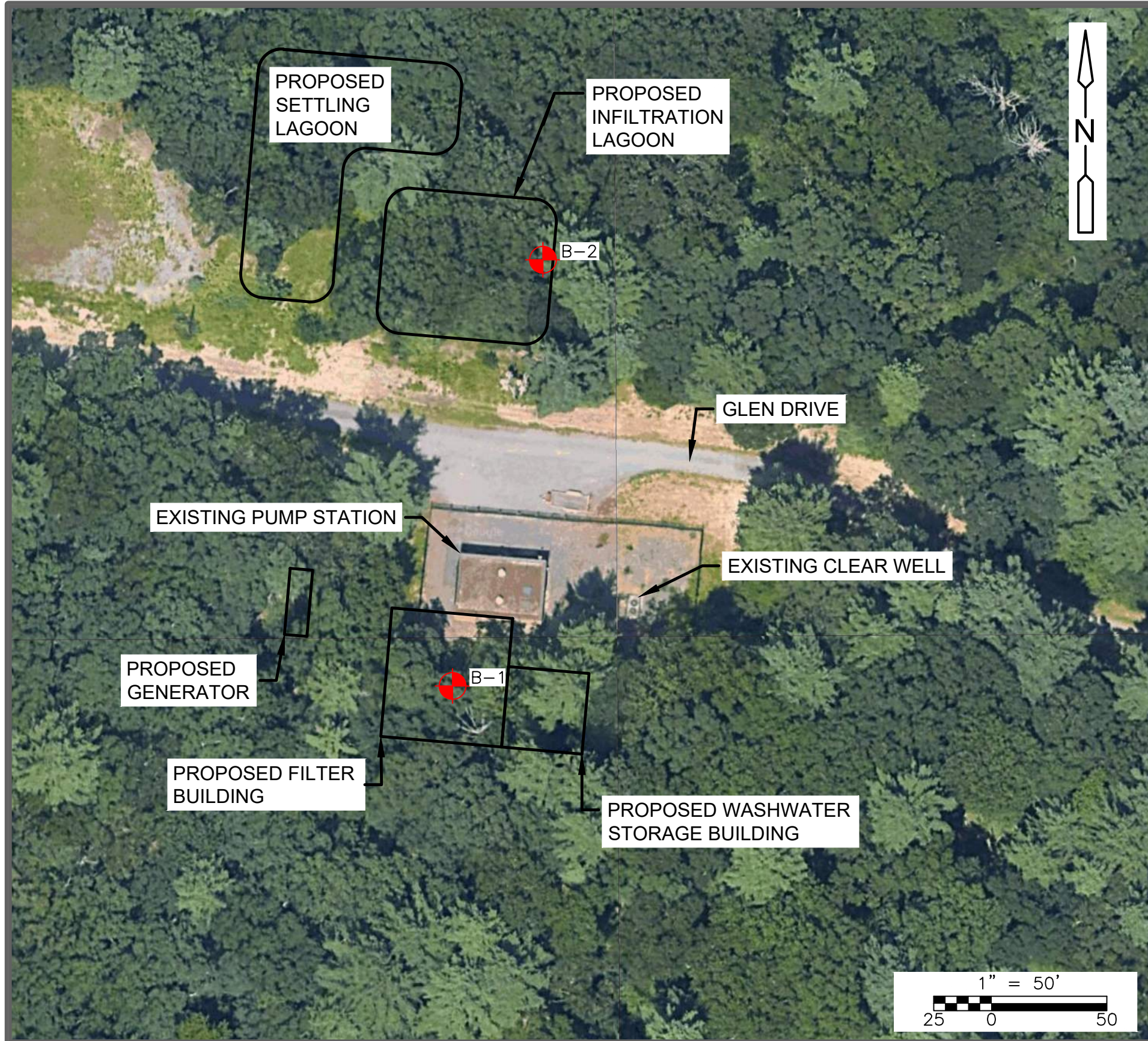
*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher



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**LEGEND:**



B-1 DESIGNATION AND APPROXIMATE LOCATION OF TEST BORINGS DRILLED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NH ON NOVEMBER 29, 2021.

**NOTES:**

1. TEST BORINGS WERE MARKED IN THE FIELD BY A CDM SMITH REPRESENTATIVE PRIOR TO DRILLING.
2. TEST BORINGS WERE OBSERVED AND LOGGED ON A FULL-TIME BASIS BY A CDM SMITH ENGINEER.
3. COORDINATES OF AS-DRILLED LOCATIONS ARE REFERENCED TO THE MASSACHUSETTS STATE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD 83).
4. ELEVATIONS ARE IN FEET AND REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
5. AERIAL PHOTOGRAPH SOURCE: GOOGLE MAPS.
6. LOCATIONS OF PROPOSED INFRASTRUCTURE IS CONSIDERED APPROXIMATE.

POINT TABLE

BORING ID	ELEVATION	NORTHING	EASTING
B-1	84.1	3029356.05	777175.17
B-2	78.5	3029540.67	777214.33



LYNNFIELD CENTER WATER DISTRICT  
GLEN DRIVE WATER TREATMENT PLANT  
LYNNFIELD, MA

SUBSURFACE EXPLORATION LOCATION PLAN  
FIGURE 1



# Attachment A

## Boring Logs



# Boring Number: B-1

**Client:** Lynnfield Center Water District

**Project Name:** Glen Drive WTP

**Project Location:** Lynnfield, MA

**Project Number:** 265722

**Drilling Contractor/Driller:** New England Boring Contractors/W. Hoeckele

**Surface Elevation (ft):** 84.1

**Drilling Method/Bore Hole Diameter:** Drive and Wash/4 in.

**Total Depth (ft):** 16.5

**Hammer Style/Weight/Drop Height/Spoon Size:** Automatic/140 lb/30 in./2 in.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:**

Depth	Date	Time
8.9	11/29/2021	11:26

N: 3029356.06

E: 777175.17

**Abandonment Method:** Backfilled with soil cuttings.

**Drilling Date: Start:** 11/29/2021

**End:** 11/29/2021

**Logged By:** A. Recio

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	Graphic Log	Strata	Material Description	Remarks	
0		SS	S-1	24	5 13 12 10	5	25	0.0	[Cross-hatch pattern]	FILL	Moist, medium dense, light gray, fine to coarse GRAVEL and fine to coarse SAND, little silt (GP-GM).	Environmental analytical sample taken at 2-4 ft bgs.	
		SS	S-2	24	10 12 12 33	16	24	0.0			Moist, medium dense, light brown-light gray, fine to coarse SAND and fine to coarse GRAVEL, little silt (SM).		
80.0		SS	S-3	24	47 27 29 100	13	56	0.0	[Dotted pattern]	SILTY SAND & GRAVEL	Moist, very dense, light brown-light gray, fine to coarse SAND, some fine gravel, little silt (SM).	Environmental analytical sample taken at 6-9.5 ft bgs.	
		SS	S-4	24	26 35 29 27	12	64	0.0					Moist, very dense, light brown-light gray, fine to coarse GRAVEL and fine to coarse SAND, little silt (GM).
		SS	S-5	15	47 44 84/3"	11	>128	0.0					Moist, very dense, light brown-light gray, fine to coarse GRAVEL and fine to coarse SAND, little silt (SM).
75.0	▼	NX	C-1	60		27			[+ symbols]	BOULDER			

Sample Types		Consistency vs Blowcount/Foot				Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch	Granular (Sand):		Fine Grained (Clay):		and	50 - 35%
CS - California Sampler	SS - Split Spoon	V. Loose: 0-4	Dense: 30-50	V. Soft: <2	Stiff: 8-15	some	35 - 20%
NQ - 1.9" Rock Core	ST - Shelby Tube	Loose: 4-10	V. Dense: >50	Soft: 2-4	V. Stiff: 15-30	little	20 - 10%
NX - 2.2" Rock Core	WS - Wash Sample	M. Dense: 10-30		M. Stiff: 4-8	Hard: >30	trace	< 10%
	GP - Geoprobe					moisture, density, color	

**Reviewed by:** T. Sousa

**Date:** 12/10/2021

**Boring Number:** B-1





# Boring Number: B-1

**Client:** Lynnfield Center Water District

**Project Name:** Glen Drive WTP

**Project Location:** Lynnfield, MA

**Project Number:** 265722

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	Graphic Log	Strata	Material Description	Remarks
70.0	15	SS	S-6	24	15	9	47	0.0	+	BOULDER	Wet, very dense, brown-gray, fine to coarse SAND, some fine gravel, little silt (SM).	
					22							
					55					SILTY SAND & GRAVEL		
											Test boring terminated at 16.5 feet bgs.	
65.0	20											
60.0	25											
55.0	30											



# Boring Number: B-2

**Client:** Lynnfield Center Water District

**Project Name:** Glen Drive WTP

**Project Location:** Lynnfield, MA

**Project Number:** 265722

**Drilling Contractor/Driller:** New England Boring Contractors/W. Hoeckele

**Surface Elevation (ft):** 78.5

**Drilling Method/Bore Hole Diameter:** Drive and Wash/4 in.

**Total Depth (ft):** 20.5

**Hammer Style/Weight/Drop Height/Spoon Size:** Automatic/140 lb/30 in./2 in.

**Depth to Initial Water Level (ft):**

**Bore Hole Location:**

Depth	Date	Time
8.4	11/29/2021	15:21

N: 3029540.67

E: 777214.33

**Abandonment Method:** Backfilled with soil cuttings.

**Drilling Date: Start:** 11/29/2021 **End:** 11/29/2021

**Logged By:** A. Recio

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	Graphic Log	Strata	Material Description	Remarks
0											4" TOPSOIL.	
		SS	S-1	24	WOH 1	6	1	0.0		FILL	Moist, very loose, brown, fine SAND, little silt (SM).	Environmental analytical sample taken from 2-4 ft bgs.
		SS	S-2	23	5 13 19 26/5"	6	32	0.0			Top 3": Moist, dense, brown, fine SAND, little silt (SM).	
		SS	S-3	1	50/1"	1	>50	0.0		SILTY SAND & GRAVEL	Bottom 3": Moist, dense, gray, fine to coarse SAND, some fine gravel, trace silt (SP-SM).	Environmental analytical sample taken at 6.5-8.5 ft bgs.
74.0		SS	S-4	24	65 48 68 80	10	116	0.0			Moist, very dense, gray, fine to coarse SAND, trace fine gravel, trace silt (SP-SM).	
	5	SS	S-5	24	51 51 45 40	14	96	0.0			Moist, very dense, gray-brown, fine to coarse SAND, some fine to coarse gravel, some silt (SM).	
		SS	S-6	24	30 32 37 71	20	69	0.0			Moist, very dense, gray, fine to coarse SAND, some fine gravel, little silt (SM).	
69.0		SS	S-6	24							Wet, very dense, gray-brown, fine to coarse SAND, little silt, trace fine gravel (SM).	

Sample Types		Consistency vs Blowcount/Foot				Burmister Classification	
AS - Auger/Grab Sample	HP - Hydro Punch	Granular (Sand):		Fine Grained (Clay):		and	50 - 35%
CS - California Sampler	SS - Split Spoon	V. Loose: 0-4	Dense: 30-50	V. Soft: <2	Stiff: 8-15	some	35 - 20%
NQ - 1.9" Rock Core	ST - Shelby Tube	Loose: 4-10	V. Dense: >50	Soft: 2-4	V. Stiff: 15-30	little	20 - 10%
NX - 2.2" Rock Core	WS - Wash Sample	M. Dense: 10-30		M. Stiff: 4-8	Hard: >30	trace	< 10%
	GP - Geoprobe					moisture, density, color	

**Reviewed by:** T. Sousa

**Date:** 12/10/2021

**Boring Number:** B-2



# Boring Number: B-2

**Client:** Lynnfield Center Water District

**Project Name:** Glen Drive WTP

**Project Location:** Lynnfield, MA

**Project Number:** 265722

Elev. (ft)	Depth (ft)	Sample Type	Sample Number	Sample Length (in)	Blows per 6 inches	Sample Recovery (in)	N-Value	PID (ppm)	Graphic Log	Strata	Material Description	Remarks
64.0	15	SS	S-7	24	37 48 19 25	10	67	0.0		SILTY SAND & GRAVEL	Wet, very dense, gray-brown, fine to coarse SAND and fine to coarse GRAVEL, little silt (SW-SM).	
59.0	20	SS	S-8	18	67 85 100	18	185	0.0			Top 12": Wet, very dense, gray-brown, fine to coarse SAND, little silt, trace fine gravel (SP-SM). Bottom 6": WEATHERED ROCK.	
54.0	25											Test boring terminated at 20.5 feet bgs.
49.0	30											

**Attachment B**  
**Geotechnical Laboratory Test Results**





## CDM Smith Geotechnical Laboratory Testing Summary Sheet

Client: Lynnfield Center Water District

Project Number: 630-265722

Reviewed By: M. Polsky - Lab Manager

Project Name: Glen Drive WTP

Task: TASK 2.4 GEOTECH

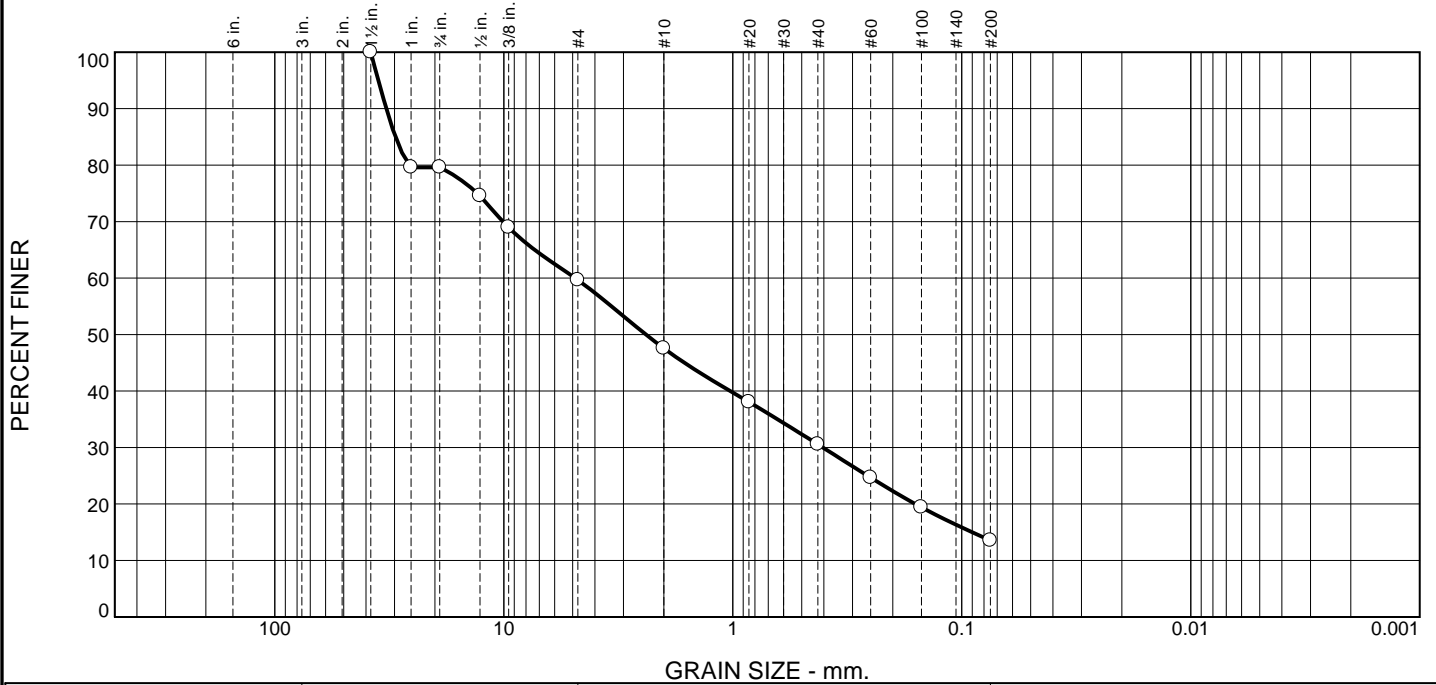
Project Location: Lynnfield, MA

Assigned By: T. Dunn

Date Reviewed: 12/10/2021

Sample Date	Boring Number	Sample	Depth (ft)	Identification Tests								Strength Tests			Soil Description
				Water Content %	LL %	PL %	Gravel %	Sand %	Fines %	Org. %	Dry unit wt.	$\sigma_c$ psi	Failure Criteria (CIU)	Compr. Ratio	
11/29/21	B-1	S-2	2-4	5.5			40.3	46.2	13.5						Light brown silty sand with gravel
11/29/21	B-1	S-4	6-8	7.2			45.0	37.4	17.6						Light brown silty gravel with sand
11/29/21	B-2	S-4	4.5-6.5	9.8			27.7	51.6	20.7						Brown silty sand with gravel USDA = sandy loam
11/29/21	B-2	S-7	14-16	10.0			43.3	46.7	10.0						Gray-brown well-graded sand with silt and gravel USDA = loamy sand

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.4	19.9	12.1	17.0	17.1	13.5	

Test Results (ASTM D6913 & ASTM D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	79.6		
0.75"	79.6		
0.5"	74.6		
0.375"	69.0		
#4	59.7		
#10	47.6		
#20	38.0		
#40	30.6		
#60	24.7		
#100	19.4		
#200	13.5		

\* (no specification provided)

**Material Description**

Light brown silty sand with gravel

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= SM      AASHTO (M 145)= A-1-b

**Coefficients**

D<sub>90</sub>= 32.5927      D<sub>85</sub>= 29.7198      D<sub>60</sub>= 4.8803  
D<sub>50</sub>= 2.3937      D<sub>30</sub>= 0.4044      D<sub>15</sub>= 0.0900  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

As Received Moisture Content = 5.5%

Date Received: 12/3/21      Date Tested: 12/10/21

Tested By: MP/HA

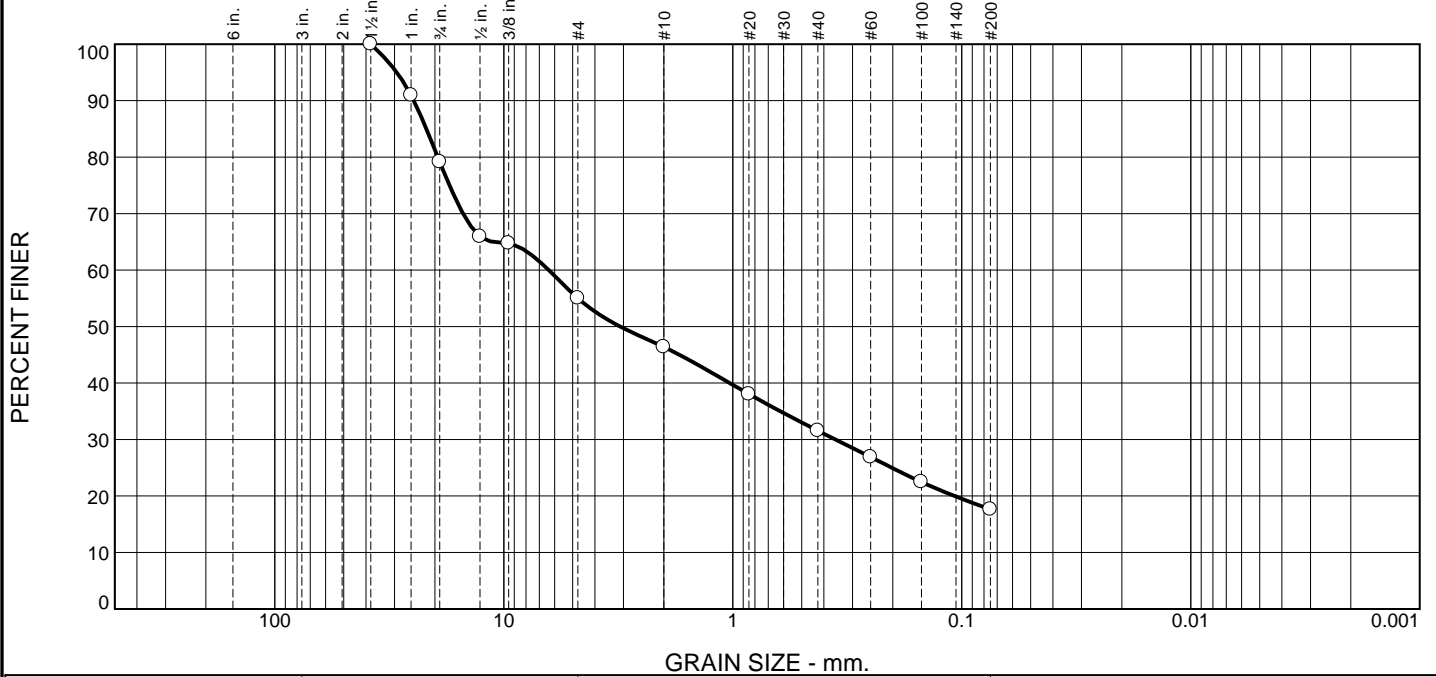
Checked By: MP

Title: Laboratory Manager

Source of Sample: B-1      Depth: 2-4'      Date Sampled: 11/29/21  
Sample Number: S-2

<b>CDM Smith</b>  <b>Boston, Massachusetts</b>	<b>Client:</b> Lynnfield Center Water District <b>Project:</b> Glen Drive WTP Lynnfield, MA <b>Project No:</b> 630-265722
--	--

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.8	24.2	8.6	14.8	14.0	17.6	

Test Results (ASTM D6913 & ASTM D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5"	100.0		
1"	90.9		
0.75"	79.2		
0.5"	65.9		
0.375"	64.7		
#4	55.0		
#10	46.4		
#20	38.0		
#40	31.6		
#60	26.9		
#100	22.5		
#200	17.6		

\* (no specification provided)

**Material Description**

Light brown silty gravel with sand

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= GM      AASHTO (M 145)= A-1-b

**Coefficients**

D<sub>90</sub>= 24.7270      D<sub>85</sub>= 21.7888      D<sub>60</sub>= 6.3632  
D<sub>50</sub>= 3.1021      D<sub>30</sub>= 0.3561      D<sub>15</sub>= \_\_\_\_\_  
D<sub>10</sub>= \_\_\_\_\_      C<sub>u</sub>= \_\_\_\_\_      C<sub>c</sub>= \_\_\_\_\_

**Remarks**

As Received Moisture Content = 7.2%

Date Received: 12/3/21      Date Tested: 12/10/21

Tested By: MP/HA

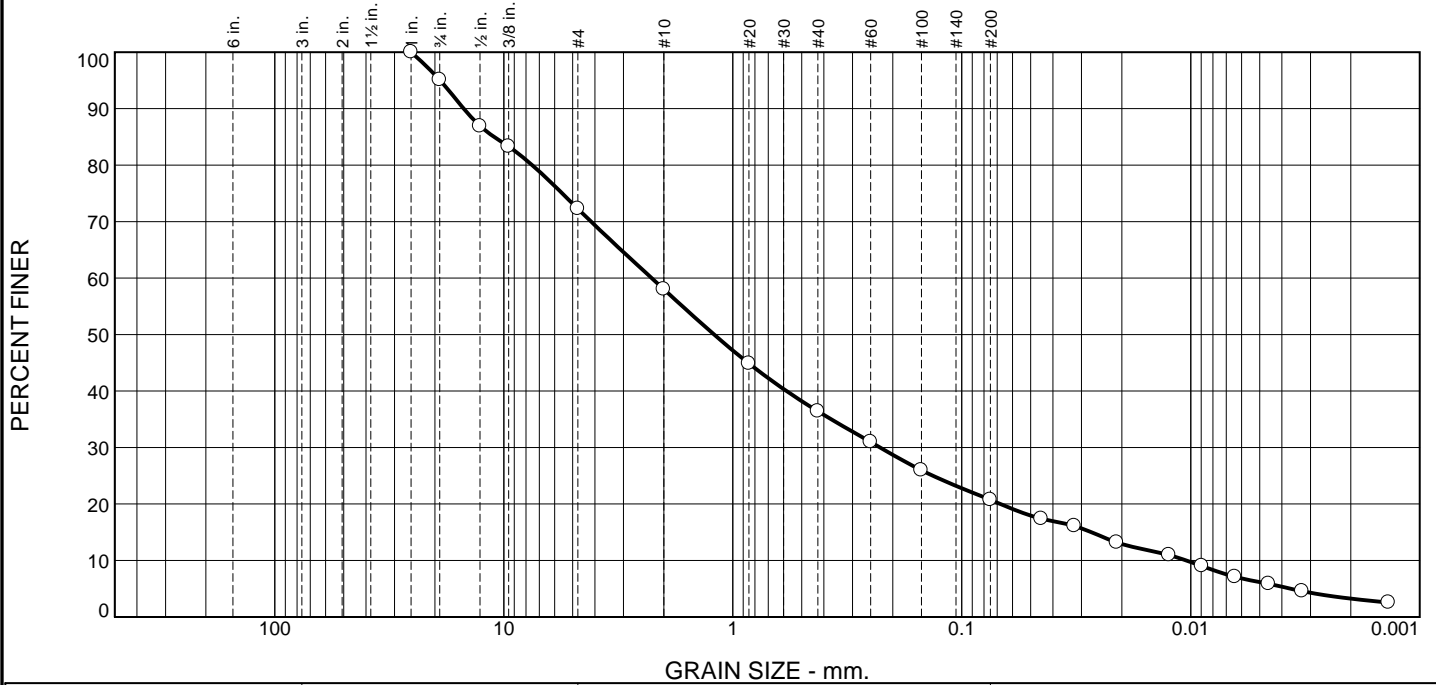
Checked By: MP

Title: Laboratory Manager

Source of Sample: B-1      Depth: 6-8'      Date Sampled: 11/29/21  
Sample Number: S-4

<b>CDM Smith</b>  <b>Boston, Massachusetts</b>	<b>Client:</b> Lynnfield Center Water District <b>Project:</b> Glen Drive WTP Lynnfield, MA <b>Project No:</b> 630-265722
--	--

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.9	22.8	14.3	21.6	15.7	14.5	6.2

Test Results (ASTM D6913 & D7928 & ASTM D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	95.1		
0.5"	86.9		
0.375"	83.3		
#4	72.3		
#10	58.0		
#20	44.9		
#40	36.4		
#60	31.0		
#100	26.0		
#200	20.7		
0.0449 mm.	17.4		
0.0323 mm.	16.1		
0.0210 mm.	13.2		
0.0124 mm.	11.0		
0.0090 mm.	9.0		
0.0064 mm.	7.1		
0.0046 mm.	5.9		
0.0033 mm.	4.6		
0.0014 mm.	2.6		

\* (no specification provided)

**Material Description**

Brown silty sand with gravel  
USDA = sandy loam

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= SM      AASHTO (M 145)= A-1-b

**Coefficients**

D<sub>90</sub>= 14.9656      D<sub>85</sub>= 11.0307      D<sub>60</sub>= 2.2612  
D<sub>50</sub>= 1.2063      D<sub>30</sub>= 0.2272      D<sub>15</sub>= 0.0271  
D<sub>10</sub>= 0.0105      C<sub>u</sub>= 216.12      C<sub>c</sub>= 2.18

**Remarks**

As Received Moisture Content = 9.8%

---

Date Received: 12/3/21      Date Tested: 12/10/21

Tested By: MP/HA

Checked By: MP

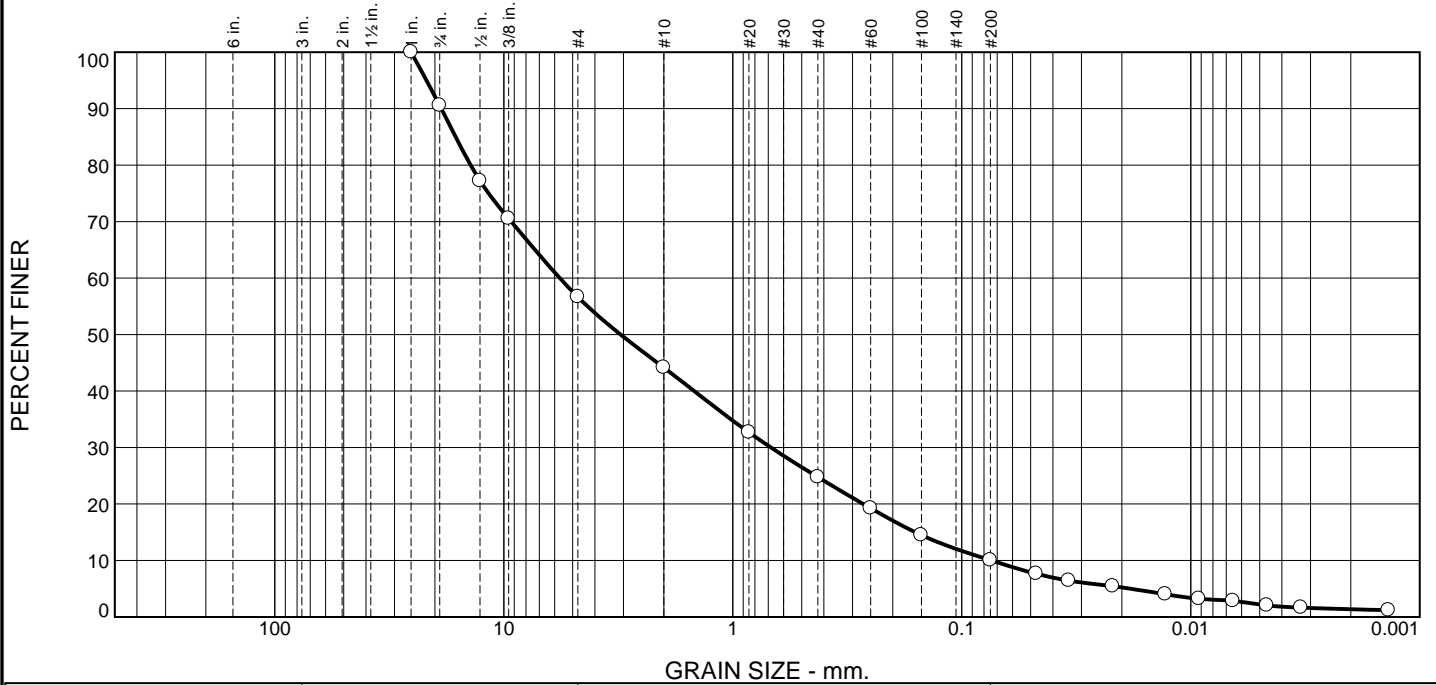
Title: Laboratory Manager

Source of Sample: B-2      Depth: 4.5-6.5'      Date Sampled: 11/29/21  
Sample Number: S-4

<b>CDM Smith</b>  <b>Boston, Massachusetts</b>	<b>Client:</b> Lynnfield Center Water District <b>Project:</b> Glen Drive WTP Lynnfield, MA <b>Project No:</b> 630-265722
--	--



# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.4	33.9	12.6	19.3	14.8	7.8	2.2

Test Results (ASTM D6913 & D7928 & ASTM D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1"	100.0		
0.75"	90.6		
0.5"	77.2		
0.375"	70.6		
#4	56.7		
#10	44.1		
#20	32.7		
#40	24.8		
#60	19.3		
#100	14.5		
#200	10.0		
0.0473 mm.	7.6		
0.0341 mm.	6.4		
0.0219 mm.	5.4		
0.0129 mm.	4.0		
0.0092 mm.	3.2		
0.0065 mm.	2.8		
0.0047 mm.	2.0		
0.0033 mm.	1.6		
0.0014 mm.	1.2		

\* (no specification provided)

**Material Description**

Gray-brown well-graded sand with silt and gravel  
USDA = loamy sand

**Atterberg Limits (ASTM D 4318)**

PL= \_\_\_\_\_ LL= \_\_\_\_\_ PI= \_\_\_\_\_

**Classification**

USCS (D 2487)= SW-SM    AASHTO (M 145)= A-1-a

**Coefficients**

D<sub>90</sub>= 18.7443    D<sub>85</sub>= 16.2304    D<sub>60</sub>= 5.6943  
D<sub>50</sub>= 3.0897    D<sub>30</sub>= 0.6814    D<sub>15</sub>= 0.1596  
D<sub>10</sub>= 0.0744    C<sub>u</sub>= 76.57    C<sub>c</sub>= 1.10

**Remarks**

As Received Moisture Content = 10.0%

---

Date Received: 12/3/21    Date Tested: 12/10/21

Tested By: MP/HA

Checked By: MP

Title: Laboratory Manager

Source of Sample: B-2    Depth: 14-16'  
Sample Number: S-7

Date Sampled: 11/29/21

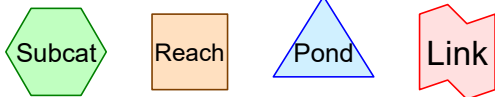
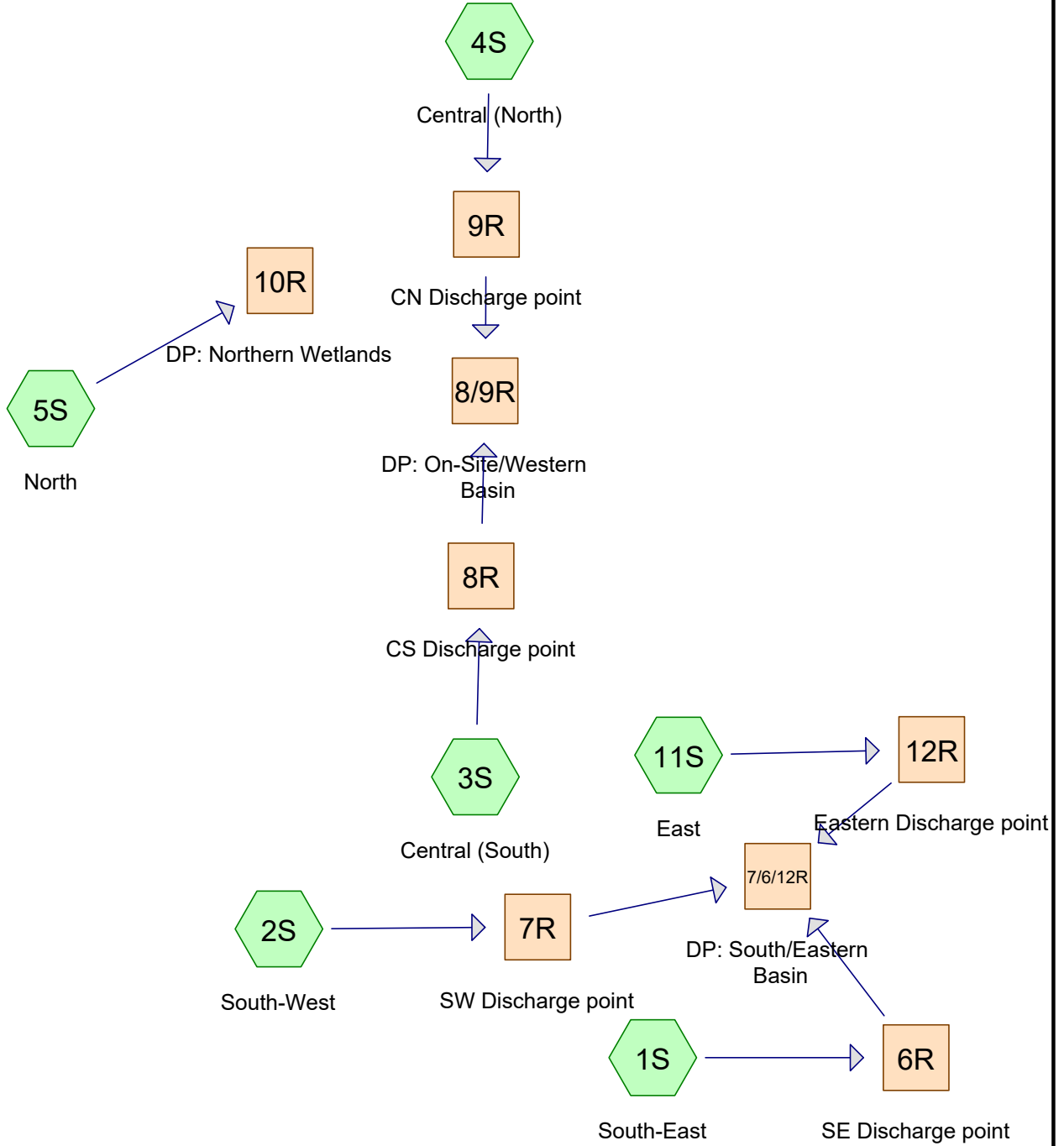
<b>CDM Smith</b>  <b>Boston, Massachusetts</b>	<b>Client:</b> Lynnfield Center Water District <b>Project:</b> Glen Drive WTP Lynnfield, MA <b>Project No:</b> 630-265722
--	--

# Appendix C

## HydroCAD Model

# Existing Conditions Model

Existing Conditions



**Lynnfield Stormwater Management EX\_PC ZBA** Type III 24-hr 2-year 24-hr Rainfall=3.31"

Prepared by CDM Smith

Printed 7/6/2023

HydroCAD® 10.20-2f s/n 01469 © 2022 HydroCAD Software Solutions LLC

Page 2

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>Subcatchment1S: South-East</b>	Runoff Area=9,937 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=54' Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af
<b>Subcatchment2S: South-West</b>	Runoff Area=22,567 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=188' Tc=8.4 min CN=30 Runoff=0.00 cfs 0.000 af
<b>Subcatchment3S: Central (South)</b>	Runoff Area=14,300 sf 0.15% Impervious Runoff Depth=0.00" Flow Length=60' Tc=6.1 min CN=38 Runoff=0.00 cfs 0.000 af
<b>Subcatchment4S: Central (North)</b>	Runoff Area=5,773 sf 40.05% Impervious Runoff Depth=1.00" Flow Length=69' Tc=6.2 min CN=72 Runoff=0.14 cfs 0.011 af
<b>Subcatchment5S: North</b>	Runoff Area=85,849 sf 6.84% Impervious Runoff Depth=0.00" Flow Length=315' Tc=9.8 min CN=35 Runoff=0.00 cfs 0.000 af
<b>Subcatchment11S: East</b>	Runoff Area=25,966 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=127' Tc=6.0 min CN=31 Runoff=0.00 cfs 0.000 af
<b>Reach 6R: SE Discharge point</b>	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
<b>Reach 7/6/12R: DP: South/EasternBasin</b>	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
<b>Reach 7R: SW Discharge point</b>	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
<b>Reach 8/9R: DP: On-Site/WesternBasin</b>	Inflow=0.14 cfs 0.011 af Outflow=0.14 cfs 0.011 af
<b>Reach 8R: CS Discharge point</b>	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
<b>Reach 9R: CN Discharge point</b>	Inflow=0.14 cfs 0.011 af Outflow=0.14 cfs 0.011 af
<b>Reach 10R: DP: Northern Wetlands</b>	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
<b>Reach 12R: Eastern Discharge point</b>	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

**Total Runoff Area = 3.774 ac Runoff Volume = 0.011 af Average Runoff Depth = 0.04"**  
**95.01% Pervious = 3.586 ac 4.99% Impervious = 0.188 ac**



**Summary for Subcatchment 1S: South-East**

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"  
 Routed to Reach 6R : SE Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
9,937	30	Woods, Good, HSG A
9,937		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	54		0.15		<b>Direct Entry, Direct Entry</b>

**Summary for Subcatchment 2S: South-West**

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"  
 Routed to Reach 7R : SW Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
22,567	30	Woods, Good, HSG A
22,567		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	43	0.0806	0.12		<b>Sheet Flow, 95.0 - 91.5</b> Woods: Light underbrush n= 0.400 P2= 3.31"
2.2	145	0.0475	1.09		<b>Shallow Concentrated Flow, 91.5 - 84.6</b> Woodland Kv= 5.0 fps
8.4	188	Total			

**Summary for Subcatchment 3S: Central (South)**

Runoff = 0.00 cfs @ 24.01 hrs, Volume= 0.000 af, Depth= 0.00"  
 Routed to Reach 8R : CS Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
11,909	30	Woods, Good, HSG A
2,369	76	Gravel roads, HSG A
22	98	Roofs, HSG A
14,300	38	Weighted Average
14,278		99.85% Pervious Area
22		0.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	35	0.0567	0.10		<b>Sheet Flow, Legth (92-90)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.1	25	0.3178	2.82		<b>Shallow Concentrated Flow, Legth (90-82)</b> Woodland Kv= 5.0 fps
6.1	60	Total			

**Summary for Subcatchment 4S: Central (North)**

Runoff = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af, Depth= 1.00"  
Routed to Reach 9R : CN Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
1,548	30	Woods, Good, HSG A
990	98	Roofs, HSG A
321	98	Paved parking, HSG A
1,913	76	Gravel roads, HSG A
22	98	Roofs, HSG A
979	98	Paved parking, HSG A
5,773	72	Weighted Average
3,461		59.95% Pervious Area
2,312		40.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0744	0.11		<b>Sheet Flow, 92-89</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.2	29	0.2429	2.46		<b>Shallow Concentrated Flow, 89-82</b> Woodland Kv= 5.0 fps
6.2	69	Total			

**Summary for Subcatchment 5S: North**

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"  
Routed to Reach 10R : DP: Northern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
78,661	30	Woods, Good, HSG A
1,315	76	Gravel roads, HSG A
5,873	98	Paved parking, HSG A
85,849	35	Weighted Average
79,976		93.16% Pervious Area
5,873		6.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	45	0.1943	0.17		<b>Sheet Flow, Legth (101.7-93)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.6	63	0.1263	1.78		<b>Shallow Concentrated Flow, Legth (93-85)</b> Woodland Kv= 5.0 fps
0.2	43	0.0233	3.10		<b>Shallow Concentrated Flow, Legth (85-84)</b> Paved Kv= 20.3 fps
0.6	39	0.0511	1.13		<b>Shallow Concentrated Flow, Legth (84-82)</b> Woodland Kv= 5.0 fps
3.6	105	0.0096	0.49		<b>Shallow Concentrated Flow, Legth (82-81)</b> Woodland Kv= 5.0 fps
0.3	20	0.0490	1.11		<b>Shallow Concentrated Flow, Legth (81-80)</b> Woodland Kv= 5.0 fps
9.8	315	Total			

**Summary for Subcatchment 11S: East**

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"  
 Routed to Reach 12R : Eastern Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
25,596	30	Woods, Good, HSG A
370	96	Gravel surface, HSG A
25,966	31	Weighted Average
25,966		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	34	0.1740	0.15		<b>Sheet Flow, Slope (92-86)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.8	40	0.0249	0.79		<b>Shallow Concentrated Flow, Slope (86-85)</b> Woodland Kv= 5.0 fps
0.6	53	0.1031	1.61		<b>Shallow Concentrated Flow, Slope (85-79.5)</b> Woodland Kv= 5.0 fps
5.1	127	Total, Increased to minimum Tc = 6.0 min			

**Summary for Reach 6R: SE Discharge point**

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

Inflow Area = 0.228 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-year 24-hr event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
 Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 7/6/12R: DP: South/Eastern Basin**

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

Inflow Area = 1.342 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-year 24-hr event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 7R: SW Discharge point**

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

Inflow Area = 0.518 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-year 24-hr event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
 Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 8/9R: DP: On-Site/Western Basin**

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

Inflow Area = 0.461 ac, 11.63% Impervious, Inflow Depth = 0.29" for 2-year 24-hr event  
 Inflow = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af  
 Outflow = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 8R: CS Discharge point

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

Inflow Area = 0.328 ac, 0.15% Impervious, Inflow Depth = 0.00" for 2-year 24-hr event  
Inflow = 0.00 cfs @ 24.01 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 24.01 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 8/9R : DP: On-Site/Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 9R: CN Discharge point

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

Inflow Area = 0.133 ac, 40.05% Impervious, Inflow Depth = 1.00" for 2-year 24-hr event  
Inflow = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af  
Outflow = 0.14 cfs @ 12.10 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 8/9R : DP: On-Site/Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 10R: DP: Northern Wetlands

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

Inflow Area = 1.971 ac, 6.84% Impervious, Inflow Depth = 0.00" for 2-year 24-hr event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 12R: Eastern Discharge point

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

Inflow Area = 0.596 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-year 24-hr event  
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3



**Lynnfield Stormwater Management EX\_PC ZBA Type III 24-hr 10-year 24-hr Rainfall=5.22"**

Prepared by CDM Smith

Printed 7/6/2023

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Page 8

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>Subcatchment1S: South-East</b>	Runoff Area=9,937 sf 0.00% Impervious Runoff Depth=0.01" Flow Length=54' Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af
<b>Subcatchment2S: South-West</b>	Runoff Area=22,567 sf 0.00% Impervious Runoff Depth=0.01" Flow Length=188' Tc=8.4 min CN=30 Runoff=0.00 cfs 0.001 af
<b>Subcatchment3S: Central (South)</b>	Runoff Area=14,300 sf 0.15% Impervious Runoff Depth=0.21" Flow Length=60' Tc=6.1 min CN=38 Runoff=0.01 cfs 0.006 af
<b>Subcatchment4S: Central (North)</b>	Runoff Area=5,773 sf 40.05% Impervious Runoff Depth=2.37" Flow Length=69' Tc=6.2 min CN=72 Runoff=0.36 cfs 0.026 af
<b>Subcatchment5S: North</b>	Runoff Area=85,849 sf 6.84% Impervious Runoff Depth=0.11" Flow Length=315' Tc=9.8 min CN=35 Runoff=0.03 cfs 0.019 af
<b>Subcatchment11S: East</b>	Runoff Area=25,966 sf 0.00% Impervious Runoff Depth=0.03" Flow Length=127' Tc=6.0 min CN=31 Runoff=0.00 cfs 0.001 af
<b>Reach 6R: SE Discharge point</b>	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
<b>Reach 7/6/12R: DP: South/EasternBasin</b>	Inflow=0.00 cfs 0.002 af Outflow=0.00 cfs 0.002 af
<b>Reach 7R: SW Discharge point</b>	Inflow=0.00 cfs 0.001 af Outflow=0.00 cfs 0.001 af
<b>Reach 8/9R: DP: On-Site/WesternBasin</b>	Inflow=0.36 cfs 0.032 af Outflow=0.36 cfs 0.032 af
<b>Reach 8R: CS Discharge point</b>	Inflow=0.01 cfs 0.006 af Outflow=0.01 cfs 0.006 af
<b>Reach 9R: CN Discharge point</b>	Inflow=0.36 cfs 0.026 af Outflow=0.36 cfs 0.026 af
<b>Reach 10R: DP: Northern Wetlands</b>	Inflow=0.03 cfs 0.019 af Outflow=0.03 cfs 0.019 af
<b>Reach 12R: Eastern Discharge point</b>	Inflow=0.00 cfs 0.001 af Outflow=0.00 cfs 0.001 af

**Total Runoff Area = 3.774 ac Runoff Volume = 0.053 af Average Runoff Depth = 0.17"**  
**95.01% Pervious = 3.586 ac 4.99% Impervious = 0.188 ac**

**Summary for Subcatchment 1S: South-East**

Runoff = 0.00 cfs @ 22.50 hrs, Volume= 0.000 af, Depth= 0.01"  
 Routed to Reach 6R : SE Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Description
9,937	30	Woods, Good, HSG A
9,937		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	54		0.15		<b>Direct Entry, Direct Entry</b>

**Summary for Subcatchment 2S: South-West**

Runoff = 0.00 cfs @ 22.54 hrs, Volume= 0.001 af, Depth= 0.01"  
 Routed to Reach 7R : SW Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Description
22,567	30	Woods, Good, HSG A
22,567		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	43	0.0806	0.12		<b>Sheet Flow, 95.0 - 91.5</b> Woods: Light underbrush n= 0.400 P2= 3.31"
2.2	145	0.0475	1.09		<b>Shallow Concentrated Flow, 91.5 - 84.6</b> Woodland Kv= 5.0 fps
8.4	188	Total			

**Summary for Subcatchment 3S: Central (South)**

Runoff = 0.01 cfs @ 12.48 hrs, Volume= 0.006 af, Depth= 0.21"  
 Routed to Reach 8R : CS Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

**Lynnfield Stormwater Management EX\_PC ZBA Type III 24-hr 10-year 24-hr Rainfall=5.22"**

Prepared by CDM Smith

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Page 10

Area (sf)	CN	Description
11,909	30	Woods, Good, HSG A
2,369	76	Gravel roads, HSG A
22	98	Roofs, HSG A
14,300	38	Weighted Average
14,278		99.85% Pervious Area
22		0.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	35	0.0567	0.10		<b>Sheet Flow, Legth (92-90)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.1	25	0.3178	2.82		<b>Shallow Concentrated Flow, Legth (90-82)</b> Woodland Kv= 5.0 fps
6.1	60	Total			

**Summary for Subcatchment 4S: Central (North)**

Runoff = 0.36 cfs @ 12.09 hrs, Volume= 0.026 af, Depth= 2.37"  
Routed to Reach 9R : CN Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Description
1,548	30	Woods, Good, HSG A
990	98	Roofs, HSG A
321	98	Paved parking, HSG A
1,913	76	Gravel roads, HSG A
22	98	Roofs, HSG A
979	98	Paved parking, HSG A
5,773	72	Weighted Average
3,461		59.95% Pervious Area
2,312		40.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0744	0.11		<b>Sheet Flow, 92-89</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.2	29	0.2429	2.46		<b>Shallow Concentrated Flow, 89-82</b> Woodland Kv= 5.0 fps
6.2	69	Total			

**Summary for Subcatchment 5S: North**

Runoff = 0.03 cfs @ 14.93 hrs, Volume= 0.019 af, Depth= 0.11"  
Routed to Reach 10R : DP: Northern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 10-year 24-hr Rainfall=5.22"

**Lynnfield Stormwater Management EX\_PC ZBA Type III 24-hr 10-year 24-hr Rainfall=5.22"**

Prepared by CDM Smith

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Page 11

Area (sf)	CN	Description
78,661	30	Woods, Good, HSG A
1,315	76	Gravel roads, HSG A
5,873	98	Paved parking, HSG A
85,849	35	Weighted Average
79,976		93.16% Pervious Area
5,873		6.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	45	0.1943	0.17		<b>Sheet Flow, Legth (101.7-93)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.6	63	0.1263	1.78		<b>Shallow Concentrated Flow, Legth (93-85)</b> Woodland Kv= 5.0 fps
0.2	43	0.0233	3.10		<b>Shallow Concentrated Flow, Legth (85-84)</b> Paved Kv= 20.3 fps
0.6	39	0.0511	1.13		<b>Shallow Concentrated Flow, Legth (84-82)</b> Woodland Kv= 5.0 fps
3.6	105	0.0096	0.49		<b>Shallow Concentrated Flow, Legth (82-81)</b> Woodland Kv= 5.0 fps
0.3	20	0.0490	1.11		<b>Shallow Concentrated Flow, Legth (81-80)</b> Woodland Kv= 5.0 fps
9.8	315	Total			

**Summary for Subcatchment 11S: East**

Runoff = 0.00 cfs @ 21.18 hrs, Volume= 0.001 af, Depth= 0.03"  
 Routed to Reach 12R : Eastern Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Description
25,596	30	Woods, Good, HSG A
370	96	Gravel surface, HSG A
25,966	31	Weighted Average
25,966		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	34	0.1740	0.15		<b>Sheet Flow, Slope (92-86)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.8	40	0.0249	0.79		<b>Shallow Concentrated Flow, Slope (86-85)</b> Woodland Kv= 5.0 fps
0.6	53	0.1031	1.61		<b>Shallow Concentrated Flow, Slope (85-79.5)</b> Woodland Kv= 5.0 fps
5.1	127	Total, Increased to minimum Tc = 6.0 min			

### Summary for Reach 6R: SE Discharge point

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

Inflow Area = 0.228 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-year 24-hr event  
Inflow = 0.00 cfs @ 22.50 hrs, Volume= 0.000 af  
Outflow = 0.00 cfs @ 22.50 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 7/6/12R: DP: South/Eastern Basin

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

Inflow Area = 1.342 ac, 0.00% Impervious, Inflow Depth = 0.02" for 10-year 24-hr event  
Inflow = 0.00 cfs @ 21.94 hrs, Volume= 0.002 af  
Outflow = 0.00 cfs @ 21.94 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 7R: SW Discharge point

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

Inflow Area = 0.518 ac, 0.00% Impervious, Inflow Depth = 0.01" for 10-year 24-hr event  
Inflow = 0.00 cfs @ 22.54 hrs, Volume= 0.001 af  
Outflow = 0.00 cfs @ 22.54 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 8/9R: DP: On-Site/Western Basin

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

Inflow Area = 0.461 ac, 11.63% Impervious, Inflow Depth = 0.83" for 10-year 24-hr event  
Inflow = 0.36 cfs @ 12.09 hrs, Volume= 0.032 af  
Outflow = 0.36 cfs @ 12.09 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 8R: CS Discharge point

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

Inflow Area = 0.328 ac, 0.15% Impervious, Inflow Depth = 0.21" for 10-year 24-hr event  
Inflow = 0.01 cfs @ 12.48 hrs, Volume= 0.006 af  
Outflow = 0.01 cfs @ 12.48 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 8/9R : DP: On-Site/Western Basin



Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### **Summary for Reach 9R: CN Discharge point**

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

Inflow Area = 0.133 ac, 40.05% Impervious, Inflow Depth = 2.37" for 10-year 24-hr event  
Inflow = 0.36 cfs @ 12.09 hrs, Volume= 0.026 af  
Outflow = 0.36 cfs @ 12.09 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 8/9R : DP: On-Site/Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### **Summary for Reach 10R: DP: Northern Wetlands**

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

Inflow Area = 1.971 ac, 6.84% Impervious, Inflow Depth = 0.11" for 10-year 24-hr event  
Inflow = 0.03 cfs @ 14.93 hrs, Volume= 0.019 af  
Outflow = 0.03 cfs @ 14.93 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### **Summary for Reach 12R: Eastern Discharge point**

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

Inflow Area = 0.596 ac, 0.00% Impervious, Inflow Depth = 0.03" for 10-year 24-hr event  
Inflow = 0.00 cfs @ 21.18 hrs, Volume= 0.001 af  
Outflow = 0.00 cfs @ 21.18 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>Subcatchment1S: South-East</b>	Runoff Area=9,937 sf 0.00% Impervious Runoff Depth=0.12" Flow Length=54' Tc=6.0 min CN=30 Runoff=0.00 cfs 0.002 af
<b>Subcatchment2S: South-West</b>	Runoff Area=22,567 sf 0.00% Impervious Runoff Depth=0.12" Flow Length=188' Tc=8.4 min CN=30 Runoff=0.01 cfs 0.005 af
<b>Subcatchment3S: Central (South)</b>	Runoff Area=14,300 sf 0.15% Impervious Runoff Depth=0.51" Flow Length=60' Tc=6.1 min CN=38 Runoff=0.07 cfs 0.014 af
<b>Subcatchment4S: Central (North)</b>	Runoff Area=5,773 sf 40.05% Impervious Runoff Depth=3.33" Flow Length=69' Tc=6.2 min CN=72 Runoff=0.51 cfs 0.037 af
<b>Subcatchment5S: North</b>	Runoff Area=85,849 sf 6.84% Impervious Runoff Depth=0.34" Flow Length=315' Tc=9.8 min CN=35 Runoff=0.19 cfs 0.056 af
<b>Subcatchment11S: East</b>	Runoff Area=25,966 sf 0.00% Impervious Runoff Depth=0.16" Flow Length=127' Tc=6.0 min CN=31 Runoff=0.01 cfs 0.008 af
<b>Reach 6R: SE Discharge point</b>	Inflow=0.00 cfs 0.002 af Outflow=0.00 cfs 0.002 af
<b>Reach 7/6/12R: DP: South/EasternBasin</b>	Inflow=0.02 cfs 0.015 af Outflow=0.02 cfs 0.015 af
<b>Reach 7R: SW Discharge point</b>	Inflow=0.01 cfs 0.005 af Outflow=0.01 cfs 0.005 af
<b>Reach 8/9R: DP: On-Site/WesternBasin</b>	Inflow=0.53 cfs 0.051 af Outflow=0.53 cfs 0.051 af
<b>Reach 8R: CS Discharge point</b>	Inflow=0.07 cfs 0.014 af Outflow=0.07 cfs 0.014 af
<b>Reach 9R: CN Discharge point</b>	Inflow=0.51 cfs 0.037 af Outflow=0.51 cfs 0.037 af
<b>Reach 10R: DP: Northern Wetlands</b>	Inflow=0.19 cfs 0.056 af Outflow=0.19 cfs 0.056 af
<b>Reach 12R: Eastern Discharge point</b>	Inflow=0.01 cfs 0.008 af Outflow=0.01 cfs 0.008 af

**Total Runoff Area = 3.774 ac Runoff Volume = 0.122 af Average Runoff Depth = 0.39"**  
**95.01% Pervious = 3.586 ac 4.99% Impervious = 0.188 ac**

**Summary for Subcatchment 1S: South-East**

Runoff = 0.00 cfs @ 15.02 hrs, Volume= 0.002 af, Depth= 0.12"  
 Routed to Reach 6R : SE Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Description
9,937	30	Woods, Good, HSG A
9,937		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	54		0.15		<b>Direct Entry, Direct Entry</b>

**Summary for Subcatchment 2S: South-West**

Runoff = 0.01 cfs @ 15.02 hrs, Volume= 0.005 af, Depth= 0.12"  
 Routed to Reach 7R : SW Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Description
22,567	30	Woods, Good, HSG A
22,567		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	43	0.0806	0.12		<b>Sheet Flow, 95.0 - 91.5</b> Woods: Light underbrush n= 0.400 P2= 3.31"
2.2	145	0.0475	1.09		<b>Shallow Concentrated Flow, 91.5 - 84.6</b> Woodland Kv= 5.0 fps
8.4	188	Total			

**Summary for Subcatchment 3S: Central (South)**

Runoff = 0.07 cfs @ 12.33 hrs, Volume= 0.014 af, Depth= 0.51"  
 Routed to Reach 8R : CS Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-year 24-hr Rainfall=6.41"

**Lynnfield Stormwater Management EX\_PC ZBA Type III 24-hr 25-year 24-hr Rainfall=6.41"**

Prepared by CDM Smith

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Page 16

Area (sf)	CN	Description
11,909	30	Woods, Good, HSG A
2,369	76	Gravel roads, HSG A
22	98	Roofs, HSG A
14,300	38	Weighted Average
14,278		99.85% Pervious Area
22		0.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	35	0.0567	0.10		<b>Sheet Flow, Legth (92-90)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.1	25	0.3178	2.82		<b>Shallow Concentrated Flow, Legth (90-82)</b> Woodland Kv= 5.0 fps
6.1	60	Total			

**Summary for Subcatchment 4S: Central (North)**

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af, Depth= 3.33"  
Routed to Reach 9R : CN Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Description
1,548	30	Woods, Good, HSG A
990	98	Roofs, HSG A
321	98	Paved parking, HSG A
1,913	76	Gravel roads, HSG A
22	98	Roofs, HSG A
979	98	Paved parking, HSG A
5,773	72	Weighted Average
3,461		59.95% Pervious Area
2,312		40.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0744	0.11		<b>Sheet Flow, 92-89</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.2	29	0.2429	2.46		<b>Shallow Concentrated Flow, 89-82</b> Woodland Kv= 5.0 fps
6.2	69	Total			

**Summary for Subcatchment 5S: North**

Runoff = 0.19 cfs @ 12.47 hrs, Volume= 0.056 af, Depth= 0.34"  
Routed to Reach 10R : DP: Northern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-year 24-hr Rainfall=6.41"

**Lynnfield Stormwater Management EX\_PC ZBA Type III 24-hr 25-year 24-hr Rainfall=6.41"**

Prepared by CDM Smith

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Page 17

Area (sf)	CN	Description
78,661	30	Woods, Good, HSG A
1,315	76	Gravel roads, HSG A
5,873	98	Paved parking, HSG A
85,849	35	Weighted Average
79,976		93.16% Pervious Area
5,873		6.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	45	0.1943	0.17		<b>Sheet Flow, Legth (101.7-93)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.6	63	0.1263	1.78		<b>Shallow Concentrated Flow, Legth (93-85)</b> Woodland Kv= 5.0 fps
0.2	43	0.0233	3.10		<b>Shallow Concentrated Flow, Legth (85-84)</b> Paved Kv= 20.3 fps
0.6	39	0.0511	1.13		<b>Shallow Concentrated Flow, Legth (84-82)</b> Woodland Kv= 5.0 fps
3.6	105	0.0096	0.49		<b>Shallow Concentrated Flow, Legth (82-81)</b> Woodland Kv= 5.0 fps
0.3	20	0.0490	1.11		<b>Shallow Concentrated Flow, Legth (81-80)</b> Woodland Kv= 5.0 fps
9.8	315	Total			

**Summary for Subcatchment 11S: East**

Runoff = 0.01 cfs @ 14.70 hrs, Volume= 0.008 af, Depth= 0.16"  
Routed to Reach 12R : Eastern Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Description
25,596	30	Woods, Good, HSG A
370	96	Gravel surface, HSG A
25,966	31	Weighted Average
25,966		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	34	0.1740	0.15		<b>Sheet Flow, Slope (92-86)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.8	40	0.0249	0.79		<b>Shallow Concentrated Flow, Slope (86-85)</b> Woodland Kv= 5.0 fps
0.6	53	0.1031	1.61		<b>Shallow Concentrated Flow, Slope (85-79.5)</b> Woodland Kv= 5.0 fps
5.1	127	Total, Increased to minimum Tc = 6.0 min			

### Summary for Reach 6R: SE Discharge point

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

Inflow Area = 0.228 ac, 0.00% Impervious, Inflow Depth = 0.12" for 25-year 24-hr event  
Inflow = 0.00 cfs @ 15.02 hrs, Volume= 0.002 af  
Outflow = 0.00 cfs @ 15.02 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 7/6/12R: DP: South/Eastern Basin

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

Inflow Area = 1.342 ac, 0.00% Impervious, Inflow Depth = 0.14" for 25-year 24-hr event  
Inflow = 0.02 cfs @ 14.87 hrs, Volume= 0.015 af  
Outflow = 0.02 cfs @ 14.87 hrs, Volume= 0.015 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 7R: SW Discharge point

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

Inflow Area = 0.518 ac, 0.00% Impervious, Inflow Depth = 0.12" for 25-year 24-hr event  
Inflow = 0.01 cfs @ 15.02 hrs, Volume= 0.005 af  
Outflow = 0.01 cfs @ 15.02 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 8/9R: DP: On-Site/Western Basin

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

Inflow Area = 0.461 ac, 11.63% Impervious, Inflow Depth = 1.32" for 25-year 24-hr event  
Inflow = 0.53 cfs @ 12.10 hrs, Volume= 0.051 af  
Outflow = 0.53 cfs @ 12.10 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 8R: CS Discharge point

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

Inflow Area = 0.328 ac, 0.15% Impervious, Inflow Depth = 0.51" for 25-year 24-hr event  
Inflow = 0.07 cfs @ 12.33 hrs, Volume= 0.014 af  
Outflow = 0.07 cfs @ 12.33 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 8/9R : DP: On-Site/Western Basin



Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### **Summary for Reach 9R: CN Discharge point**

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

Inflow Area = 0.133 ac, 40.05% Impervious, Inflow Depth = 3.33" for 25-year 24-hr event  
Inflow = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af  
Outflow = 0.51 cfs @ 12.09 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 8/9R : DP: On-Site/Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### **Summary for Reach 10R: DP: Northern Wetlands**

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

Inflow Area = 1.971 ac, 6.84% Impervious, Inflow Depth = 0.34" for 25-year 24-hr event  
Inflow = 0.19 cfs @ 12.47 hrs, Volume= 0.056 af  
Outflow = 0.19 cfs @ 12.47 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### **Summary for Reach 12R: Eastern Discharge point**

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

Inflow Area = 0.596 ac, 0.00% Impervious, Inflow Depth = 0.16" for 25-year 24-hr event  
Inflow = 0.01 cfs @ 14.70 hrs, Volume= 0.008 af  
Outflow = 0.01 cfs @ 14.70 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>Subcatchment1S: South-East</b>	Runoff Area=9,937 sf 0.00% Impervious Runoff Depth=0.48" Flow Length=54' Tc=6.0 min CN=30 Runoff=0.03 cfs 0.009 af
<b>Subcatchment2S: South-West</b>	Runoff Area=22,567 sf 0.00% Impervious Runoff Depth=0.48" Flow Length=188' Tc=8.4 min CN=30 Runoff=0.08 cfs 0.021 af
<b>Subcatchment3S: Central (South)</b>	Runoff Area=14,300 sf 0.15% Impervious Runoff Depth=1.17" Flow Length=60' Tc=6.1 min CN=38 Runoff=0.28 cfs 0.032 af
<b>Subcatchment4S: Central (North)</b>	Runoff Area=5,773 sf 40.05% Impervious Runoff Depth=4.91" Flow Length=69' Tc=6.2 min CN=72 Runoff=0.76 cfs 0.054 af
<b>Subcatchment5S: North</b>	Runoff Area=85,849 sf 6.84% Impervious Runoff Depth=0.89" Flow Length=315' Tc=9.8 min CN=35 Runoff=0.87 cfs 0.146 af
<b>Subcatchment11S: East</b>	Runoff Area=25,966 sf 0.00% Impervious Runoff Depth=0.55" Flow Length=127' Tc=6.0 min CN=31 Runoff=0.12 cfs 0.028 af
<b>Reach 6R: SE Discharge point</b>	Inflow=0.03 cfs 0.009 af Outflow=0.03 cfs 0.009 af
<b>Reach 7/6/12R: DP: South/EasternBasin</b>	Inflow=0.23 cfs 0.057 af Outflow=0.23 cfs 0.057 af
<b>Reach 7R: SW Discharge point</b>	Inflow=0.08 cfs 0.021 af Outflow=0.08 cfs 0.021 af
<b>Reach 8/9R: DP: On-Site/WesternBasin</b>	Inflow=1.03 cfs 0.086 af Outflow=1.03 cfs 0.086 af
<b>Reach 8R: CS Discharge point</b>	Inflow=0.28 cfs 0.032 af Outflow=0.28 cfs 0.032 af
<b>Reach 9R: CN Discharge point</b>	Inflow=0.76 cfs 0.054 af Outflow=0.76 cfs 0.054 af
<b>Reach 10R: DP: Northern Wetlands</b>	Inflow=0.87 cfs 0.146 af Outflow=0.87 cfs 0.146 af
<b>Reach 12R: Eastern Discharge point</b>	Inflow=0.12 cfs 0.028 af Outflow=0.12 cfs 0.028 af

**Total Runoff Area = 3.774 ac Runoff Volume = 0.290 af Average Runoff Depth = 0.92"**  
**95.01% Pervious = 3.586 ac 4.99% Impervious = 0.188 ac**

**Summary for Subcatchment 1S: South-East**

Runoff = 0.03 cfs @ 12.39 hrs, Volume= 0.009 af, Depth= 0.48"  
 Routed to Reach 6R : SE Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Description
9,937	30	Woods, Good, HSG A
9,937		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	54		0.15		<b>Direct Entry, Direct Entry</b>

**Summary for Subcatchment 2S: South-West**

Runoff = 0.08 cfs @ 12.44 hrs, Volume= 0.021 af, Depth= 0.48"  
 Routed to Reach 7R : SW Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Description
22,567	30	Woods, Good, HSG A
22,567		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	43	0.0806	0.12		<b>Sheet Flow, 95.0 - 91.5</b> Woods: Light underbrush n= 0.400 P2= 3.31"
2.2	145	0.0475	1.09		<b>Shallow Concentrated Flow, 91.5 - 84.6</b> Woodland Kv= 5.0 fps
8.4	188	Total			

**Summary for Subcatchment 3S: Central (South)**

Runoff = 0.28 cfs @ 12.12 hrs, Volume= 0.032 af, Depth= 1.17"  
 Routed to Reach 8R : CS Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

**Lynnfield Stormwater Management EX\_PC ZBA Type III 24-hr 100-year 24-hr Rainfall=8.25"**

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Printed 7/6/2023

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Page 22

Area (sf)	CN	Description
11,909	30	Woods, Good, HSG A
2,369	76	Gravel roads, HSG A
22	98	Roofs, HSG A
14,300	38	Weighted Average
14,278		99.85% Pervious Area
22		0.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	35	0.0567	0.10		<b>Sheet Flow, Legth (92-90)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.1	25	0.3178	2.82		<b>Shallow Concentrated Flow, Legth (90-82)</b> Woodland Kv= 5.0 fps
6.1	60	Total			

**Summary for Subcatchment 4S: Central (North)**

Runoff = 0.76 cfs @ 12.09 hrs, Volume= 0.054 af, Depth= 4.91"  
Routed to Reach 9R : CN Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Description
1,548	30	Woods, Good, HSG A
990	98	Roofs, HSG A
321	98	Paved parking, HSG A
1,913	76	Gravel roads, HSG A
22	98	Roofs, HSG A
979	98	Paved parking, HSG A
5,773	72	Weighted Average
3,461		59.95% Pervious Area
2,312		40.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40	0.0744	0.11		<b>Sheet Flow, 92-89</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.2	29	0.2429	2.46		<b>Shallow Concentrated Flow, 89-82</b> Woodland Kv= 5.0 fps
6.2	69	Total			

**Summary for Subcatchment 5S: North**

Runoff = 0.87 cfs @ 12.29 hrs, Volume= 0.146 af, Depth= 0.89"  
Routed to Reach 10R : DP: Northern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Description
78,661	30	Woods, Good, HSG A
1,315	76	Gravel roads, HSG A
5,873	98	Paved parking, HSG A
85,849	35	Weighted Average
79,976		93.16% Pervious Area
5,873		6.84% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	45	0.1943	0.17		<b>Sheet Flow, Legth (101.7-93)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.6	63	0.1263	1.78		<b>Shallow Concentrated Flow, Legth (93-85)</b> Woodland Kv= 5.0 fps
0.2	43	0.0233	3.10		<b>Shallow Concentrated Flow, Legth (85-84)</b> Paved Kv= 20.3 fps
0.6	39	0.0511	1.13		<b>Shallow Concentrated Flow, Legth (84-82)</b> Woodland Kv= 5.0 fps
3.6	105	0.0096	0.49		<b>Shallow Concentrated Flow, Legth (82-81)</b> Woodland Kv= 5.0 fps
0.3	20	0.0490	1.11		<b>Shallow Concentrated Flow, Legth (81-80)</b> Woodland Kv= 5.0 fps
9.8	315	Total			

**Summary for Subcatchment 11S: East**

Runoff = 0.12 cfs @ 12.37 hrs, Volume= 0.028 af, Depth= 0.55"  
 Routed to Reach 12R : Eastern Discharge point

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Description
25,596	30	Woods, Good, HSG A
370	96	Gravel surface, HSG A
25,966	31	Weighted Average
25,966		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	34	0.1740	0.15		<b>Sheet Flow, Slope (92-86)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.8	40	0.0249	0.79		<b>Shallow Concentrated Flow, Slope (86-85)</b> Woodland Kv= 5.0 fps
0.6	53	0.1031	1.61		<b>Shallow Concentrated Flow, Slope (85-79.5)</b> Woodland Kv= 5.0 fps
5.1	127	Total, Increased to minimum Tc = 6.0 min			

### Summary for Reach 6R: SE Discharge point

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

Inflow Area = 0.228 ac, 0.00% Impervious, Inflow Depth = 0.48" for 100-year 24-hr event  
Inflow = 0.03 cfs @ 12.39 hrs, Volume= 0.009 af  
Outflow = 0.03 cfs @ 12.39 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 7/6/12R: DP: South/Eastern Basin

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

Inflow Area = 1.342 ac, 0.00% Impervious, Inflow Depth = 0.51" for 100-year 24-hr event  
Inflow = 0.23 cfs @ 12.39 hrs, Volume= 0.057 af  
Outflow = 0.23 cfs @ 12.39 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 7R: SW Discharge point

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

Inflow Area = 0.518 ac, 0.00% Impervious, Inflow Depth = 0.48" for 100-year 24-hr event  
Inflow = 0.08 cfs @ 12.44 hrs, Volume= 0.021 af  
Outflow = 0.08 cfs @ 12.44 hrs, Volume= 0.021 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 8/9R: DP: On-Site/Western Basin

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

Inflow Area = 0.461 ac, 11.63% Impervious, Inflow Depth = 2.25" for 100-year 24-hr event  
Inflow = 1.03 cfs @ 12.10 hrs, Volume= 0.086 af  
Outflow = 1.03 cfs @ 12.10 hrs, Volume= 0.086 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### Summary for Reach 8R: CS Discharge point

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

Inflow Area = 0.328 ac, 0.15% Impervious, Inflow Depth = 1.17" for 100-year 24-hr event  
Inflow = 0.28 cfs @ 12.12 hrs, Volume= 0.032 af  
Outflow = 0.28 cfs @ 12.12 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 8/9R : DP: On-Site/Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### **Summary for Reach 9R: CN Discharge point**

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

Inflow Area = 0.133 ac, 40.05% Impervious, Inflow Depth = 4.91" for 100-year 24-hr event  
Inflow = 0.76 cfs @ 12.09 hrs, Volume= 0.054 af  
Outflow = 0.76 cfs @ 12.09 hrs, Volume= 0.054 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 8/9R : DP: On-Site/Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### **Summary for Reach 10R: DP: Northern Wetlands**

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

Inflow Area = 1.971 ac, 6.84% Impervious, Inflow Depth = 0.89" for 100-year 24-hr event  
Inflow = 0.87 cfs @ 12.29 hrs, Volume= 0.146 af  
Outflow = 0.87 cfs @ 12.29 hrs, Volume= 0.146 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

### **Summary for Reach 12R: Eastern Discharge point**

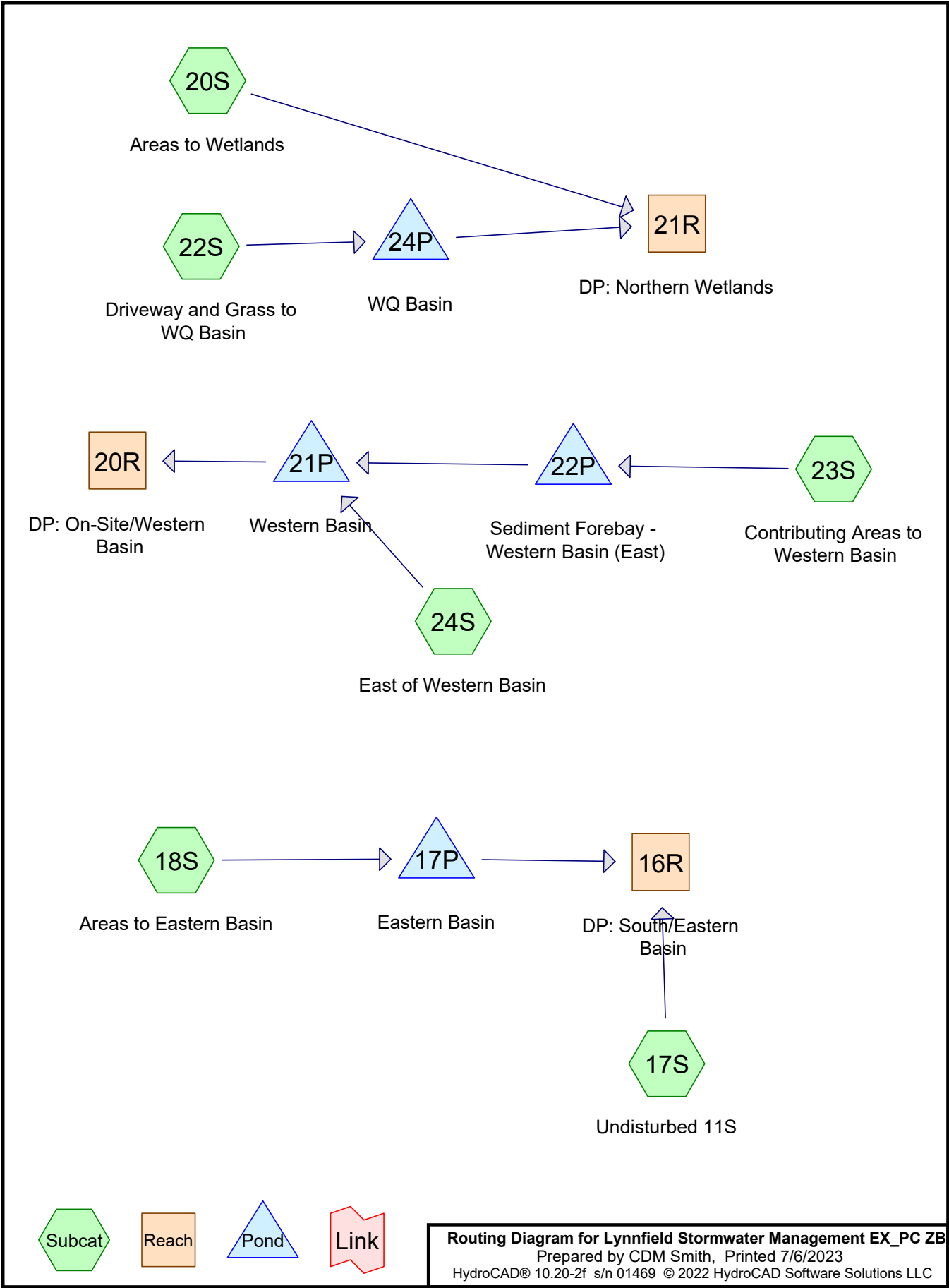
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 0.596 ac, 0.00% Impervious, Inflow Depth = 0.55" for 100-year 24-hr event  
Inflow = 0.12 cfs @ 12.37 hrs, Volume= 0.028 af  
Outflow = 0.12 cfs @ 12.37 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min  
Routed to Reach 7/6/12R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3



# Proposed Conditions Model



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment17S: Undisturbed 11S** Runoff Area=25,214 sf 0.00% Impervious Runoff Depth=0.00"  
 Flow Length=127' Tc=6.0 min CN=31 Runoff=0.00 cfs 0.000 af

**Subcatchment18S: Areas to Eastern Basin** Runoff Area=36,560 sf 19.58% Impervious Runoff Depth=0.07"  
 Flow Length=104' Tc=6.0 min UI Adjusted CN=46 Runoff=0.01 cfs 0.005 af

**Subcatchment20S: Areas to Wetlands** Runoff Area=43,405 sf 3.44% Impervious Runoff Depth=0.00"  
 Tc=9.8 min CN=35 Runoff=0.00 cfs 0.000 af

**Subcatchment22S: Driveway and Grass to** Runoff Area=17,264 sf 23.58% Impervious Runoff Depth=0.25"  
 Flow Length=220' Tc=6.0 min CN=54 Runoff=0.04 cfs 0.008 af

**Subcatchment23S: Contributing Areas to** Runoff Area=6,795 sf 23.11% Impervious Runoff Depth=0.18"  
 Flow Length=92' Tc=6.0 min UI Adjusted CN=51 Runoff=0.01 cfs 0.002 af

**Subcatchment24S: East of Western Basin** Runoff Area=21,261 sf 32.85% Impervious Runoff Depth=0.35"  
 Flow Length=52' Slope=0.2112 '/' Tc=6.0 min CN=57 Runoff=0.09 cfs 0.014 af

**Reach 16R: DP: South/Eastern Basin** Inflow=0.00 cfs 0.000 af  
 Outflow=0.00 cfs 0.000 af

**Reach 20R: DP: On-Site/Western Basin** Inflow=0.00 cfs 0.000 af  
 Outflow=0.00 cfs 0.000 af

**Reach 21R: DP: Northern Wetlands** Inflow=0.00 cfs 0.000 af  
 Outflow=0.00 cfs 0.000 af

**Pond 17P: Eastern Basin** Peak Elev=78.00' Storage=3 cf Inflow=0.01 cfs 0.005 af  
 Discarded=0.01 cfs 0.005 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.005 af

**Pond 21P: Western Basin** Peak Elev=78.27' Storage=189 cf Inflow=0.09 cfs 0.016 af  
 Discarded=0.02 cfs 0.016 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.016 af

**Pond 22P: Sediment Forebay - Western Basin** Peak Elev=79.54' Storage=0 cf Inflow=0.01 cfs 0.002 af  
 Discarded=0.00 cfs 0.000 af Primary=0.01 cfs 0.002 af Outflow=0.01 cfs 0.002 af

**Pond 24P: WQ Basin** Peak Elev=77.14' Storage=63 cf Inflow=0.04 cfs 0.008 af  
 Discarded=0.01 cfs 0.008 af Primary=0.00 cfs 0.000 af Outflow=0.01 cfs 0.008 af

**Total Runoff Area = 3.455 ac Runoff Volume = 0.030 af Average Runoff Depth = 0.10"**  
**85.86% Pervious = 2.967 ac 14.14% Impervious = 0.488 ac**

**Summary for Subcatchment 17S: Undisturbed 11S**

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"  
 Routed to Reach 16R : DP: South/Eastern Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
23,293	30	Woods, Good, HSG A
323	96	Gravel surface, HSG A
1,598	39	>75% Grass cover, Good, HSG A
25,214	31	Weighted Average
25,214		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	34	0.1740	0.15		<b>Sheet Flow, Slope (92-86)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.8	40	0.0249	0.79		<b>Shallow Concentrated Flow, Slope (86-85)</b> Woodland Kv= 5.0 fps
0.6	53	0.1031	1.61		<b>Shallow Concentrated Flow, Slope (85-79.5)</b> Woodland Kv= 5.0 fps
5.1	127	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 18S: Areas to Eastern Basin**

Runoff = 0.01 cfs @ 14.82 hrs, Volume= 0.005 af, Depth= 0.07"  
 Routed to Pond 17P : Eastern Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Adj	Description
11,553	30		Woods, Good, HSG A
1,434	98		Unconnected pavement, HSG A
17,850	39		>75% Grass cover, Good, HSG A
5,723	98		Roofs, HSG A
36,560	48	46	Weighted Average, UI Adjusted
29,403			80.42% Pervious Area
7,157			19.58% Impervious Area
1,434			20.04% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	43	0.2805	0.19		<b>Sheet Flow, 94-82</b> Woods: Light underbrush n= 0.400 P2= 3.31"
1.6	61	0.0165	0.64		<b>Shallow Concentrated Flow, 82-81</b> Woodland Kv= 5.0 fps
5.3	104	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 20S: Areas to Wetlands**

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"  
 Routed to Reach 21R : DP: Northern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
26,730	30	Woods, Good, HSG A
15,181	39	>75% Grass cover, Good, HSG A
1,494	98	Paved parking, HSG A
43,405	35	Weighted Average
41,911		96.56% Pervious Area
1,494		3.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8					<b>Direct Entry, same as EC 5S</b>

**Summary for Subcatchment 22S: Driveway and Grass to WQ Basin**

Runoff = 0.04 cfs @ 12.34 hrs, Volume= 0.008 af, Depth= 0.25"  
 Routed to Pond 24P : WQ Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
4,070	98	Paved parking, HSG A
6,386	30	Woods, Good, HSG A
2,212	76	Gravel roads, HSG A
4,596	39	>75% Grass cover, Good, HSG A
17,264	54	Weighted Average
13,194		76.42% Pervious Area
4,070		23.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	47	0.0425	1.63		<b>Sheet Flow, 85-83</b> Smooth surfaces n= 0.011 P2= 3.31"
0.8	96	0.0104	2.07		<b>Shallow Concentrated Flow, 83-82</b> Paved Kv= 20.3 fps
1.3	77	0.0390	0.99		<b>Shallow Concentrated Flow, 82-79</b> Woodland Kv= 5.0 fps
2.6	220	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 23S: Contributing Areas to Western Basin**

Runoff = 0.01 cfs @ 12.41 hrs, Volume= 0.002 af, Depth= 0.18"  
 Routed to Pond 22P : Sediment Forebay - Western Basin (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Adj	Description
991	98		Roofs, HSG A
148	98		Unconnected pavement, HSG A
5,225	39		>75% Grass cover, Good, HSG A
127	98		Unconnected pavement, HSG A
304	98		Paved parking, HSG A
6,795	53	51	Weighted Average, UI Adjusted
5,225			76.89% Pervious Area
1,570			23.11% Impervious Area
275			17.52% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	33	0.0045	0.62		<b>Sheet Flow, 82.4-82.25</b> Smooth surfaces n= 0.011 P2= 3.31"
1.2	59	0.0128	0.79		<b>Shallow Concentrated Flow, 82.25-81.5</b> Short Grass Pasture Kv= 7.0 fps
2.1	92	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 24S: East of Western Basin**

Runoff = 0.09 cfs @ 12.15 hrs, Volume= 0.014 af, Depth= 0.35"  
 Routed to Pond 21P : Western Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 2-year 24-hr Rainfall=3.31"

Area (sf)	CN	Description
6,429	98	Paved parking, HSG A
12,054	39	>75% Grass cover, Good, HSG A
2,223	30	Woods, Good, HSG A
555	98	Roofs, HSG A
21,261	57	Weighted Average
14,277		67.15% Pervious Area
6,984		32.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	52	0.2112	0.18		<b>Sheet Flow, 93-82</b> Woods: Light underbrush n= 0.400 P2= 3.31"
4.9	52	Total, Increased to minimum Tc = 6.0 min			

**Summary for Reach 16R: DP: South/Eastern Basin**

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

Inflow Area = 1.418 ac, 11.59% Impervious, Inflow Depth = 0.00" for 2-year 24-hr event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 20R: DP: On-Site/Western Basin**

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

Inflow Area = 0.644 ac, 30.49% Impervious, Inflow Depth = 0.00" for 2-year 24-hr event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 21R: DP: Northern Wetlands**

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

Inflow Area = 1.393 ac, 9.17% Impervious, Inflow Depth = 0.00" for 2-year 24-hr event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3



**Summary for Pond 17P: Eastern Basin**

Inflow Area = 0.839 ac, 19.58% Impervious, Inflow Depth = 0.07" for 2-year 24-hr event  
 Inflow = 0.01 cfs @ 14.82 hrs, Volume= 0.005 af  
 Outflow = 0.01 cfs @ 14.95 hrs, Volume= 0.005 af, Atten= 0%, Lag= 7.8 min  
 Discarded = 0.01 cfs @ 14.95 hrs, Volume= 0.005 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 16R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 78.00' @ 14.95 hrs Surf.Area= 784 sf Storage= 3 cf  
 Flood Elev= 82.00' Surf.Area= 5,520 sf Storage= 11,966 cf

Plug-Flow detention time= 7.0 min calculated for 0.005 af (100% of inflow)  
 Center-of-Mass det. time= 7.0 min ( 1,070.9 - 1,063.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	78.00'	11,966 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	781	0	0
79.00	1,570	1,176	1,176
80.00	3,012	2,291	3,467
81.00	4,233	3,623	7,089
82.00	5,520	4,877	11,966

Device	Routing	Invert	Outlet Devices
#1	Primary	81.00'	<b>8.0' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	78.00'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.01 cfs @ 14.95 hrs HW=78.00' (Free Discharge)  
 ↑2=Exfiltration ( Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=78.00' TW=0.00' (Dynamic Tailwater)  
 ↑1=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Summary for Pond 21P: Western Basin**

Inflow Area = 0.644 ac, 30.49% Impervious, Inflow Depth = 0.30" for 2-year 24-hr event  
 Inflow = 0.09 cfs @ 12.15 hrs, Volume= 0.016 af  
 Outflow = 0.02 cfs @ 15.25 hrs, Volume= 0.016 af, Atten= 79%, Lag= 186.0 min  
 Discarded = 0.02 cfs @ 15.25 hrs, Volume= 0.016 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 20R : DP: On-Site/Western Basin

**Lynnfield Stormwater Management EX\_PC ZBA** Type III 24-hr 2-year 24-hr Rainfall=3.31"

Prepared by CDM Smith

Printed 7/6/2023

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Page 8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 78.27' @ 15.25 hrs Surf.Area= 738 sf Storage= 189 cf  
 Flood Elev= 82.00' Surf.Area= 2,450 sf Storage= 5,751 cf

Plug-Flow detention time= 109.1 min calculated for 0.016 af (100% of inflow)  
 Center-of-Mass det. time= 109.1 min ( 1,049.0 - 939.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	78.00'	5,751 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	645	0	0
79.00	986	816	816
80.00	1,382	1,184	2,000
81.00	1,835	1,609	3,608
82.00	2,450	2,143	5,751

Device	Routing	Invert	Outlet Devices
#1	Primary	81.50'	<b>8.0' long x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	78.00'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.02 cfs @ 15.25 hrs HW=78.27' (Free Discharge)  
 ↑**2=Exfiltration** ( Controls 0.02 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=78.00' TW=0.00' (Dynamic Tailwater)  
 ↑**1=Broad-Crested Rectangular Weir**( Controls 0.00 cfs)

**Summary for Pond 22P: Sediment Forebay - Western Basin (East)**

Inflow Area = 0.156 ac, 23.11% Impervious, Inflow Depth = 0.18" for 2-year 24-hr event  
 Inflow = 0.01 cfs @ 12.41 hrs, Volume= 0.002 af  
 Outflow = 0.01 cfs @ 12.43 hrs, Volume= 0.002 af, Atten= 0%, Lag= 1.0 min  
 Discarded = 0.00 cfs @ 12.43 hrs, Volume= 0.000 af  
 Primary = 0.01 cfs @ 12.43 hrs, Volume= 0.002 af  
 Routed to Pond 21P : Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 79.54' @ 12.43 hrs Surf.Area= 23 sf Storage= 0 cf  
 Flood Elev= 81.50' Surf.Area= 1,150 sf Storage= 1,058 cf

Plug-Flow detention time= 0.9 min calculated for 0.002 af (100% of inflow)  
 Center-of-Mass det. time= 0.9 min ( 987.5 - 986.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	79.50'	1,734 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
79.50	0	0	0
80.00	280	70	70
81.00	747	514	584
82.00	1,553	1,150	1,734

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.50'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'
#2	Primary	79.50'	<b>12.0" Round 12" DI Pipe</b> L= 66.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 79.50' / 78.00' S= 0.0226 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.00 cfs @ 12.43 hrs HW=79.54' (Free Discharge)  
 ↑1=Exfiltration ( Controls 0.00 cfs)

**Primary OutFlow** Max=0.01 cfs @ 12.43 hrs HW=79.54' TW=78.14' (Dynamic Tailwater)  
 ↑2=12" DI Pipe (Inlet Controls 0.01 cfs @ 0.68 fps)

### Summary for Pond 24P: WQ Basin

contributing imperv area 5564 ft2

original areas:

- 78 - 355ft2
- 79 - 535ft2
- 80 - 895ft2

Inflow Area =	0.396 ac, 23.58% Impervious, Inflow Depth = 0.25" for 2-year 24-hr event
Inflow =	0.04 cfs @ 12.34 hrs, Volume= 0.008 af
Outflow =	0.01 cfs @ 14.45 hrs, Volume= 0.008 af, Atten= 70%, Lag= 126.5 min
Discarded =	0.01 cfs @ 14.45 hrs, Volume= 0.008 af
Primary =	0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routed to Reach 21R : DP: Northern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 77.14' @ 14.45 hrs Surf.Area= 482 sf Storage= 63 cf  
 Flood Elev= 80.00' Surf.Area= 1,827 sf Storage= 3,076 cf

Plug-Flow detention time= 50.5 min calculated for 0.008 af (100% of inflow)  
 Center-of-Mass det. time= 50.5 min ( 1,007.3 - 956.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	77.00'	3,076 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

**Lynnfield Stormwater Management EX\_PC ZBA** Type III 24-hr 2-year 24-hr Rainfall=3.31"

Prepared by CDM Smith

Printed 7/6/2023

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Page 10

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
77.00	435	0	0
78.00	775	605	605
79.00	1,170	973	1,578
80.00	1,827	1,499	3,076

Device	Routing	Invert	Outlet Devices
#1	Primary	79.50'	<b>10.7' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	77.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.01 cfs @ 14.45 hrs HW=77.14' (Free Discharge)

↑ **2=Exfiltration** ( Controls 0.01 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=77.00' TW=0.00' (Dynamic Tailwater)

↑ **1=Broad-Crested Rectangular Weir**( Controls 0.00 cfs)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment17S: Undisturbed 11S** Runoff Area=25,214 sf 0.00% Impervious Runoff Depth=0.03"  
 Flow Length=127' Tc=6.0 min CN=31 Runoff=0.00 cfs 0.001 af

**Subcatchment18S: Areas to Eastern Basin** Runoff Area=36,560 sf 19.58% Impervious Runoff Depth=0.56"  
 Flow Length=104' Tc=6.0 min UI Adjusted CN=46 Runoff=0.26 cfs 0.039 af

**Subcatchment20S: Areas to Wetlands** Runoff Area=43,405 sf 3.44% Impervious Runoff Depth=0.11"  
 Tc=9.8 min CN=35 Runoff=0.01 cfs 0.009 af

**Subcatchment22S: Driveway and Grass to** Runoff Area=17,264 sf 23.58% Impervious Runoff Depth=1.03"  
 Flow Length=220' Tc=6.0 min CN=54 Runoff=0.38 cfs 0.034 af

**Subcatchment23S: Contributing Areas to** Runoff Area=6,795 sf 23.11% Impervious Runoff Depth=0.84"  
 Flow Length=92' Tc=6.0 min UI Adjusted CN=51 Runoff=0.11 cfs 0.011 af

**Subcatchment24S: East of Western Basin** Runoff Area=21,261 sf 32.85% Impervious Runoff Depth=1.22"  
 Flow Length=52' Slope=0.2112 '/' Tc=6.0 min CN=57 Runoff=0.61 cfs 0.050 af

**Reach 16R: DP: South/Eastern Basin** Inflow=0.00 cfs 0.001 af  
 Outflow=0.00 cfs 0.001 af

**Reach 20R: DP: On-Site/Western Basin** Inflow=0.00 cfs 0.000 af  
 Outflow=0.00 cfs 0.000 af

**Reach 21R: DP: Northern Wetlands** Inflow=0.01 cfs 0.009 af  
 Outflow=0.01 cfs 0.009 af

**Pond 17P: Eastern Basin** Peak Elev=78.64' Storage=656 cf Inflow=0.26 cfs 0.039 af  
 Discarded=0.04 cfs 0.039 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.039 af

**Pond 21P: Western Basin** Peak Elev=79.53' Storage=1,389 cf Inflow=0.70 cfs 0.060 af  
 Discarded=0.04 cfs 0.060 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.060 af

**Pond 22P: Sediment Forebay - Western Basin** Peak Elev=79.66' Storage=7 cf Inflow=0.11 cfs 0.011 af  
 Discarded=0.00 cfs 0.001 af Primary=0.10 cfs 0.010 af Outflow=0.11 cfs 0.011 af

**Pond 24P: WQ Basin** Peak Elev=78.11' Storage=693 cf Inflow=0.38 cfs 0.034 af  
 Discarded=0.03 cfs 0.034 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.034 af

**Total Runoff Area = 3.455 ac Runoff Volume = 0.145 af Average Runoff Depth = 0.50"**  
**85.86% Pervious = 2.967 ac 14.14% Impervious = 0.488 ac**

**Summary for Subcatchment 17S: Undisturbed 11S**

Runoff = 0.00 cfs @ 21.18 hrs, Volume= 0.001 af, Depth= 0.03"  
 Routed to Reach 16R : DP: South/Eastern Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Description
23,293	30	Woods, Good, HSG A
323	96	Gravel surface, HSG A
1,598	39	>75% Grass cover, Good, HSG A
25,214	31	Weighted Average
25,214		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	34	0.1740	0.15		<b>Sheet Flow, Slope (92-86)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.8	40	0.0249	0.79		<b>Shallow Concentrated Flow, Slope (86-85)</b> Woodland Kv= 5.0 fps
0.6	53	0.1031	1.61		<b>Shallow Concentrated Flow, Slope (85-79.5)</b> Woodland Kv= 5.0 fps
5.1	127	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 18S: Areas to Eastern Basin**

Runoff = 0.26 cfs @ 12.14 hrs, Volume= 0.039 af, Depth= 0.56"  
 Routed to Pond 17P : Eastern Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Adj	Description
11,553	30		Woods, Good, HSG A
1,434	98		Unconnected pavement, HSG A
17,850	39		>75% Grass cover, Good, HSG A
5,723	98		Roofs, HSG A
36,560	48	46	Weighted Average, UI Adjusted
29,403			80.42% Pervious Area
7,157			19.58% Impervious Area
1,434			20.04% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	43	0.2805	0.19		<b>Sheet Flow, 94-82</b> Woods: Light underbrush n= 0.400 P2= 3.31"
1.6	61	0.0165	0.64		<b>Shallow Concentrated Flow, 82-81</b> Woodland Kv= 5.0 fps
5.3	104	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 20S: Areas to Wetlands**

Runoff = 0.01 cfs @ 14.93 hrs, Volume= 0.009 af, Depth= 0.11"  
 Routed to Reach 21R : DP: Northern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Description
26,730	30	Woods, Good, HSG A
15,181	39	>75% Grass cover, Good, HSG A
1,494	98	Paved parking, HSG A
43,405	35	Weighted Average
41,911		96.56% Pervious Area
1,494		3.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8					<b>Direct Entry, same as EC 5S</b>

**Summary for Subcatchment 22S: Driveway and Grass to WQ Basin**

Runoff = 0.38 cfs @ 12.11 hrs, Volume= 0.034 af, Depth= 1.03"  
 Routed to Pond 24P : WQ Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Description
4,070	98	Paved parking, HSG A
6,386	30	Woods, Good, HSG A
2,212	76	Gravel roads, HSG A
4,596	39	>75% Grass cover, Good, HSG A
17,264	54	Weighted Average
13,194		76.42% Pervious Area
4,070		23.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	47	0.0425	1.63		<b>Sheet Flow, 85-83</b> Smooth surfaces n= 0.011 P2= 3.31"
0.8	96	0.0104	2.07		<b>Shallow Concentrated Flow, 83-82</b> Paved Kv= 20.3 fps
1.3	77	0.0390	0.99		<b>Shallow Concentrated Flow, 82-79</b> Woodland Kv= 5.0 fps
2.6	220	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 23S: Contributing Areas to Western Basin**

Runoff = 0.11 cfs @ 12.11 hrs, Volume= 0.011 af, Depth= 0.84"  
 Routed to Pond 22P : Sediment Forebay - Western Basin (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Adj	Description
991	98		Roofs, HSG A
148	98		Unconnected pavement, HSG A
5,225	39		>75% Grass cover, Good, HSG A
127	98		Unconnected pavement, HSG A
304	98		Paved parking, HSG A
6,795	53	51	Weighted Average, UI Adjusted
5,225			76.89% Pervious Area
1,570			23.11% Impervious Area
275			17.52% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	33	0.0045	0.62		<b>Sheet Flow, 82.4-82.25</b> Smooth surfaces n= 0.011 P2= 3.31"
1.2	59	0.0128	0.79		<b>Shallow Concentrated Flow, 82.25-81.5</b> Short Grass Pasture Kv= 7.0 fps
2.1	92	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 24S: East of Western Basin**

Runoff = 0.61 cfs @ 12.10 hrs, Volume= 0.050 af, Depth= 1.22"  
 Routed to Pond 21P : Western Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 10-year 24-hr Rainfall=5.22"

Area (sf)	CN	Description
6,429	98	Paved parking, HSG A
12,054	39	>75% Grass cover, Good, HSG A
2,223	30	Woods, Good, HSG A
555	98	Roofs, HSG A
21,261	57	Weighted Average
14,277		67.15% Pervious Area
6,984		32.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	52	0.2112	0.18		<b>Sheet Flow, 93-82</b> Woods: Light underbrush n= 0.400 P2= 3.31"
4.9	52	Total, Increased to minimum Tc = 6.0 min			



**Summary for Reach 16R: DP: South/Eastern Basin**

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

Inflow Area = 1.418 ac, 11.59% Impervious, Inflow Depth = 0.01" for 10-year 24-hr event  
 Inflow = 0.00 cfs @ 21.18 hrs, Volume= 0.001 af  
 Outflow = 0.00 cfs @ 21.18 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 20R: DP: On-Site/Western Basin**

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

Inflow Area = 0.644 ac, 30.49% Impervious, Inflow Depth = 0.00" for 10-year 24-hr event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 21R: DP: Northern Wetlands**

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

Inflow Area = 1.393 ac, 9.17% Impervious, Inflow Depth = 0.08" for 10-year 24-hr event  
 Inflow = 0.01 cfs @ 14.93 hrs, Volume= 0.009 af  
 Outflow = 0.01 cfs @ 14.93 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Pond 17P: Eastern Basin**

Inflow Area = 0.839 ac, 19.58% Impervious, Inflow Depth = 0.56" for 10-year 24-hr event  
 Inflow = 0.26 cfs @ 12.14 hrs, Volume= 0.039 af  
 Outflow = 0.04 cfs @ 15.99 hrs, Volume= 0.039 af, Atten= 86%, Lag= 231.0 min  
 Discarded = 0.04 cfs @ 15.99 hrs, Volume= 0.039 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routed to Reach 16R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Peak Elev= 78.64' @ 15.99 hrs Surf.Area= 1,283 sf Storage= 656 cf  
 Flood Elev= 82.00' Surf.Area= 5,520 sf Storage= 11,966 cf

Plug-Flow detention time= 236.0 min calculated for 0.039 af (100% of inflow)  
 Center-of-Mass det. time= 236.0 min ( 1,167.8 - 931.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	78.00'	11,966 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

**Lynnfield Stormwater Management EX\_PC ZBA Type III 24-hr 10-year 24-hr Rainfall=5.22"**

Prepared by CDM Smith

Printed 7/6/2023

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Page 16

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	781	0	0
79.00	1,570	1,176	1,176
80.00	3,012	2,291	3,467
81.00	4,233	3,623	7,089
82.00	5,520	4,877	11,966

Device	Routing	Invert	Outlet Devices
#1	Primary	81.00'	<b>8.0' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	78.00'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.04 cfs @ 15.99 hrs HW=78.64' (Free Discharge)  
 ↳ **2=Exfiltration** ( Controls 0.04 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=78.00' TW=0.00' (Dynamic Tailwater)  
 ↳ **1=Broad-Crested Rectangular Weir**( Controls 0.00 cfs)

**Summary for Pond 21P: Western Basin**

Inflow Area = 0.644 ac, 30.49% Impervious, Inflow Depth = 1.12" for 10-year 24-hr event  
 Inflow = 0.70 cfs @ 12.11 hrs, Volume= 0.060 af  
 Outflow = 0.04 cfs @ 16.29 hrs, Volume= 0.060 af, Atten= 94%, Lag= 250.9 min  
 Discarded = 0.04 cfs @ 16.29 hrs, Volume= 0.060 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 20R : DP: On-Site/Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 79.53' @ 16.29 hrs Surf.Area= 1,194 sf Storage= 1,389 cf  
 Flood Elev= 82.00' Surf.Area= 2,450 sf Storage= 5,751 cf

Plug-Flow detention time= 456.2 min calculated for 0.060 af (100% of inflow)  
 Center-of-Mass det. time= 456.2 min ( 1,340.7 - 884.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	78.00'	5,751 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	645	0	0
79.00	986	816	816
80.00	1,382	1,184	2,000
81.00	1,835	1,609	3,608
82.00	2,450	2,143	5,751

Device	Routing	Invert	Outlet Devices
#1	Primary	81.50'	<b>8.0' long x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	78.00'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.04 cfs @ 16.29 hrs HW=79.53' (Free Discharge)  
 ↳2=Exfiltration ( Controls 0.04 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=78.00' TW=0.00' (Dynamic Tailwater)  
 ↳1=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Summary for Pond 22P: Sediment Forebay - Western Basin (East)**

Inflow Area = 0.156 ac, 23.11% Impervious, Inflow Depth = 0.84" for 10-year 24-hr event  
 Inflow = 0.11 cfs @ 12.11 hrs, Volume= 0.011 af  
 Outflow = 0.11 cfs @ 12.13 hrs, Volume= 0.011 af, Atten= 2%, Lag= 1.2 min  
 Discarded = 0.00 cfs @ 12.13 hrs, Volume= 0.001 af  
 Primary = 0.10 cfs @ 12.13 hrs, Volume= 0.010 af  
 Routed to Pond 21P : Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 79.66' @ 12.13 hrs Surf.Area= 87 sf Storage= 7 cf  
 Flood Elev= 81.50' Surf.Area= 1,150 sf Storage= 1,058 cf

Plug-Flow detention time= 2.0 min calculated for 0.011 af (100% of inflow)  
 Center-of-Mass det. time= 2.0 min ( 906.9 - 904.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	79.50'	1,734 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
79.50	0	0	0
80.00	280	70	70
81.00	747	514	584
82.00	1,553	1,150	1,734

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.50'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'
#2	Primary	79.50'	<b>12.0" Round 12" DI Pipe</b> L= 66.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 79.50' / 78.00' S= 0.0226 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.00 cfs @ 12.13 hrs HW=79.66' (Free Discharge)  
 ↑1=Exfiltration ( Controls 0.00 cfs)

**Primary OutFlow** Max=0.10 cfs @ 12.13 hrs HW=79.66' TW=78.49' (Dynamic Tailwater)  
 ↑2=12" DI Pipe (Inlet Controls 0.10 cfs @ 1.34 fps)

**Summary for Pond 24P: WQ Basin**

contributing imperv area 5564 ft2

original areas:  
 - 78 - 355ft2  
 - 79 - 535ft2  
 - 80 - 895ft2

Inflow Area = 0.396 ac, 23.58% Impervious, Inflow Depth = 1.03" for 10-year 24-hr event  
 Inflow = 0.38 cfs @ 12.11 hrs, Volume= 0.034 af  
 Outflow = 0.03 cfs @ 15.71 hrs, Volume= 0.034 af, Atten= 93%, Lag= 216.2 min  
 Discarded = 0.03 cfs @ 15.71 hrs, Volume= 0.034 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 21R : DP: Northern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 78.11' @ 15.71 hrs Surf.Area= 819 sf Storage= 693 cf  
 Flood Elev= 80.00' Surf.Area= 1,827 sf Storage= 3,076 cf

Plug-Flow detention time= 326.4 min calculated for 0.034 af (100% of inflow)  
 Center-of-Mass det. time= 326.4 min ( 1,218.8 - 892.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	77.00'	3,076 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
77.00	435	0	0
78.00	775	605	605
79.00	1,170	973	1,578
80.00	1,827	1,499	3,076

Device	Routing	Invert	Outlet Devices
#1	Primary	79.50'	<b>10.7' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	77.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.03 cfs @ 15.71 hrs HW=78.11' (Free Discharge)

↳ **2=Exfiltration** ( Controls 0.03 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=77.00' TW=0.00' (Dynamic Tailwater)

↳ **1=Broad-Crested Rectangular Weir**( Controls 0.00 cfs)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment17S: Undisturbed 11S** Runoff Area=25,214 sf 0.00% Impervious Runoff Depth=0.16"  
 Flow Length=127' Tc=6.0 min CN=31 Runoff=0.01 cfs 0.008 af

**Subcatchment18S: Areas to Eastern Basin** Runoff Area=36,560 sf 19.58% Impervious Runoff Depth=1.04"  
 Flow Length=104' Tc=6.0 min UI Adjusted CN=46 Runoff=0.73 cfs 0.073 af

**Subcatchment20S: Areas to Wetlands** Runoff Area=43,405 sf 3.44% Impervious Runoff Depth=0.34"  
 Tc=9.8 min CN=35 Runoff=0.09 cfs 0.028 af

**Subcatchment22S: Driveway and Grass to** Runoff Area=17,264 sf 23.58% Impervious Runoff Depth=1.67"  
 Flow Length=220' Tc=6.0 min CN=54 Runoff=0.70 cfs 0.055 af

**Subcatchment23S: Contributing Areas to** Runoff Area=6,795 sf 23.11% Impervious Runoff Depth=1.43"  
 Flow Length=92' Tc=6.0 min UI Adjusted CN=51 Runoff=0.22 cfs 0.019 af

**Subcatchment24S: East of Western Basin** Runoff Area=21,261 sf 32.85% Impervious Runoff Depth=1.93"  
 Flow Length=52' Slope=0.2112 '/' Tc=6.0 min CN=57 Runoff=1.03 cfs 0.079 af

**Reach 16R: DP: South/Eastern Basin** Inflow=0.01 cfs 0.008 af  
 Outflow=0.01 cfs 0.008 af

**Reach 20R: DP: On-Site/Western Basin** Inflow=0.00 cfs 0.000 af  
 Outflow=0.00 cfs 0.000 af

**Reach 21R: DP: Northern Wetlands** Inflow=0.09 cfs 0.028 af  
 Outflow=0.09 cfs 0.028 af

**Pond 17P: Eastern Basin** Peak Elev=79.20' Storage=1,518 cf Inflow=0.73 cfs 0.073 af  
 Discarded=0.06 cfs 0.073 af Primary=0.00 cfs 0.000 af Outflow=0.06 cfs 0.073 af

**Pond 21P: Western Basin** Peak Elev=80.18' Storage=2,251 cf Inflow=1.23 cfs 0.089 af  
 Discarded=0.05 cfs 0.089 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.089 af

**Pond 22P: Sediment Forebay - Western Basin** Peak Elev=80.18' Storage=127 cf Inflow=0.22 cfs 0.019 af  
 Discarded=0.01 cfs 0.008 af Primary=0.21 cfs 0.011 af Outflow=0.22 cfs 0.019 af

**Pond 24P: WQ Basin** Peak Elev=78.72' Storage=1,265 cf Inflow=0.70 cfs 0.055 af  
 Discarded=0.04 cfs 0.055 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.055 af

**Total Runoff Area = 3.455 ac Runoff Volume = 0.261 af Average Runoff Depth = 0.91"**  
**85.86% Pervious = 2.967 ac 14.14% Impervious = 0.488 ac**

**Summary for Subcatchment 17S: Undisturbed 11S**

Runoff = 0.01 cfs @ 14.70 hrs, Volume= 0.008 af, Depth= 0.16"  
 Routed to Reach 16R : DP: South/Eastern Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Description
23,293	30	Woods, Good, HSG A
323	96	Gravel surface, HSG A
1,598	39	>75% Grass cover, Good, HSG A
25,214	31	Weighted Average
25,214		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	34	0.1740	0.15		<b>Sheet Flow, Slope (92-86)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.8	40	0.0249	0.79		<b>Shallow Concentrated Flow, Slope (86-85)</b> Woodland Kv= 5.0 fps
0.6	53	0.1031	1.61		<b>Shallow Concentrated Flow, Slope (85-79.5)</b> Woodland Kv= 5.0 fps
5.1	127	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 18S: Areas to Eastern Basin**

Runoff = 0.73 cfs @ 12.11 hrs, Volume= 0.073 af, Depth= 1.04"  
 Routed to Pond 17P : Eastern Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Adj	Description
11,553	30		Woods, Good, HSG A
1,434	98		Unconnected pavement, HSG A
17,850	39		>75% Grass cover, Good, HSG A
5,723	98		Roofs, HSG A
36,560	48	46	Weighted Average, UI Adjusted
29,403			80.42% Pervious Area
7,157			19.58% Impervious Area
1,434			20.04% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	43	0.2805	0.19		<b>Sheet Flow, 94-82</b> Woods: Light underbrush n= 0.400 P2= 3.31"
1.6	61	0.0165	0.64		<b>Shallow Concentrated Flow, 82-81</b> Woodland Kv= 5.0 fps
5.3	104	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 20S: Areas to Wetlands**

Runoff = 0.09 cfs @ 12.47 hrs, Volume= 0.028 af, Depth= 0.34"  
 Routed to Reach 21R : DP: Northern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Description
26,730	30	Woods, Good, HSG A
15,181	39	>75% Grass cover, Good, HSG A
1,494	98	Paved parking, HSG A
43,405	35	Weighted Average
41,911		96.56% Pervious Area
1,494		3.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8					<b>Direct Entry, same as EC 5S</b>

**Summary for Subcatchment 22S: Driveway and Grass to WQ Basin**

Runoff = 0.70 cfs @ 12.10 hrs, Volume= 0.055 af, Depth= 1.67"  
 Routed to Pond 24P : WQ Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Description
4,070	98	Paved parking, HSG A
6,386	30	Woods, Good, HSG A
2,212	76	Gravel roads, HSG A
4,596	39	>75% Grass cover, Good, HSG A
17,264	54	Weighted Average
13,194		76.42% Pervious Area
4,070		23.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	47	0.0425	1.63		<b>Sheet Flow, 85-83</b> Smooth surfaces n= 0.011 P2= 3.31"
0.8	96	0.0104	2.07		<b>Shallow Concentrated Flow, 83-82</b> Paved Kv= 20.3 fps
1.3	77	0.0390	0.99		<b>Shallow Concentrated Flow, 82-79</b> Woodland Kv= 5.0 fps
2.6	220	Total, Increased to minimum Tc = 6.0 min			



**Summary for Subcatchment 23S: Contributing Areas to Western Basin**

Runoff = 0.22 cfs @ 12.10 hrs, Volume= 0.019 af, Depth= 1.43"  
 Routed to Pond 22P : Sediment Forebay - Western Basin (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Adj	Description
991	98		Roofs, HSG A
148	98		Unconnected pavement, HSG A
5,225	39		>75% Grass cover, Good, HSG A
127	98		Unconnected pavement, HSG A
304	98		Paved parking, HSG A
6,795	53	51	Weighted Average, UI Adjusted
5,225			76.89% Pervious Area
1,570			23.11% Impervious Area
275			17.52% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	33	0.0045	0.62		<b>Sheet Flow, 82.4-82.25</b> Smooth surfaces n= 0.011 P2= 3.31"
1.2	59	0.0128	0.79		<b>Shallow Concentrated Flow, 82.25-81.5</b> Short Grass Pasture Kv= 7.0 fps
2.1	92	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 24S: East of Western Basin**

Runoff = 1.03 cfs @ 12.10 hrs, Volume= 0.079 af, Depth= 1.93"  
 Routed to Pond 21P : Western Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 25-year 24-hr Rainfall=6.41"

Area (sf)	CN	Description
6,429	98	Paved parking, HSG A
12,054	39	>75% Grass cover, Good, HSG A
2,223	30	Woods, Good, HSG A
555	98	Roofs, HSG A
21,261	57	Weighted Average
14,277		67.15% Pervious Area
6,984		32.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	52	0.2112	0.18		<b>Sheet Flow, 93-82</b> Woods: Light underbrush n= 0.400 P2= 3.31"
4.9	52	Total, Increased to minimum Tc = 6.0 min			

**Summary for Reach 16R: DP: South/Eastern Basin**

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

Inflow Area = 1.418 ac, 11.59% Impervious, Inflow Depth = 0.06" for 25-year 24-hr event  
 Inflow = 0.01 cfs @ 14.70 hrs, Volume= 0.008 af  
 Outflow = 0.01 cfs @ 14.70 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 20R: DP: On-Site/Western Basin**

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

Inflow Area = 0.644 ac, 30.49% Impervious, Inflow Depth = 0.00" for 25-year 24-hr event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 21R: DP: Northern Wetlands**

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

Inflow Area = 1.393 ac, 9.17% Impervious, Inflow Depth = 0.24" for 25-year 24-hr event  
 Inflow = 0.09 cfs @ 12.47 hrs, Volume= 0.028 af  
 Outflow = 0.09 cfs @ 12.47 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Pond 17P: Eastern Basin**

Inflow Area = 0.839 ac, 19.58% Impervious, Inflow Depth = 1.04" for 25-year 24-hr event  
 Inflow = 0.73 cfs @ 12.11 hrs, Volume= 0.073 af  
 Outflow = 0.06 cfs @ 16.08 hrs, Volume= 0.073 af, Atten= 92%, Lag= 237.9 min  
 Discarded = 0.06 cfs @ 16.08 hrs, Volume= 0.073 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routed to Reach 16R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Peak Elev= 79.20' @ 16.08 hrs Surf.Area= 1,858 sf Storage= 1,518 cf  
 Flood Elev= 82.00' Surf.Area= 5,520 sf Storage= 11,966 cf

Plug-Flow detention time= 368.5 min calculated for 0.073 af (100% of inflow)  
 Center-of-Mass det. time= 368.5 min ( 1,272.8 - 904.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	78.00'	11,966 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

**Lynnfield Stormwater Management EX\_PC ZBA Type III 24-hr 25-year 24-hr Rainfall=6.41"**

Prepared by CDM Smith

Printed 7/6/2023

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Page 25

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	781	0	0
79.00	1,570	1,176	1,176
80.00	3,012	2,291	3,467
81.00	4,233	3,623	7,089
82.00	5,520	4,877	11,966

Device	Routing	Invert	Outlet Devices
#1	Primary	81.00'	<b>8.0' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	78.00'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.06 cfs @ 16.08 hrs HW=79.20' (Free Discharge)  
 ↳ **2=Exfiltration** ( Controls 0.06 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=78.00' TW=0.00' (Dynamic Tailwater)  
 ↳ **1=Broad-Crested Rectangular Weir**( Controls 0.00 cfs)

**Summary for Pond 21P: Western Basin**

Inflow Area = 0.644 ac, 30.49% Impervious, Inflow Depth = 1.67" for 25-year 24-hr event  
 Inflow = 1.23 cfs @ 12.10 hrs, Volume= 0.089 af  
 Outflow = 0.05 cfs @ 16.08 hrs, Volume= 0.089 af, Atten= 96%, Lag= 238.6 min  
 Discarded = 0.05 cfs @ 16.08 hrs, Volume= 0.089 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 20R : DP: On-Site/Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 80.18' @ 16.08 hrs Surf.Area= 1,462 sf Storage= 2,251 cf  
 Flood Elev= 82.00' Surf.Area= 2,450 sf Storage= 5,751 cf

Plug-Flow detention time= 565.7 min calculated for 0.089 af (100% of inflow)  
 Center-of-Mass det. time= 565.8 min ( 1,432.0 - 866.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	78.00'	5,751 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	645	0	0
79.00	986	816	816
80.00	1,382	1,184	2,000
81.00	1,835	1,609	3,608
82.00	2,450	2,143	5,751

Device	Routing	Invert	Outlet Devices
#1	Primary	81.50'	<b>8.0' long x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	78.00'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.05 cfs @ 16.08 hrs HW=80.18' (Free Discharge)

↳ **2=Exfiltration** ( Controls 0.05 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=78.00' TW=0.00' (Dynamic Tailwater)

↳ **1=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Summary for Pond 22P: Sediment Forebay - Western Basin (East)**

Inflow Area = 0.156 ac, 23.11% Impervious, Inflow Depth = 1.43" for 25-year 24-hr event  
 Inflow = 0.22 cfs @ 12.10 hrs, Volume= 0.019 af  
 Outflow = 0.22 cfs @ 12.12 hrs, Volume= 0.019 af, Atten= 3%, Lag= 1.2 min  
 Discarded = 0.01 cfs @ 16.08 hrs, Volume= 0.008 af  
 Primary = 0.21 cfs @ 12.12 hrs, Volume= 0.011 af  
 Routed to Pond 21P : Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Peak Elev= 80.18' @ 16.08 hrs Surf.Area= 363 sf Storage= 127 cf

Flood Elev= 81.50' Surf.Area= 1,150 sf Storage= 1,058 cf

Plug-Flow detention time= 74.0 min calculated for 0.019 af (100% of inflow)

Center-of-Mass det. time= 74.0 min ( 958.7 - 884.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	79.50'	1,734 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
79.50	0	0	0
80.00	280	70	70
81.00	747	514	584
82.00	1,553	1,150	1,734

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.50'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'
#2	Primary	79.50'	<b>12.0" Round 12" DI Pipe</b> L= 66.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 79.50' / 78.00' S= 0.0226 '/ Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.01 cfs @ 16.08 hrs HW=80.18' (Free Discharge)  
 ↑1=Exfiltration ( Controls 0.01 cfs)

**Primary OutFlow** Max=0.21 cfs @ 12.12 hrs HW=79.72' TW=78.90' (Dynamic Tailwater)  
 ↑2=12" DI Pipe (Inlet Controls 0.21 cfs @ 1.61 fps)

**Summary for Pond 24P: WQ Basin**

contributing imperv area 5564 ft2

- original areas:  
 - 78 - 355ft2  
 - 79 - 535ft2  
 - 80 - 895ft2

Inflow Area = 0.396 ac, 23.58% Impervious, Inflow Depth = 1.67" for 25-year 24-hr event  
 Inflow = 0.70 cfs @ 12.10 hrs, Volume= 0.055 af  
 Outflow = 0.04 cfs @ 15.80 hrs, Volume= 0.055 af, Atten= 94%, Lag= 222.0 min  
 Discarded = 0.04 cfs @ 15.80 hrs, Volume= 0.055 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 21R : DP: Northern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 78.72' @ 15.80 hrs Surf.Area= 1,059 sf Storage= 1,265 cf  
 Flood Elev= 80.00' Surf.Area= 1,827 sf Storage= 3,076 cf

Plug-Flow detention time= 423.2 min calculated for 0.055 af (100% of inflow)  
 Center-of-Mass det. time= 423.3 min ( 1,298.4 - 875.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	77.00'	3,076 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
77.00	435	0	0
78.00	775	605	605
79.00	1,170	973	1,578
80.00	1,827	1,499	3,076

Device	Routing	Invert	Outlet Devices
#1	Primary	79.50'	<b>10.7' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	77.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.04 cfs @ 15.80 hrs HW=78.72' (Free Discharge)

↳ **2=Exfiltration** ( Controls 0.04 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=77.00' TW=0.00' (Dynamic Tailwater)

↳ **1=Broad-Crested Rectangular Weir**( Controls 0.00 cfs)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Subcatchment17S: Undisturbed 11S** Runoff Area=25,214 sf 0.00% Impervious Runoff Depth=0.55"  
 Flow Length=127' Tc=6.0 min CN=31 Runoff=0.12 cfs 0.027 af

**Subcatchment18S: Areas to Eastern Basin** Runoff Area=36,560 sf 19.58% Impervious Runoff Depth=1.97"  
 Flow Length=104' Tc=6.0 min UI Adjusted CN=46 Runoff=1.69 cfs 0.138 af

**Subcatchment20S: Areas to Wetlands** Runoff Area=43,405 sf 3.44% Impervious Runoff Depth=0.89"  
 Tc=9.8 min CN=35 Runoff=0.44 cfs 0.074 af

**Subcatchment22S: Driveway and Grass to** Runoff Area=17,264 sf 23.58% Impervious Runoff Depth=2.84"  
 Flow Length=220' Tc=6.0 min CN=54 Runoff=1.27 cfs 0.094 af

**Subcatchment23S: Contributing Areas to** Runoff Area=6,795 sf 23.11% Impervious Runoff Depth=2.51"  
 Flow Length=92' Tc=6.0 min UI Adjusted CN=51 Runoff=0.43 cfs 0.033 af

**Subcatchment24S: East of Western Basin** Runoff Area=21,261 sf 32.85% Impervious Runoff Depth=3.18"  
 Flow Length=52' Slope=0.2112 '/' Tc=6.0 min CN=57 Runoff=1.78 cfs 0.129 af

**Reach 16R: DP: South/Eastern Basin** Inflow=0.12 cfs 0.027 af  
 Outflow=0.12 cfs 0.027 af

**Reach 20R: DP: On-Site/Western Basin** Inflow=0.00 cfs 0.000 af  
 Outflow=0.00 cfs 0.000 af

**Reach 21R: DP: Northern Wetlands** Inflow=0.44 cfs 0.076 af  
 Outflow=0.44 cfs 0.076 af

**Pond 17P: Eastern Basin** Peak Elev=79.93' Storage=3,246 cf Inflow=1.69 cfs 0.138 af  
 Discarded=0.09 cfs 0.138 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.138 af

**Pond 21P: Western Basin** Peak Elev=81.07' Storage=3,736 cf Inflow=2.12 cfs 0.139 af  
 Discarded=0.07 cfs 0.139 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.139 af

**Pond 22P: Sediment Forebay - Western Basin** Peak Elev=80.93' Storage=530 cf Inflow=0.43 cfs 0.033 af  
 Discarded=0.02 cfs 0.023 af Primary=0.35 cfs 0.010 af Outflow=0.35 cfs 0.033 af

**Pond 24P: WQ Basin** Peak Elev=79.51' Storage=2,259 cf Inflow=1.27 cfs 0.094 af  
 Discarded=0.06 cfs 0.092 af Primary=0.02 cfs 0.002 af Outflow=0.08 cfs 0.094 af

**Total Runoff Area = 3.455 ac Runoff Volume = 0.495 af Average Runoff Depth = 1.72"**  
**85.86% Pervious = 2.967 ac 14.14% Impervious = 0.488 ac**

**Summary for Subcatchment 17S: Undisturbed 11S**

Runoff = 0.12 cfs @ 12.37 hrs, Volume= 0.027 af, Depth= 0.55"  
 Routed to Reach 16R : DP: South/Eastern Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Description
23,293	30	Woods, Good, HSG A
323	96	Gravel surface, HSG A
1,598	39	>75% Grass cover, Good, HSG A
25,214	31	Weighted Average
25,214		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	34	0.1740	0.15		<b>Sheet Flow, Slope (92-86)</b> Woods: Light underbrush n= 0.400 P2= 3.31"
0.8	40	0.0249	0.79		<b>Shallow Concentrated Flow, Slope (86-85)</b> Woodland Kv= 5.0 fps
0.6	53	0.1031	1.61		<b>Shallow Concentrated Flow, Slope (85-79.5)</b> Woodland Kv= 5.0 fps
5.1	127	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 18S: Areas to Eastern Basin**

Runoff = 1.69 cfs @ 12.10 hrs, Volume= 0.138 af, Depth= 1.97"  
 Routed to Pond 17P : Eastern Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Adj	Description
11,553	30		Woods, Good, HSG A
1,434	98		Unconnected pavement, HSG A
17,850	39		>75% Grass cover, Good, HSG A
5,723	98		Roofs, HSG A
36,560	48	46	Weighted Average, UI Adjusted
29,403			80.42% Pervious Area
7,157			19.58% Impervious Area
1,434			20.04% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.7	43	0.2805	0.19		<b>Sheet Flow, 94-82</b> Woods: Light underbrush n= 0.400 P2= 3.31"
1.6	61	0.0165	0.64		<b>Shallow Concentrated Flow, 82-81</b> Woodland Kv= 5.0 fps
5.3	104	Total, Increased to minimum Tc = 6.0 min			



**Summary for Subcatchment 20S: Areas to Wetlands**

Runoff = 0.44 cfs @ 12.29 hrs, Volume= 0.074 af, Depth= 0.89"  
 Routed to Reach 21R : DP: Northern Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Description
26,730	30	Woods, Good, HSG A
15,181	39	>75% Grass cover, Good, HSG A
1,494	98	Paved parking, HSG A
43,405	35	Weighted Average
41,911		96.56% Pervious Area
1,494		3.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8					<b>Direct Entry, same as EC 5S</b>

**Summary for Subcatchment 22S: Driveway and Grass to WQ Basin**

Runoff = 1.27 cfs @ 12.09 hrs, Volume= 0.094 af, Depth= 2.84"  
 Routed to Pond 24P : WQ Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Description
4,070	98	Paved parking, HSG A
6,386	30	Woods, Good, HSG A
2,212	76	Gravel roads, HSG A
4,596	39	>75% Grass cover, Good, HSG A
17,264	54	Weighted Average
13,194		76.42% Pervious Area
4,070		23.58% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	47	0.0425	1.63		<b>Sheet Flow, 85-83</b> Smooth surfaces n= 0.011 P2= 3.31"
0.8	96	0.0104	2.07		<b>Shallow Concentrated Flow, 83-82</b> Paved Kv= 20.3 fps
1.3	77	0.0390	0.99		<b>Shallow Concentrated Flow, 82-79</b> Woodland Kv= 5.0 fps
2.6	220	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 23S: Contributing Areas to Western Basin**

Runoff = 0.43 cfs @ 12.10 hrs, Volume= 0.033 af, Depth= 2.51"  
 Routed to Pond 22P : Sediment Forebay - Western Basin (East)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Adj	Description
991	98		Roofs, HSG A
148	98		Unconnected pavement, HSG A
5,225	39		>75% Grass cover, Good, HSG A
127	98		Unconnected pavement, HSG A
304	98		Paved parking, HSG A
6,795	53	51	Weighted Average, UI Adjusted
5,225			76.89% Pervious Area
1,570			23.11% Impervious Area
275			17.52% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	33	0.0045	0.62		<b>Sheet Flow, 82.4-82.25</b> Smooth surfaces n= 0.011 P2= 3.31"
1.2	59	0.0128	0.79		<b>Shallow Concentrated Flow, 82.25-81.5</b> Short Grass Pasture Kv= 7.0 fps
2.1	92	Total, Increased to minimum Tc = 6.0 min			

**Summary for Subcatchment 24S: East of Western Basin**

Runoff = 1.78 cfs @ 12.09 hrs, Volume= 0.129 af, Depth= 3.18"  
 Routed to Pond 21P : Western Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Type III 24-hr 100-year 24-hr Rainfall=8.25"

Area (sf)	CN	Description
6,429	98	Paved parking, HSG A
12,054	39	>75% Grass cover, Good, HSG A
2,223	30	Woods, Good, HSG A
555	98	Roofs, HSG A
21,261	57	Weighted Average
14,277		67.15% Pervious Area
6,984		32.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	52	0.2112	0.18		<b>Sheet Flow, 93-82</b> Woods: Light underbrush n= 0.400 P2= 3.31"
4.9	52	Total, Increased to minimum Tc = 6.0 min			

**Summary for Reach 16R: DP: South/Eastern Basin**

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

Inflow Area = 1.418 ac, 11.59% Impervious, Inflow Depth = 0.23" for 100-year 24-hr event  
 Inflow = 0.12 cfs @ 12.37 hrs, Volume= 0.027 af  
 Outflow = 0.12 cfs @ 12.37 hrs, Volume= 0.027 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 20R: DP: On-Site/Western Basin**

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

Inflow Area = 0.644 ac, 30.49% Impervious, Inflow Depth = 0.00" for 100-year 24-hr event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Reach 21R: DP: Northern Wetlands**

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

Inflow Area = 1.393 ac, 9.17% Impervious, Inflow Depth = 0.65" for 100-year 24-hr event  
 Inflow = 0.44 cfs @ 12.29 hrs, Volume= 0.076 af  
 Outflow = 0.44 cfs @ 12.29 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

**Summary for Pond 17P: Eastern Basin**

Inflow Area = 0.839 ac, 19.58% Impervious, Inflow Depth = 1.97" for 100-year 24-hr event  
 Inflow = 1.69 cfs @ 12.10 hrs, Volume= 0.138 af  
 Outflow = 0.09 cfs @ 16.07 hrs, Volume= 0.138 af, Atten= 95%, Lag= 238.3 min  
 Discarded = 0.09 cfs @ 16.07 hrs, Volume= 0.138 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routed to Reach 16R : DP: South/Eastern Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3

Peak Elev= 79.93' @ 16.07 hrs Surf.Area= 2,904 sf Storage= 3,246 cf  
 Flood Elev= 82.00' Surf.Area= 5,520 sf Storage= 11,966 cf

Plug-Flow detention time= 481.1 min calculated for 0.138 af (100% of inflow)  
 Center-of-Mass det. time= 481.2 min ( 1,361.6 - 880.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	78.00'	11,966 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	781	0	0
79.00	1,570	1,176	1,176
80.00	3,012	2,291	3,467
81.00	4,233	3,623	7,089
82.00	5,520	4,877	11,966

Device	Routing	Invert	Outlet Devices
#1	Primary	81.00'	<b>8.0' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	78.00'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.09 cfs @ 16.07 hrs HW=79.93' (Free Discharge)  
 ↑2=Exfiltration ( Controls 0.09 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=78.00' TW=0.00' (Dynamic Tailwater)  
 ↑1=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Summary for Pond 21P: Western Basin**

[80] Warning: Exceeded Pond 22P by 0.14' @ 15.94 hrs (1.26 cfs 0.914 af)

Inflow Area = 0.644 ac, 30.49% Impervious, Inflow Depth = 2.59" for 100-year 24-hr event  
 Inflow = 2.12 cfs @ 12.09 hrs, Volume= 0.139 af  
 Outflow = 0.07 cfs @ 16.11 hrs, Volume= 0.139 af, Atten= 97%, Lag= 240.8 min  
 Discarded = 0.07 cfs @ 16.11 hrs, Volume= 0.139 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 20R : DP: On-Site/Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 81.07' @ 16.11 hrs Surf.Area= 1,877 sf Storage= 3,736 cf  
 Flood Elev= 82.00' Surf.Area= 2,450 sf Storage= 5,751 cf

Plug-Flow detention time= 685.2 min calculated for 0.139 af (100% of inflow)  
 Center-of-Mass det. time= 685.2 min ( 1,540.2 - 855.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	78.00'	5,751 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.00	645	0	0
79.00	986	816	816
80.00	1,382	1,184	2,000
81.00	1,835	1,609	3,609
82.00	2,450	2,143	5,751

Device	Routing	Invert	Outlet Devices
#1	Primary	81.50'	<b>8.0' long x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	78.00'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.07 cfs @ 16.11 hrs HW=81.07' (Free Discharge)  
 ↳2=Exfiltration ( Controls 0.07 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=78.00' TW=0.00' (Dynamic Tailwater)  
 ↳1=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

### Summary for Pond 22P: Sediment Forebay - Western Basin (East)

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=1)

Inflow Area = 0.156 ac, 23.11% Impervious, Inflow Depth = 2.51" for 100-year 24-hr event  
 Inflow = 0.43 cfs @ 12.10 hrs, Volume= 0.033 af  
 Outflow = 0.35 cfs @ 12.10 hrs, Volume= 0.033 af, Atten= 18%, Lag= 0.3 min  
 Discarded = 0.02 cfs @ 16.23 hrs, Volume= 0.023 af  
 Primary = 0.35 cfs @ 12.10 hrs, Volume= 0.010 af  
 Routed to Pond 21P : Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 80.93' @ 16.23 hrs Surf.Area= 713 sf Storage= 530 cf  
 Flood Elev= 81.50' Surf.Area= 1,150 sf Storage= 1,058 cf

Plug-Flow detention time= 269.6 min calculated for 0.033 af (100% of inflow)  
 Center-of-Mass det. time= 269.6 min ( 1,135.5 - 865.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	79.50'	1,734 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
79.50	0	0	0
80.00	280	70	70
81.00	747	514	584
82.00	1,553	1,150	1,734

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.50'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'
#2	Primary	79.50'	<b>12.0" Round 12" DI Pipe</b> L= 66.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 79.50' / 78.00' S= 0.0226 '/ Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.02 cfs @ 16.23 hrs HW=80.93' (Free Discharge)  
 ↑1=Exfiltration ( Controls 0.02 cfs)

**Primary OutFlow** Max=0.35 cfs @ 12.10 hrs HW=79.86' TW=79.51' (Dynamic Tailwater)  
 ↑2=12" DI Pipe (Outlet Controls 0.35 cfs @ 2.04 fps)

**Summary for Pond 24P: WQ Basin**

contributing imperv area 5564 ft2

original areas:  
 - 78 - 355ft2  
 - 79 - 535ft2  
 - 80 - 895ft2

Inflow Area = 0.396 ac, 23.58% Impervious, Inflow Depth = 2.84" for 100-year 24-hr event  
 Inflow = 1.27 cfs @ 12.09 hrs, Volume= 0.094 af  
 Outflow = 0.08 cfs @ 14.74 hrs, Volume= 0.094 af, Atten= 93%, Lag= 158.7 min  
 Discarded = 0.06 cfs @ 14.74 hrs, Volume= 0.092 af  
 Primary = 0.02 cfs @ 14.74 hrs, Volume= 0.002 af  
 Routed to Reach 21R : DP: Northern Wetlands

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 79.51' @ 14.74 hrs Surf.Area= 1,505 sf Storage= 2,259 cf  
 Flood Elev= 80.00' Surf.Area= 1,827 sf Storage= 3,076 cf

Plug-Flow detention time= 506.0 min calculated for 0.094 af (100% of inflow)  
 Center-of-Mass det. time= 505.9 min ( 1,364.2 - 858.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	77.00'	3,076 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
77.00	435	0	0
78.00	775	605	605
79.00	1,170	973	1,578
80.00	1,827	1,499	3,076

Device	Routing	Invert	Outlet Devices
#1	Primary	79.50'	<b>10.7' long + 3.0 ' SideZ x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Discarded	77.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'

**Discarded OutFlow** Max=0.06 cfs @ 14.74 hrs HW=79.51' (Free Discharge)

↳ **2=Exfiltration** ( Controls 0.06 cfs)

**Primary OutFlow** Max=0.02 cfs @ 14.74 hrs HW=79.51' TW=0.00' (Dynamic Tailwater)

↳ **1=Broad-Crested Rectangular Weir**(Weir Controls 0.02 cfs @ 0.23 fps)

**Appendix D**  
**Recharge Volume and Water Quality Volume**  
**Calculations**



**Glen Drive WTP  
Sediment Forebay, WQv and Rv Calculations**

**Water Quality Volume - Eastern Basin**

Impervious Area: 7,157 sf

WQV Target: 1.0 in

WQv Required: **596 cf**

WQv Required: **0.014 af**

WQv Provided\*: **860 cf**

\*volume to El. 79 ft contour in main basin

**Water Quality Volume - WQ Basin**

Impervious Area: 4,070 sf

WQV Target: 1.0 in

WQv Required: **339 cf**

WQv Required: **0.008 af**

WQv Provided: **2,245 cf**

**Water Quality Volume - Western Basin**

Impervious Area: 8,554 sf

WQV Target: 1.0 in

WQv Required: **713 cf**

WQv Required: **0.016 af**

WQv Provided: **3,608 cf**

**Recharge Volume - Eastern Basin**

Impervious Area: 7,157 sf

Rv Target: 0.60 in

Rv Required: **358 cf**

Rv Required: **0.008 af**

Total Volume Provided\*: **860 cf**

**Recharge Volume - WQ Basin**

Impervious Area: 4,070 sf

Rv Target: 0.60 in

Rv Required: **204 cf**

Rv Required: **0.005 af**

Total Volume Provided: **2,245 cf**

**Recharge Volume - Western Basin**

Impervious Area: 8,554 sf

Rv Target: 0.60 in

Rv Required: **428 cf**

Rv Required: **0.010 af**

Total Volume Provided: **3,608 cf**

**Sediment Forebay - Eastern Basin**

Impervious Area: 7,157 sf

Storage Target: 0.10 in

Vol. Required: **60 cf**

Vol. Required: **0.001 af**

Total Volume Provided: **317 cf**

**Sediment Forebay - WQ Basin**

Impervious Area: 4,070 sf

Storage Target: 0.10 in

Vol. Required: **34 cf**

Vol. Required: **0.001 af**

Total Volume Provided: **90 cf**

**Sediment Forebay - Western Basin (South)**

Impervious Area: 6,984 sf

Storage Target: 0.10 in

Vol. Required: **58 cf**

Vol. Required: **0.001 af**

Total Volume Provided: **196 cf**

**Sediment Forebay - Western Basin (East)**

Impervious Area: 1,570 sf

Storage Target: 0.10 in

Vol. Required: **13 cf**

Vol. Required: **0.000 af**

Total Volume Provided: **70 cf**

**Drawdown Time - Eastern Basin**

1.02 in/hr infiltration rate

1,570 sf, bottom area

7,089 cf, total volume provided\*\*

53.1 hours <72 hours, ok

\*\* El. 81 ft contour wraps around sediment forebay and main basin. Includes area of main basin and sediment basin.

**Drawdown Time - WQ Basin**

1.02 in/hr infiltration rate

435 sf, bottom area

2,245 cf, total volume provided

60.7 hours <72 hours, ok

**Drawdown Time - Western Basin**

1.02 in/hr infiltration rate

645 sf, bottom area

3,608 cf, total volume provided

65.8 hours <72 hours, ok



WQ Basin Sediment Forebay



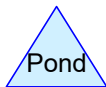
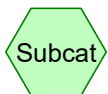
Sediment Forebay - Western Basin (East)



Sediment Forebay - Western Basin (South)



Eastern Basin Sediment Forebay



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 3  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

**Pond 22P: Sediment Forebay - Western Basin** Peak Elev=79.54' Storage=0 cf Inflow=0.01 cfs 0.002 af  
Discarded=0.00 cfs 0.000 af Primary=0.01 cfs 0.002 af Outflow=0.01 cfs 0.002 af

**Pond 25P: Sediment Forebay - Western Basin (South)** Peak Elev=0.00' Storage=0 cf

**Pond 26P: Eastern Basin Sediment Forebay** Peak Elev=0.00' Storage=0 cf

**Pond 29P: WQ Basin Sediment Forebay** Peak Elev=0.00' Storage=0 cf

**Summary for Pond 22P: Sediment Forebay - Western Basin (East)**

Inflow Area = 0.156 ac, 23.11% Impervious, Inflow Depth = 0.18" for 2-year 24-hr event  
 Inflow = 0.01 cfs @ 12.41 hrs, Volume= 0.002 af  
 Outflow = 0.01 cfs @ 12.43 hrs, Volume= 0.002 af, Atten= 0%, Lag= 1.0 min  
 Discarded = 0.00 cfs @ 12.43 hrs, Volume= 0.000 af  
 Primary = 0.01 cfs @ 12.43 hrs, Volume= 0.002 af  
 Routed to Pond 21P : Western Basin

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 79.54' @ 12.43 hrs Surf.Area= 23 sf Storage= 0 cf  
 Flood Elev= 81.50' Surf.Area= 1,150 sf Storage= 1,058 cf

Plug-Flow detention time= 0.9 min calculated for 0.002 af (100% of inflow)  
 Center-of-Mass det. time= 0.9 min ( 987.5 - 986.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	79.50'	1,734 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
79.50	0	0	0
<b>80.00</b>	<b>280</b>	<b>70</b>	<b>70</b>
81.00	747	514	584
82.00	1,553	1,150	1,734

Volume Provided  
(check dam elevation)

Device	Routing	Invert	Outlet Devices
#1	Discarded	79.50'	<b>1.020 in/hr Exfiltration over Horizontal area</b> Conductivity to Groundwater Elevation = 75.20' Phase-In= 0.01'
#2	Primary	79.50'	<b>12.0" Round 12" DI Pipe</b> L= 66.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 79.50' / 78.00' S= 0.0226 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf

**Discarded OutFlow** Max=0.00 cfs @ 12.43 hrs HW=79.54' (Free Discharge)  
 ↑1=Exfiltration ( Controls 0.00 cfs)

**Primary OutFlow** Max=0.01 cfs @ 12.43 hrs HW=79.54' TW=78.14' (Dynamic Tailwater)  
 ↑2=12" DI Pipe (Inlet Controls 0.01 cfs @ 0.68 fps)

**Summary for Pond 25P: Sediment Forebay - Western Basin (South)**

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	196 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
79.00	0	0	0	
80.00	47	24	24	
81.00	298	173	196	Volume Provided

**Summary for Pond 26P: Eastern Basin Sediment Forebay**

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	78.00'	317 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
78.00	97	0	0	
79.00	536	317	317	Volume Provided

**Summary for Pond 29P: WQ Basin Sediment Forebay**

[43] Hint: Has no inflow (Outflow=Zero)

Volume	Invert	Avail.Storage	Storage Description
#1	79.00'	90 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
79.00	35	0	0	
80.00	145	90	90	Volume Provided

**Stage-Area-Storage for Pond 17P: Eastern Basin**

Elevation (feet)	Surface (sq-ft)	Horizontal (sq-ft)	Storage (cubic-feet)
78.00	781	781	0
78.10	860	860	82
78.20	939	939	172
78.30	1,018	1,018	270
78.40	1,097	1,097	376
78.50	1,176	1,176	489
78.60	1,254	1,254	611
78.70	1,333	1,333	740
78.80	1,412	1,412	877
78.90	1,491	1,491	1,022
79.00	1,570	1,570	1,176
79.10	1,714	1,714	1,340
79.20	1,858	1,858	1,518
79.30	2,003	2,003	1,711
79.40	2,147	2,147	1,919
79.50	2,291	2,291	2,141
79.60	2,435	2,435	2,377
79.70	2,579	2,579	2,628
79.80	2,724	2,724	2,893
79.90	2,868	2,868	3,173
80.00	3,012	3,012	3,467
80.10	3,134	3,134	3,774
80.20	3,256	3,256	4,093
80.30	3,378	3,378	4,425
80.40	3,500	3,500	4,769
80.50	3,623	3,623	5,125
80.60	3,745	3,745	5,493
80.70	3,867	3,867	5,874
80.80	3,989	3,989	6,267
80.90	4,111	4,111	6,672
<b>81.00</b>	<b>4,233</b>	<b>4,233</b>	<b>7,089</b>
81.10	4,362	4,362	7,519
81.20	4,490	4,490	7,961
81.30	4,619	4,619	8,417
81.40	4,748	4,748	8,885
81.50	4,877	4,877	9,366
81.60	5,005	5,005	9,860
81.70	5,134	5,134	10,367
81.80	5,263	5,263	10,887
81.90	5,391	5,391	11,420
82.00	<b>5,520</b>	<b>5,520</b>	<b>11,966</b>

Storage Volume for WQv and Rv  
 in Main Basin:  
 El. 78 = 684 sf  
 El. 79 = 1034 sf  
 Vol = (684+1034)/2 = 859 cf

Storage Volume  
 for Drawdown

**Stage-Area-Storage for Pond 21P: Western Basin**

Elevation (feet)	Surface (sq-ft)	Horizontal (sq-ft)	Storage (cubic-feet)	
78.00	645	645	0	
78.10	679	679	66	
78.20	713	713	136	
78.30	747	747	209	
78.40	781	781	285	
78.50	816	816	365	
78.60	850	850	448	
78.70	884	884	535	
78.80	918	918	625	
78.90	952	952	719	
79.00	986	986	816	
79.10	1,026	1,026	916	
79.20	1,065	1,065	1,021	
79.30	1,105	1,105	1,129	
79.40	1,144	1,144	1,242	
79.50	1,184	1,184	1,358	
79.60	1,224	1,224	1,478	
79.70	1,263	1,263	1,603	
79.80	1,303	1,303	1,731	
79.90	1,342	1,342	1,863	
80.00	1,382	1,382	2,000	
80.10	1,427	1,427	2,140	
80.20	1,473	1,473	2,285	
80.30	1,518	1,518	2,434	
80.40	1,563	1,563	2,589	
80.50	1,609	1,609	2,747	
80.60	1,654	1,654	2,910	
80.70	1,699	1,699	3,078	
80.80	1,744	1,744	3,250	
80.90	1,790	1,790	3,427	
<b>81.00</b>	<b>1,835</b>	<b>1,835</b>	<b>3,608</b>	<b>Storage Volume</b>
81.10	1,896	1,896	3,795	
81.20	1,958	1,958	3,987	
81.30	2,019	2,019	4,186	
81.40	2,081	2,081	4,391	
81.50	2,143	2,143	4,602	
81.60	2,204	2,204	4,820	
81.70	2,266	2,266	5,043	
81.80	2,327	2,327	5,273	
81.90	2,389	2,389	5,509	
82.00	<b>2,450</b>	<b>2,450</b>	<b>5,751</b>	

**Stage-Area-Storage for Pond 24P: WQ Basin**

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
77.00	435	0	79.60	1,564	2,398
77.05	452	22	79.65	1,597	2,477
77.10	469	45	79.70	1,630	2,557
77.15	486	69	79.75	1,663	2,640
77.20	503	94	79.80	1,696	2,724
77.25	520	119	79.85	1,728	2,809
77.30	537	146	79.90	1,761	2,897
77.35	554	173	79.95	1,794	2,985
77.40	571	201	80.00	<b>1,827</b>	<b>3,076</b>
77.45	588	230			
77.50	605	260			
77.55	622	291			
77.60	639	322			
77.65	656	355			
77.70	673	388			
77.75	690	422			
77.80	707	457			
77.85	724	493			
77.90	741	529			
77.95	758	567			
78.00	775	605			
78.05	795	644			
78.10	814	684			
78.15	834	726			
78.20	854	768			
78.25	874	811			
78.30	893	855			
78.35	913	900			
78.40	933	947			
78.45	953	994			
78.50	973	1,042			
78.55	992	1,091			
78.60	1,012	1,141			
78.65	1,032	1,192			
78.70	1,052	1,244			
78.75	1,071	1,297			
78.80	1,091	1,351			
78.85	1,111	1,406			
78.90	1,131	1,462			
78.95	1,150	1,519			
79.00	1,170	1,578			
79.05	1,203	1,637			
79.10	1,236	1,698			
79.15	1,269	1,760			
79.20	1,301	1,825			
79.25	1,334	1,891			
79.30	1,367	1,958			
79.35	1,400	2,027			
79.40	1,433	2,098			
79.45	1,466	2,171			
<b>79.50</b>	<b>1,499</b>	<b>2,245</b>			
79.55	1,531	2,320			

Storage Volume



**Appendix E**  
**TSS Removal Spreadsheet**

**INSTRUCTIONS:**

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location:

**TSS Removal Calculation Worksheet**

B BMP <sup>1</sup>	C TSS Removal Rate <sup>1</sup>	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

**Total TSS Removal =**

**Separate Form Needs to be Completed for Each Outlet or BMP Train**

Project:   
 Prepared By:   
 Date:

\*Equals remaining load from previous BMP (E) which enters the BMP

**INSTRUCTIONS:**

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location:

**TSS Removal Calculation Worksheet**

B BMP <sup>1</sup>	C TSS Removal Rate <sup>1</sup>	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
<input type="text" value="Infiltration Basin"/>	0.80	1.00	0.80	0.20
<input type="text"/>	0.00	0.20	0.00	0.20
<input type="text"/>	0.00	0.20	0.00	0.20
<input type="text"/>	0.00	0.20	0.00	0.20
<input type="text"/>	0.00	0.20	0.00	0.20

**Total TSS Removal =**

**Separate Form Needs to be Completed for Each Outlet or BMP Train**

Project:   
 Prepared By:   
 Date:

\*Equals remaining load from previous BMP (E) which enters the BMP

**INSTRUCTIONS:**

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location:

**TSS Removal Calculation Worksheet**

B BMP <sup>1</sup>	C TSS Removal Rate <sup>1</sup>	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Basin	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

**Total TSS Removal =**

**Separate Form Needs to be Completed for Each Outlet or BMP Train**

Project:   
 Prepared By:   
 Date:

\*Equals remaining load from previous BMP (E) which enters the BMP

**Appendix F**  
**Operation and Maintenance Plan/  
Long-Term Pollution Prevention Plan**

# **Post-Construction Operation and Maintenance Plan**

Project: Glen Drive Water Treatment Plant

Location: 10 Glen Drive, Lynnfield, MA

Owner/Responsible Party: Lynnfield Center Water District

This document describes the operation and maintenance activities for the proposed stormwater management facilities associated with the Glen Drive Water Treatment Plant.

## **Sediment Forebay**

Sediment forebays are located in the infiltration basins. Maintenance activities include the following:

- Inspect the sediment forebay monthly for sediment depth and signs of rilling and gullyng, with repair being performed as needed.
- Clean out the sediment forebay at least two times per year and when sediment depth is 3 inches.
- Repair any vegetation damaged after removing the sediment. Damaged vegetation should be replaced by either reseeding or resodding. When reseeding, hydroseeding should be accompanied with a tackifier, blanket, or similar practice to ensure that no scour occurs in the forebay, while the seeds germinate and develop roots.

## **Infiltration Basin**

The infiltration basins are located at the entrance of the Glen Drive Water Treatment Plant (Western Infiltration Basin), to the east of the Filter Building (Eastern Infiltration Basin), and adjacent to the lagoons (WQ Infiltration Basin). Maintenance activities include the following:

- Inspect the infiltration basins after every major storm (a storm equal to or greater than the 2-year, 24-hour storm) for the first three months when the infiltration basins are first put into use to ensure they are stabilized and functioning properly. If necessary, corrective action should be taken. Thereafter, the infiltration basins should be inspected at least twice per year for the following conditions:
  - Signs of differential settlement
  - Evidence of cracking or erosion,
  - Tree growth on the embankments,
  - Condition of riprap, and
  - Accumulation of sediment in the basin.
- Mow the interior side slopes and bottom at least twice a year. When mowing grasses, the grass height should be no greater than 6 inches, and no lower than 3 to 4 inches.
- Remove grass clippings, accumulated organic matter, and trash and debris at the time of mowing.
- If any surfaces are clogged, use deep tilling to break up clogged surfaces, and then the area revegetated immediately.
- Revegetate barren or eroded areas immediately after inspection to prevent additional erosion.

- Remove sediment from the basins when the depth of sediment is 3 inches. Removal should not occur until the floor of the basin is thoroughly dry. Light equipment should be used to remove the top layer so as to not compact the underlying soil. The remaining soil should be deeply tilled and revegetated as soon as possible.
- Do not use the infiltration basin for stockpiling of plowed snow and ice, compost, or any other material.

## Stormwater Management Facility Inspection Form

**Location:** Glen Drive Water Treatment Plant  
10 Glen Drive, Lynnfield, MA

**Inspected By:** \_\_\_\_\_

**Inspection Date:** \_\_\_\_\_

<b>BMP Measure</b>	<b>Status/Inspection</b>	<b>Action Taken</b>
Sediment Forebay		
Western Infiltration Basin		
Eastern Infiltration Basin		
WQ Infiltration Basin		



## **Long-Term Pollution Prevention Plan**

The following practices will be employed at the Glen Drive Water Treatment Plant to provide source control and pollution prevention:

1. The entrance driveway will be periodically swept to remove trash and debris.
2. The sediment forebays and infiltration basins will be inspected periodically to remove trash and debris.
3. No hazardous materials shall be stored outside at the site.
4. Salt and de-icing chemicals shall be used sparingly on the entrance driveway.
5. Any spills that occur at the site shall be contained and cleaned up in a timely manner to prevent the spilled product from entering the infiltration basins.

All personnel who provide regular maintenance at the Glen Drive Water Treatment Plant shall be trained annually on the pollution prevention measures described above.