

STORMWATER MANAGEMENT REPORT

Northborough Fire Station 61&65 West Main Street Northborough, Massachusetts

Assessors Map 63, Lots 9 & 10

Prepared for:

Town of Northborough, MA
63 Main Street
Northborough, MA 01532

Prepared by:

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MARCH 2024

TABLE OF CONTENTS

<u>PROJECT DESCRIPTION</u>	<u>Page</u>
Purpose	1
Project Description	1
Soil Data	2
Methodology	3
Existing Conditions of Study Area	3
Proposed Conditions of Study Area	4
Stormwater Management Standards	8
Proposed Drainage Conveyance System	12
Summary	12

APPENDICES

Appendix A	Locus Map NRCS Soils Map FEMA Firmette IDF Curve TR-55 Curve numbers Design Storms Stormwater Checklist Test Pit Log
Appendix B	Hydrologic Calculations – Existing and Proposed Conditions Hydraulic Design Table
Appendix C	Channel Capacity Calculations Stormwater Treatment – TSS & Phosphorus Calculation Proprietary System Calculations Underground Infiltration System Calculations Mounding Analysis Calculations Recharge Volume Calculations
Appendix D	H1.0 Existing Hydrology H2.0 Proposed Hydrology



PURPOSE

Pare Corporation (Pare) has prepared this report to summarize the stormwater management system for the proposed Town of Northborough's new fire station. The proposed building will be located at 65 West Main Street Northborough, MA. The project will include a new fire station building, parking and access drives, curbing, concrete walks, a retaining wall, associated stormwater management, and utility lines. The project is proposed on three lots, a 2.73 +/- acre parcel, a 0.54 +/- acre parcel and a 0.43 +/- acre property. The existing Site previously contained an abandoned gas station and residential property. The site lies on Northborough's Assessor's Map 63, Lot 7, 9, & 10.

The following sections of the report discuss the existing conditions, proposed development, methodology employed to evaluate stormwater runoff for existing and proposed conditions, and design elements for the proposed stormwater management system components. Supporting documentation is provided in the attached appendices.

PROJECT DESCRIPTION

The study area, hereby referred to as the "Site", included in this hydrologic study comprises approximately 4.51 +/- acres of land. The Site is bound by West Main Street and commercial properties to the north and west, a bank to the east, and woodland and residential properties to the south.

There are no established wetland or natural resource areas located in and around the site based on research of GIS overlays on Mass Mapper. There are also no historical records of wetland or natural resource areas in and around the site.

There are no NHESP Priority Habitats, Certified Vernal Pools, or Potential Vernal Pools onsite as mapped by MassGIS. The Site is not located in a Zone II Wellhead Protection Area, Interim Wellhead Protection Area, or Zone I Wellhead Protection Area. Additionally, the Site is not located in a Zone A, B, or C Surface Water Protection Area.

According to the FEMA Flood Insurance Rate Map for Worcester County, Massachusetts (Community-Panel 25027C0634F, revision date July 16, 2014), included in Appendix A of this report, the project Site is located entirely within FEMA Zone X.

The existing topography of the Site generally slopes from the southwest to the southeast. A portion of the site at the east of the site flows to an abutting property, the rest of the site flows overland to a state MS4.



SOIL DATA

NRCS Soil mapping indicates that natural soil in the north of the Site is comprised of Merrimac series sandy loam, 3 to 8 percent slopes. Merrimac series soils are classified as a Hydrologic Soil Group (HSG) rating A. Class A soils are typically well drained to excessively well drained soils. Test pit investigations referenced on this page suggest that this area is better described as a Charlton Series material, a Class B soil that is well drained rather than excessively well drained. This description remains true for all site areas, whether they be located in the north close to the grade of the road or more southerly on the hillside. The southern portion of the Site is located on a drumlin, which typically have tighter, more compacted soils. The more compacted soils from the drumlin may cause a perched water table, if the soil is removed the water table may reset to the depth of the surrounding soils.

A subsurface investigation, inclusive of ten (10) test pits was conducted to evaluate soil conditions at the Site on 2/21/2024 (TP-1 through TP-10). Test pit logs from the investigation are provided in Appendix A.

The soil profile and the natural material found did not vary widely across the ten test pits conducted. Fill was found in TP-102, 103, and 104 at depths ranging from 16" – 18". Natural soil typically saw a 6" – 24" A layer of organics followed by a 2"-13" B layer. The natural occurring parent material in the C layer was a coarse, homogenized sand; typical of the Carver series suspected to be present. This sand was loose in place, allowing for the conclusion that the parent material across the developed areas of the Site reflect the A type composition previously indicated, though appearing much deeper than the surface depositional layer as found in TP-3. This parent material was found to be overlain by a more recent depositional event, more reflective of the Class B soil used to model surficial hydrology(classified as Merrimac/Paxton in the attached soil logs).

Groundwater varied somewhat widely across the site. In some test pits (TP-3 for example) the groundwater elevation was deeper than the limits of the machine doing the digging. In other test pits (TP-2 or TP-4 for example), the groundwater table was determined through weeping or through redox. For design purposes, bottom of pit was determined to be seasonal high groundwater elevation where no evidence was found. These results, though, reflect a site that may be subject to localized perching of the water table, with the true water table in an on-site well likely reflected a much lower elevation.

Soil disturbance onsite will include the excavation around the foundations for the building addition, construction of the proposed stormwater systems, and excavation for all proposed utilities, in addition



to paving of vehicular areas. Water will be sprayed as necessary to control dust. Existing catch basins in the vicinity of the Site will require inlet protection.

METHODOLOGY

Hydrologic calculations for existing and proposed conditions were performed using HydroCAD Version 10.00 software, which uses TR-55 methodology to calculate runoff and TR-20 methodology for storm routing through the stormwater detention facilities. Site hydrology was evaluated for the 2-year, 10-year, 25-year, and 100-year frequency storms in accordance with the guidelines of the Massachusetts Stormwater Handbook. Existing and Proposed Watershed Maps, indicating the subwatersheds and associated stormwater flow paths may be found in Appendix D.

The hydraulic design calculations were completed using HydroCAD to calculate the accumulated flows to each structure. The stormwater conveyance system was designed using Manning's Equation. The stormwater conveyance system was designed to handle the runoff generated by a 25-year design storm.

EXISTING CONDITIONS OF STUDY AREA

The Site is currently used as a residential property and an abandoned gas station. Also, on site a paved driveways, landscaped areas, and woods. Under existing conditions, six (6) subwatersheds were analyzed, EDA-1, EDA-2A, EDA-2B, EDA-2C, EDA-3A, and EDA-3B.

The existing Site contains approximately 0.74 acres of impervious area within the hydrologic boundary, which consists of paved parking and access areas and existing buildings. The remaining portions of the Site are grassed or wooded areas.

The Site is considered to have three design points (DP-1 Mass DOT East, DP-2 Mass DOT West, DP-3 Bank Parking Lot. DP-1 & 2 are analyzed for flow to the Massachusetts MS4 system. DP-3 is analyzed for flow heading off-site to an abutting property. The Existing Hydrology Plan, H1.0, included in Appendix D, depicts the limits of the Existing Drainage Areas (EDA), described below:

- **EDA-1:** EDA-1 is located at the northwest corner of the site and analyzes on-site flow. It is comprised of woods and grass cover, the composite CN value for this subcatchment is 46. Runoff for this subcatchment flows overland to a catch basin in West Main Street. EDA-1 contributes to Design Point "DP-1 Mass DOT West".



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- **EDA-2A:** EDA-2A is located at the north side of the site and analyzes on-site flow. It is comprised of woods, grass cover, paved drives, and existing buildings, the composite CN value for this subcatchment is 67. Runoff for this subcatchment flows overland to a catch basin in West Main Street. EDA-2A contributes to Design Point “DP-2 Mass DOT East”.
 - **EDA-2B:** EDA-2B is located at the south east side of the site and analyzes off-site flow. It is comprised entirely of woods, the composite CN value for this subcatchment is 70. Runoff for this subcatchment flows overland first over EDA-2A then to a catch basin in West Main Street. EDA-2B contributes to Design Point “DP-2 Mass DOT East”.
 - **EDA-2C:** EDA-2C is located at the southwest corner of the site and analyzes off-site flow. It is comprised of woods and residential properties, the composite CN value for this subcatchment is 76. Runoff for this subcatchment flows overland first over EDA-2A then to a catch basin in West Main Street. EDA-2C contributes to Design Point “DP-2 Mass DOT East”.
 - **EDA-3A:** EDA-3A is located in two separate locations, one at the east side of the site and the other on the southeast side of the site. EDA-3A analyzes on-site flow. It is comprised of woods, grass cover, and a paved access drive, the composite CN value for this subcatchment is 56. Runoff for this subcatchment flows overland to a catch basin in the abutting property to the east. EDA-3A contributes to Design Point “DP-3 Bank Parking Lot”.

PROPOSED CONDITIONS OF STUDY AREA

Included in the proposed site is a new Fire Station, with associated site features. Those site features include access drives, paved parking, pedestrian walks, a retaining wall, the associated stormwater management, and utilities. The proposed condition has approximately 1.74 acres of impervious cover within the analyzed drainage area, resulting in a net increase of 1.00 acres of impervious.

The site has two main entrances, one in the northwest corner of the site for public access, and one on the northeast corner of the site for fire apparatus and employee access. ADA parking is provided in the western parking lot adjacent to the pedestrian walkway. Parking for visitors and administration is located in the western parking lot, parking for fire staff is on the eastern lot behind the building.

The proposed project will be outfitted with a stormwater system to better achieve groundwater recharge, treatment requirements, and peak flow attenuation. All new stormwater collection, storage, and treatment systems have been designed in accordance with the guidelines of the Massachusetts Stormwater Handbook prepared by the Massachusetts Department of Environmental Protection (MADEP). Post-development runoff rates will be maintained or reduced from the pre-development condition and released into the existing Mass-DOT drainage system. Proposed impervious areas will be treated prior to leaving the Site in accordance with the handbook.



The grading scheme is designed to shed water to match the existing conditions to the maximum extent possible. Grades generally slope away from the Fire Station building to protect the structure from stormwater runoff. Stormwater is conveyed to best management practices (BMP's) via overland flow and a stormwater conveyance system consisting of catch basins, area drains, manholes, and HDPE piping.

The drainage system is designed to incorporate features that address flow rate, quantity of runoff, and quality of runoff from the developed Site. Runoff from the Site flows overland into catch basins, the street, or the building's roof and foundation drainage system into an underground infiltration system or water quality unit. Flow from the water quality units and overflow from infiltration system 1 & 2 is sent to underground detention basins on-site. Underground infiltration system 3 overflow is controlled by a diversion manhole. Overflow from the underground infiltration systems is connected via a pipe to a diversion manhole, which overtops upon the filling of the infiltration system. The overflow in this instance would then flow via pipe to the existing drainage system in the road, where the existing stormwater already flows directly to.

- **Source Control and Maintenance:** Properly maintaining sources of pollutants promotes a site that produces higher quality stormwater runoff than sites that do not control sources of pollutants. An example of source control includes the removal of sediment buildup from best management practices during regular maintenance per the Long-Term Operations & Maintenance Plan.
- **Underground Infiltration System:** The underground infiltration system has been designed in accordance with the Massachusetts Stormwater Handbook Standards to promote water quality. The system is sized to exfiltrate the entire water quality volume through the surrounding soils prior to use of any overflows. Any excess stormwater that enters the infiltration system will overflow into the outlet control structure and subsequently into the existing wetlands.
- **Water Quality Unit:** The water quality unit is a proprietary water quality structure (WQS) that has been designed in accordance with the Massachusetts Stormwater Handbook requirements to promote water quality. The system is sized to treat the water quality flow passing through the system and is also sized to bypass flows during a 25-year storm event. Sizing calculations for the system are included in Appendix C. The units within the scope of the current design achieve 93% TSS removal efficiency and 88.6% Phosphorus removal efficiency.



Under proposed conditions, twenty-two subwatersheds were analyzed. The Proposed Hydrology Plan, H-2.0, included in Appendix D, depicts the limits of the Proposed Drainage Areas (PDA), described below:

- **PDA-1:** PDA-1 is located at the northwest corner of the site and analyzes off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 83. Runoff for this subcatchment flows overland to a catch basin in West Main Street. PDA-1 contributes to Design Point “DP-1 Mass DOT West”.
- **PDA-2A:** PDA-2A is located at the north of the site and analyzes off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 83. Runoff for this subcatchment flows overland to a catch basin in West Main Street. PDA-2A contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-2B:** PDA-2B is located at the northeast corner of the site and analyzes off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 94. Runoff for this subcatchment flows overland to a catch basin in West Main Street. PDA-2B contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-2C:** PDA-2C is located at the northwest corner of the site, north of the proposed building and analyzes both on-site and off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 73. Runoff for this subcatchment flows overland to an area drain and is sent to Detention Basin 2. PDA-2C contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-2D:** PDA-2D is located at the north of the site and analyzes both on-site and off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 66. Runoff for this subcatchment flows overland to an area drain and is sent to Detention Basin 2. PDA-2D contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-2E:** PDA-2E is located at the north of the site and analyzes both on-site and off-site flow. It is comprised entirely of paved area cover, the composite CN value for this subcatchment is 98. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 2. PDA-2E contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-2F:** PDA-2F is located at the northeast corner of the site and analyzes both on-site and off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 94. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 1. PDA-2F contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-2G:** PDA-2G is located at the northeast corner of the site and analyzes both on-site and off-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 85. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 1. PDA-2G contributes to Design Point “DP-2 Mass DOT East”.



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- **PDA-2H:** PDA-2H is located at the east of the site and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 94. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 1. PDA-2H contributes to Design Point “DP-2 Mass DOT East”.
 - **PDA-2I:** PDA-2I is located at the east of the site and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 61. Runoff for this subcatchment flows overland to an area drain and sent to UGIS-5. PDA-2I contributes to Design Point “DP-2 Mass DOT East”.
 - **PDA-2J:** PDA-2J is located at the center of the site, south of the proposed building and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 94. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 1. PDA-2J contributes to Design Point “DP-2 Mass DOT East”.
 - **PDA-2K:** PDA-2K is located in the center of the site, southwest of the proposed building and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 64. Runoff for this subcatchment flows overland to an area drain and is sent to Detention Basin 2. PDA-2K contributes to Design Point “DP-2 Mass DOT East”.
 - **PDA-2L:** PDA-2L is located in the center of the site, southeast of the proposed building and analyzes on-site flow. It is comprised of paved areas and grass cover, the composite CN value for this subcatchment is 93. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 2. PDA-2L contributes to Design Point “DP-2 Mass DOT East”.
 - **PDA-2M:** PDA-2M is located at the northwest corner of the site and analyzes on-site flow. It is comprised of paved areas, woods, and grass cover, the composite CN value for this subcatchment is 85. Runoff for this subcatchment flows overland to a catch basin and is sent to Detention Basin 2. PDA-2M contributes to Design Point “DP-2 Mass DOT East”.
 - **PDA-2N:** PDA-2N is located at the west of the site and analyzes on-site flow. It is comprised of woods and grass cover, the composite CN value for this subcatchment is 61. Runoff for this subcatchment flows overland to an area drain and is sent to UGIS-1. PDA-2N contributes to Design Point “DP-2 Mass DOT East”.
 - **PDA-2O:** PDA-2O is located in the center of the site, south of the proposed retaining wall and analyzes on-site flow. It is comprised of paved areas, woods, and grass cover, the composite CN value for this subcatchment is 56. Runoff for this subcatchment flows overland to an area drain and is sent to UGIS-3. PDA-2O contributes to Design Point “DP-2 Mass DOT East”.
 - **PDA-2P:** PDA-2P is located at the southeast corner of the site and analyzes off-site flow. It is comprised entirely of woods, the composite CN value for this subcatchment is 55. Runoff for



this subcatchment flows overland to an area drain and is sent to UGIS-3. PDA-2P contributes to Design Point “DP-2 Mass DOT East”.

- **PDA-2Q:** PDA-2Q is located at the southwest corner of the site and analyzes off-site flow. It is comprised of paved areas, woods, roof cover, and grass cover, the composite CN value for this subcatchment is 68. Runoff for this subcatchment flows overland to an area drain and is sent to UGIS-3. PDA-2Q contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-2R:** PDA-2R is located at the east side of the site and analyzes on-site flow. It is comprised of woods and grass cover, the composite CN value for this subcatchment is 61. Runoff for this subcatchment flows overland to an area drain and is sent to UGIS-3. PDA-2R contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-ROOF1:** PDA-ROOF1 is located at the center of the site and analyzes on-site flow. It is comprised entirely of roof cover, the composite CN value for this subcatchment is 98. Runoff for this subcatchment is captured and piped to Detention Basin 2. PDA-ROOF1 contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-ROOF2:** PDA-ROOF2 is located at the center of the site and analyzes on-site flow. It is comprised entirely of roof cover, the composite CN value for this subcatchment is 98. Runoff for this subcatchment is captured and piped to UGIS-2. PDA-ROOF2 contributes to Design Point “DP-2 Mass DOT East”.
- **PDA-ROOF3:** PDA-ROOF3 is located at the center of the site and analyzes on-site flow. It is comprised entirely of roof cover, the composite CN value for this subcatchment is 98. Runoff for this subcatchment is captured and piped to Detention Basin 2. PDA-ROOF2 contributes to Design Point “DP-2 Mass DOT East”.

STORMWATER MANAGEMENT STANDARDS

This proposed stormwater management system complies with the current regulations of the Massachusetts Stormwater Handbook) and the Town of Northborough requirements. Compliance and applicability of the ten (10) Stormwater Management Standards for this redevelopment project are discussed below.

STANDARD #1 – NO NEW UNTREATED DISCHARGES

No new point discharges of untreated stormwater are proposed for the project. Water quality is achieved by source control and conveying stormwater from impervious areas through the proposed best management practices. Stormwater throughout the Site is treated using the proposed underground infiltration systems and proprietary water quality systems. Portions of the Site directly adjacent to offsite areas will remain untreated as in the existing condition.



STANDARD #2 – POST-DEVELOPMENT PEAK DISCHARGE RATES

MassDEP Stormwater Standard #2 states that runoff rates from the developed Site must not exceed existing runoff rates for the 2-year and 10-year, 24-hour storm events. Standard 2 states that the 100-year, 24-hour storm event must also be evaluated to demonstrate that there will be no increased flooding impacts off-site. The 25-year storm is shown for additional clarity.

The proposed stormwater management system is designed to reduce runoff rates from the 2-, 10-, 25-, and 100-year, 24-hour storm events. This is achieved by controlling runoff using the proposed stormwater management systems and their associated outlet control structures.

Existing and proposed peak runoff rates from the Site were generated for the rainfall events having a return rate of 2-year, 10-year, and 100-year using the SCS TR-20 Method (refer to Appendix B for hydrology calculations). Runoff hydrographs were developed for the existing and proposed conditions for each of the design points of the Site. Results for each storm event and the net difference in pre- and post-development flows are shown in Table 1 below; a negative number indicates flows are decreased in the proposed condition. The peak flows for this site have been reduced at all design points, however the peak volumes for design point 2 going to the Mass DOT system are increasing.

Table 1: Peak Flow Table (CFS)

Design Storm:	2	10	25	100
DP-1: Mass-DOT West				
Pre	0.08	0.32	0.49	0.79
Post	0.07	0.14	0.18	0.24
Difference	-0.01	-0.18	-0.31	-0.55
DP-2: Mass-DOT East				
Pre	2.91	8.92	13.49	21.00
Post	2.77	4.89	6.25	10.83
Difference	-0.14	-4.03	-7.24	-10.17
DP-3: Bank Parking Lot				
Pre	0.01	0.06	0.10	0.16
Post	0.00	0.00	0.10	0.00
Difference	-0.01	-0.06	-0.10	-0.16

Table 2: Peak Volume Table (CF)

Design Storm:	2	10	25	100
DP-1: Mass-DOT West				
Pre	239	707	1,069	1,701



Post	159	304	398	548
Percent Reduction	33.5%	57.0%	62.8%	67.8%
DP-2: Mass-DOT East				
Pre	10,091	25,672	37,237	56,950
Post	18,058	36,608	49,629	71,293
Percent Reduction	-79.0%	-42.6%	-33.3%	25.2%
DP-3: Bank Parking Lot				
Pre	43	139	214	346
Post	0	0	0	0
Percent Reduction	100%	100%	100%	100%

STANDARD #3 – RECHARGE TO GROUNDWATER

Stormwater Standard #3 states that loss of groundwater recharge from the proposed development shall be eliminated or minimized and at a minimum, the recharge volume, which is dependent on soil type, shall be recharged to the groundwater. The intent of this standard is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions. This standard is being met through the use of an underground infiltration BMP. Groundwater recharge calculations are provided in Appendix C of this report.

STANDARD #4 – TSS REMOVAL

Stormwater Standard #4 requires that stormwater management systems shall be designed to remove the annual post-construction load of Total Suspended Solids (TSS) to the maximum extent practicable. TSS is being removed using underground infiltration systems and proprietary systems. See Appendix C for TSS calculations.

STANDARD #5 – LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS (LUHPPL)

Standard #5 specifies that LUHPPLs appropriately reduce and control potential pollutants from entering groundwater or waterways. LUHPPLs are identified in the Massachusetts stormwater handbook as “Land uses with higher potential pollutant loads are defined in 310 CMR 10.04 and 314 CMR 9.02 to include the following: Land uses identified in 310 CMR 22.20B(2), 310 CMR 22.20C(2)(a)-(k) and (m), 310 CMR 22.21(2)(a)(1)-(8) and 310 CMR 22.21(2)(b)(1)-(6)”. 310 CMR 22.21(2)(b)6 notes that a cut of soil within 4’ of the historical high groundwater table would qualify as a LUHPPL. Since there is a large elevation change over the Site, a cut within 4’ of the historic high ground water table will be



required. The proposed system complies with 314 CMR 3.00, 4.00, and 5.00. For a detailed source control and pollution prevention plan see Standard #8. See Standard #4 for TSS removal compliance.

STANDARD #6 – PROTECTION OF CRITICAL AREAS

The proposed development is not located within a Zone II or Interim Wellhead Protection Area. Standard #6 is not applicable to this project.

STANDARD #7 – REDEVELOPMENT PROJECTS

The proposed development is designated as a new development, therefore Standard #7 is not applicable to this project.

STANDARD #8 – EROSION & SEDIMENT CONTROL PLAN

The project proposes to disturb greater than 1 acre of land and is therefore required to develop a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the Environmental Protection Agency (EPA) National Pollution Discharge Elimination System (NPDES) Construction General Permit (CGP) for discharges from construction activities. The SWPPP will include means and methods at the discretion of the Contractor to comply with the NPDES CGP. The SWPPP and the Notice of Intent under the CGP will be required to be prepared and submitted by the Contractor as the Operator of the Site. The SWPPP is required to be submitted to the town prior to the start of earth disturbing activities.

Minimum erosion and sediment control features, including perimeter silt fencing, filter socks, and inlet protection are shown on the Project Plans.

STANDARD #9 – OPERATIONS AND MAINTENANCE PLAN

The Town of Northborough will be responsible for the Operation and Maintenance of the Stormwater Management System post-construction. The Stormwater Operation and Maintenance Plan is included under separate cover.

STANDARD #10 – ILLICIT DISCHARGES

The Stormwater Management System has been designed to treat stormwater by a best-management practice prior to discharge. To Pare Corporation’s knowledge, based on the best-available information and in-field reviews of the current Site, there are no known non-stormwater discharges that will be connected to the proposed stormwater collection system that would convey pollutants directly to groundwater or surface waters.



PROPOSED DRAINAGE CONVEYANCE SYSTEM

The proposed stormwater conveyance system includes catch basins, drain manholes, an outlet control structures, water quality units, detention basins, and underground infiltration systems. The proposed system has been designed for a 25-year 24-hour storm event utilizing the Rational Method. The Manning equation was used to model the stormwater conveyance system and perform the hydraulic analysis of the system. The following criteria were used to design the conveyance system:

- Manholes are provided at directional changes, connections, and conduit size increases.
- Pipes are designed to convey the 25-year stormwater event.
- All new conduit is HDPE pipe sized 12” diameter or larger.
- Minimum pipe velocity is 0.83 feet per second.
- Maximum pipe velocity is 7.85 feet per second.

All pipes are modeled in the hydraulic calculations in Appendix B of this report.

SUMMARY

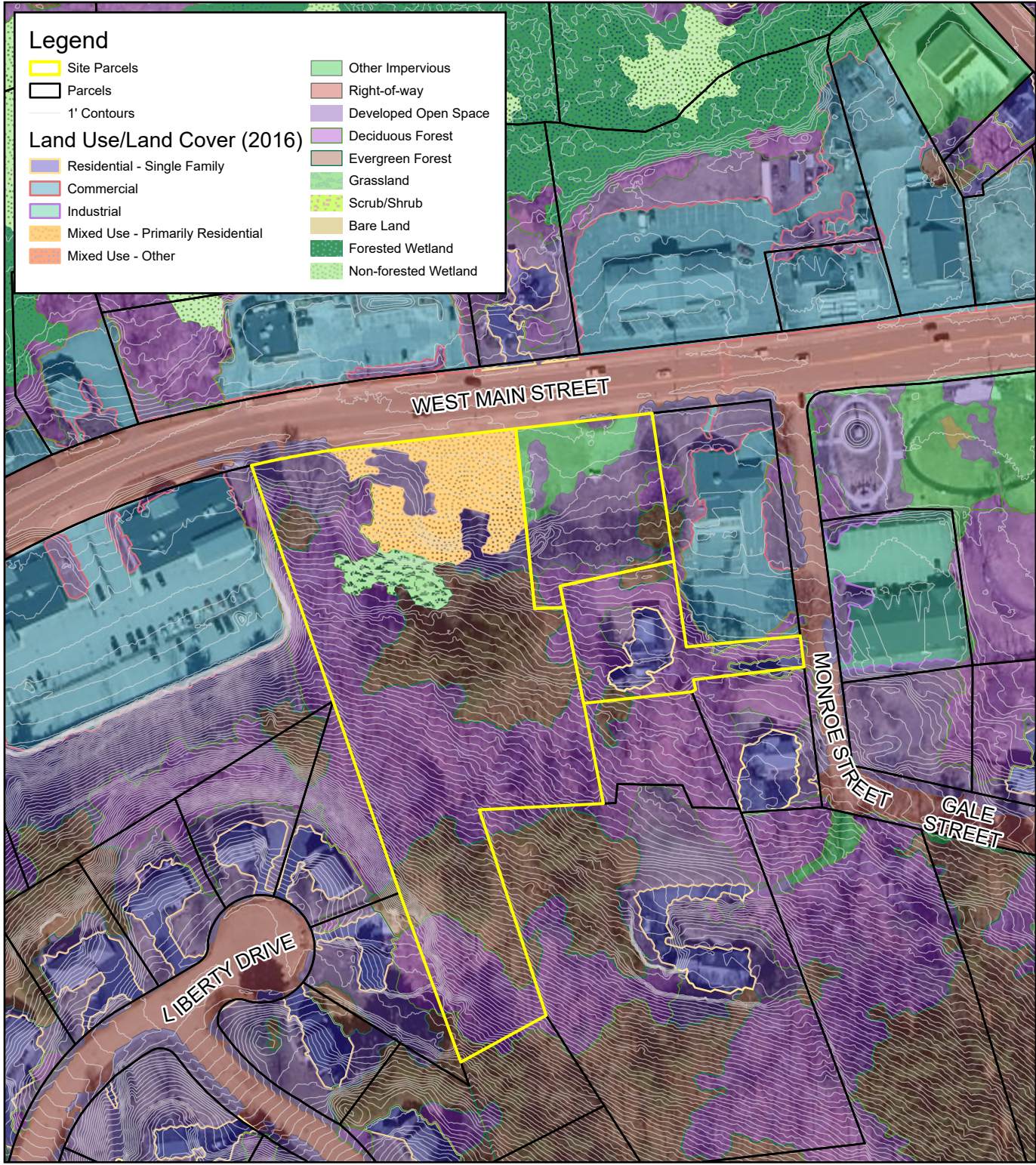
The proposed developments at 65 West Main Street will be creating new impervious areas. The post-development stormwater management system has been designed in accordance with the Massachusetts Stormwater Handbook requirements to the maximum extent practical. The proposed stormwater management system addresses both the quantity and quality of the stormwater runoff. The stormwater management system promotes recharge and ultimately provides reductions in peak runoff rate within the hydrologic analysis area for the design storm events. The development of the property is proposed to improve existing conditions and the stormwater discharges to the State Right of Way.



Town of Northborough
NORTHBOROUGH FIRE STATION

APPENDIX A

Locus Map
NRCS Soils Map
FEMA Firmette
IDF Curve
TR-55 Curve Numbers
Design Storms
Stormwater Checklist
Test Pit Logs



SITE LOCUS MAP

SCALE: 1" = 200'



8 BLACKSTONE VALLEY PLACE
 LINCOLN, RI 02865
 (401) 334-4100

10 LINCOLN ROAD, SUITE 210
 FOXBORO, MA 02035
 (508) 543-1755

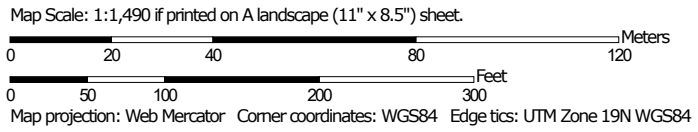
FIGURE 1

**NORTHBOROUGH FIRE STATION
 NORTHBOROUGH, MA**

Hydrologic Soil Group—Worcester County, Massachusetts, Northeastern Part



Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
 Survey Area Data: Version 18, Sep 10, 2023

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	0.0	0.0%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	5.0	56.3%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	A	0.0	0.1%
305D	Paxton fine sandy loam, 15 to 25 percent slopes	C	0.9	10.6%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	C	2.9	33.1%
Totals for Area of Interest			8.9	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

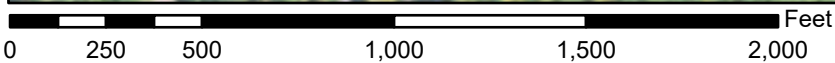
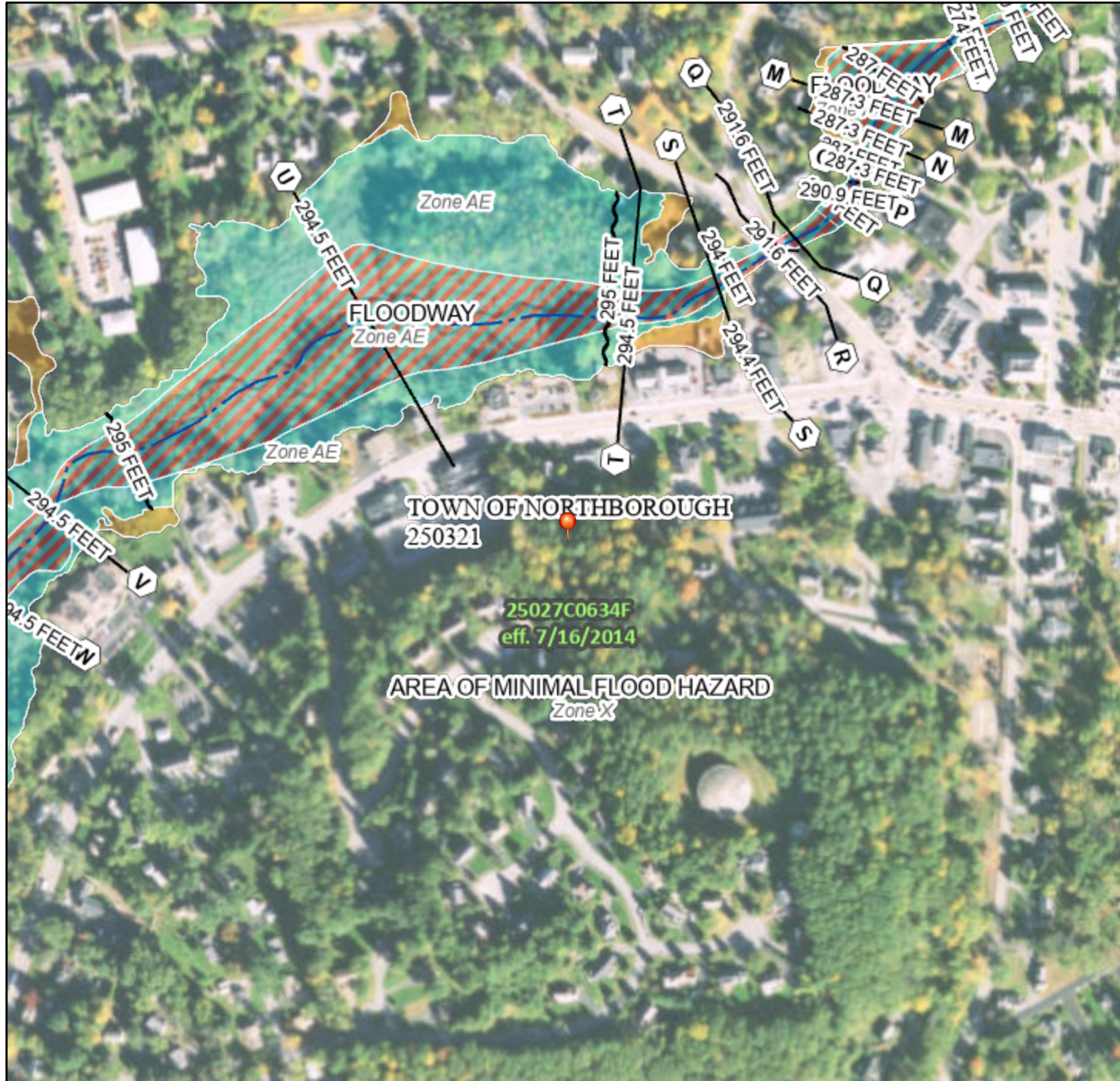
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette



71°39'6"W 42°19'21"N



1:6,000

71°38'29"W 42°18'55"N

Basemap Imagery Source: USGS National Map 2023

Legend

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

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



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

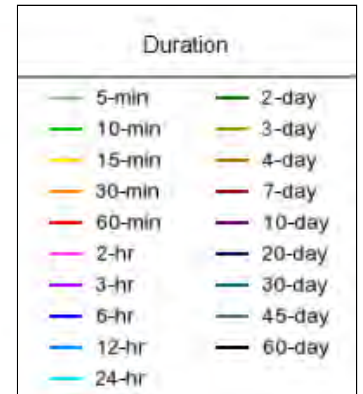
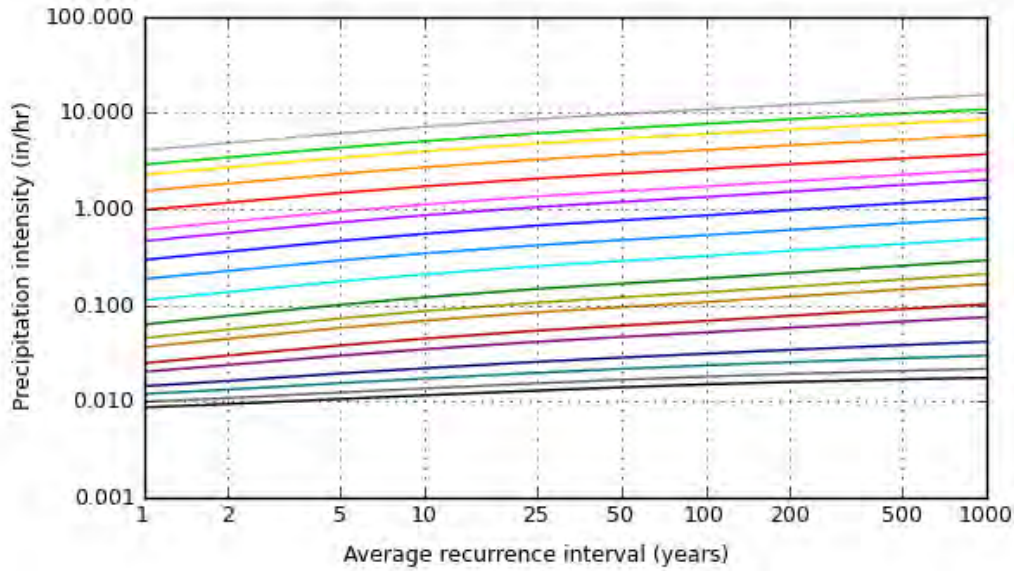
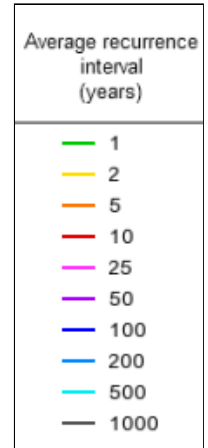
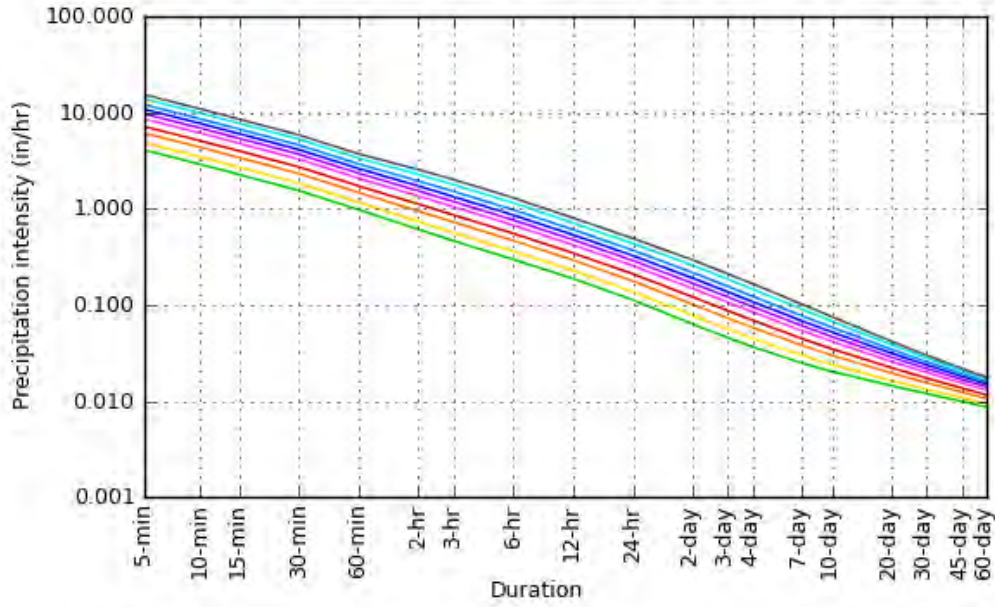
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **10/20/2023 at 9:42 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

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

Latitude: 42.2667°, Longitude: -71.6333°



[Back to Top](#)

Maps & aeriels

Small scale terrain

Table 2-2a Runoff curve numbers for urban areas ^{1/}

Cover description	Average percent impervious area ^{2/}	Curve numbers for hydrologic soil group			
		A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
Open space (lawns, parks, golf courses, cemeteries, etc.) ^{3/} :					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) ^{4/}		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
<i>Developing urban areas</i>					
Newly graded areas (pervious areas only, no vegetation) ^{5/}					
		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

¹ Average runoff condition, and $I_a = 0.2S$.

² The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

³ CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

⁴ Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

⁵ Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.



NOAA Atlas 14, Volume 10, Version 3
Location name: Northborough, Massachusetts,
USA*

Latitude: 42.3195°, Longitude: -71.6465°

Elevation: 302 ft**

* source: ESRI Maps

** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.346 (0.264-0.445)	0.408 (0.312-0.526)	0.510 (0.389-0.660)	0.595 (0.451-0.774)	0.712 (0.524-0.966)	0.800 (0.578-1.11)	0.892 (0.626-1.28)	0.992 (0.665-1.46)	1.13 (0.732-1.72)	1.24 (0.787-1.94)
10-min	0.490 (0.375-0.631)	0.578 (0.442-0.746)	0.723 (0.551-0.936)	0.843 (0.639-1.10)	1.01 (0.742-1.37)	1.13 (0.819-1.57)	1.26 (0.887-1.81)	1.41 (0.942-2.07)	1.60 (1.04-2.45)	1.76 (1.12-2.74)
15-min	0.576 (0.441-0.742)	0.680 (0.520-0.877)	0.850 (0.648-1.10)	0.992 (0.752-1.29)	1.19 (0.873-1.61)	1.33 (0.963-1.85)	1.49 (1.04-2.13)	1.65 (1.11-2.44)	1.89 (1.22-2.88)	2.07 (1.31-3.23)
30-min	0.779 (0.596-1.00)	0.921 (0.704-1.19)	1.15 (0.879-1.49)	1.35 (1.02-1.75)	1.61 (1.19-2.19)	1.81 (1.31-2.51)	2.02 (1.42-2.90)	2.25 (1.51-3.31)	2.57 (1.66-3.92)	2.83 (1.79-4.40)
60-min	0.982 (0.751-1.26)	1.16 (0.888-1.50)	1.46 (1.11-1.88)	1.70 (1.29-2.21)	2.04 (1.50-2.76)	2.29 (1.65-3.17)	2.56 (1.80-3.67)	2.85 (1.91-4.19)	3.25 (2.10-4.96)	3.58 (2.27-5.58)
2-hr	1.22 (0.939-1.56)	1.47 (1.13-1.88)	1.87 (1.43-2.41)	2.21 (1.68-2.86)	2.67 (1.98-3.62)	3.01 (2.20-4.17)	3.38 (2.40-4.87)	3.81 (2.56-5.58)	4.44 (2.88-6.72)	4.96 (3.15-7.67)
3-hr	1.39 (1.08-1.78)	1.69 (1.30-2.16)	2.17 (1.67-2.78)	2.56 (1.96-3.31)	3.11 (2.32-4.21)	3.52 (2.58-4.87)	3.96 (2.83-5.70)	4.48 (3.02-6.54)	5.25 (3.41-7.93)	5.91 (3.76-9.10)
6-hr	1.78 (1.38-2.26)	2.16 (1.68-2.74)	2.78 (2.15-3.55)	3.30 (2.54-4.23)	4.01 (3.00-5.40)	4.54 (3.34-6.25)	5.11 (3.67-7.32)	5.79 (3.92-8.40)	6.81 (4.44-10.2)	7.68 (4.90-11.8)
12-hr	2.27 (1.77-2.86)	2.74 (2.14-3.47)	3.52 (2.74-4.47)	4.17 (3.23-5.32)	5.06 (3.81-6.77)	5.73 (4.23-7.83)	6.44 (4.64-9.15)	7.28 (4.94-10.5)	8.54 (5.59-12.7)	9.61 (6.15-14.6)
24-hr	2.70 (2.12-3.39)	3.28 (2.58-4.12)	4.23 (3.31-5.34)	5.02 (3.91-6.37)	6.10 (4.62-8.11)	6.90 (5.13-9.39)	7.77 (5.64-11.0)	8.80 (6.00-12.6)	10.4 (6.80-15.4)	11.7 (7.50-17.6)
2-day	2.99 (2.37-3.73)	3.67 (2.90-4.59)	4.79 (3.78-6.01)	5.72 (4.48-7.21)	6.99 (5.33-9.26)	7.93 (5.94-10.8)	8.96 (6.56-12.7)	10.2 (6.99-14.6)	12.2 (8.00-17.9)	13.8 (8.91-20.7)
3-day	3.23 (2.57-4.02)	3.96 (3.15-4.94)	5.16 (4.09-6.46)	6.16 (4.85-7.75)	7.53 (5.76-9.95)	8.55 (6.42-11.6)	9.65 (7.08-13.6)	11.0 (7.55-15.6)	13.1 (8.64-19.2)	14.9 (9.62-22.3)
4-day	3.46 (2.76-4.30)	4.23 (3.37-5.27)	5.49 (4.36-6.85)	6.53 (5.15-8.20)	7.96 (6.11-10.5)	9.02 (6.79-12.2)	10.2 (7.48-14.3)	11.6 (7.96-16.4)	13.8 (9.09-20.1)	15.6 (10.1-23.3)
7-day	4.14 (3.32-5.13)	4.97 (3.98-6.16)	6.33 (5.05-7.87)	7.45 (5.91-9.31)	9.00 (6.92-11.8)	10.2 (7.66-13.6)	11.4 (8.37-15.8)	12.9 (8.87-18.1)	15.1 (10.0-21.9)	17.0 (11.0-25.2)
10-day	4.82 (3.87-5.94)	5.68 (4.56-7.02)	7.09 (5.68-8.79)	8.26 (6.58-10.3)	9.88 (7.61-12.8)	11.1 (8.37-14.7)	12.4 (9.07-17.0)	13.9 (9.58-19.4)	16.0 (10.7-23.2)	17.9 (11.6-26.4)
20-day	6.86 (5.56-8.42)	7.79 (6.30-9.57)	9.30 (7.49-11.5)	10.6 (8.45-13.1)	12.3 (9.50-15.8)	13.6 (10.3-17.8)	14.9 (10.9-20.2)	16.4 (11.4-22.8)	18.4 (12.3-26.4)	19.9 (12.9-29.2)
30-day	8.57 (6.96-10.5)	9.53 (7.74-11.7)	11.1 (8.98-13.6)	12.4 (9.98-15.3)	14.2 (11.0-18.1)	15.6 (11.8-20.3)	17.0 (12.4-22.7)	18.4 (12.8-25.4)	20.1 (13.5-28.8)	21.5 (14.0-31.3)
45-day	10.7 (8.72-13.0)	11.7 (9.53-14.3)	13.3 (10.8-16.3)	14.7 (11.9-18.1)	16.6 (12.9-21.0)	18.1 (13.7-23.3)	19.5 (14.2-25.8)	20.8 (14.6-28.6)	22.4 (15.1-31.9)	23.5 (15.3-34.2)
60-day	12.4 (10.2-15.1)	13.5 (11.0-16.4)	15.2 (12.4-18.6)	16.6 (13.5-20.4)	18.6 (14.5-23.5)	20.1 (15.3-25.9)	21.6 (15.7-28.4)	22.9 (16.1-31.4)	24.4 (16.4-34.5)	25.3 (16.5-36.7)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

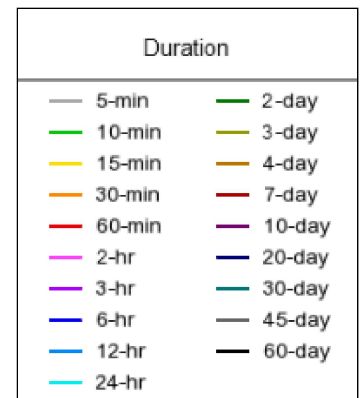
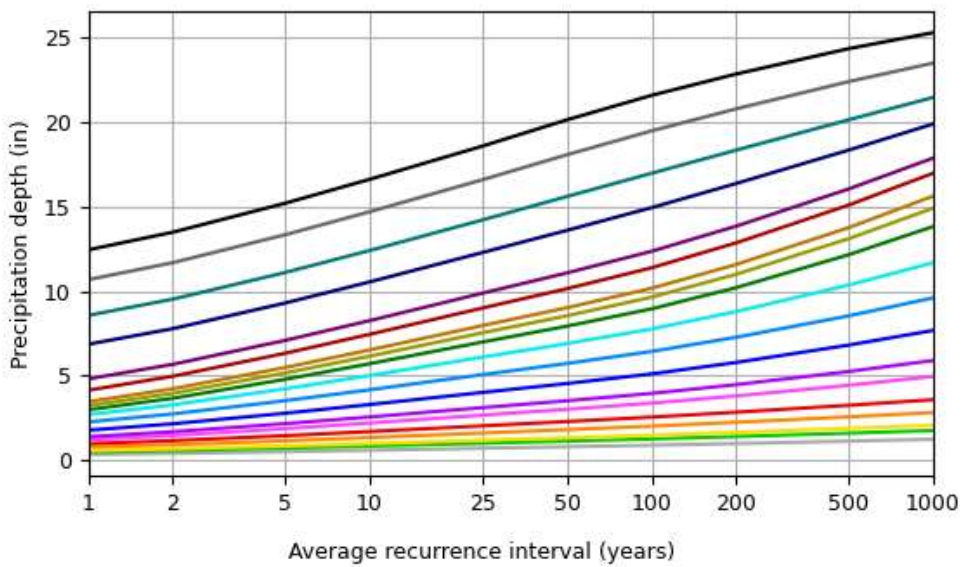
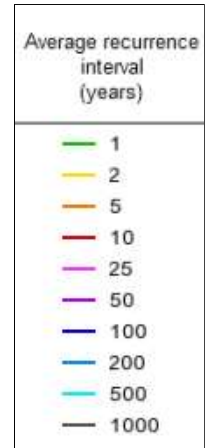
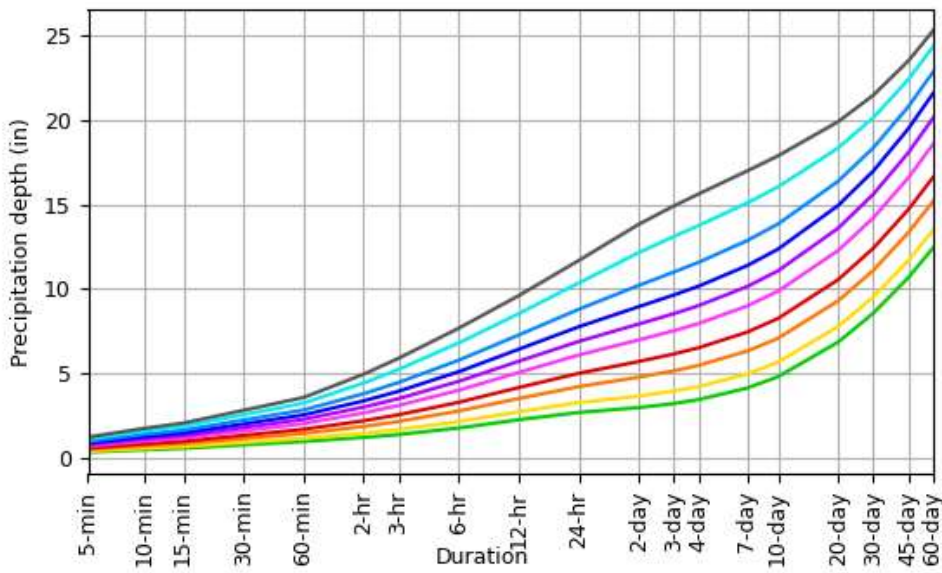
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical

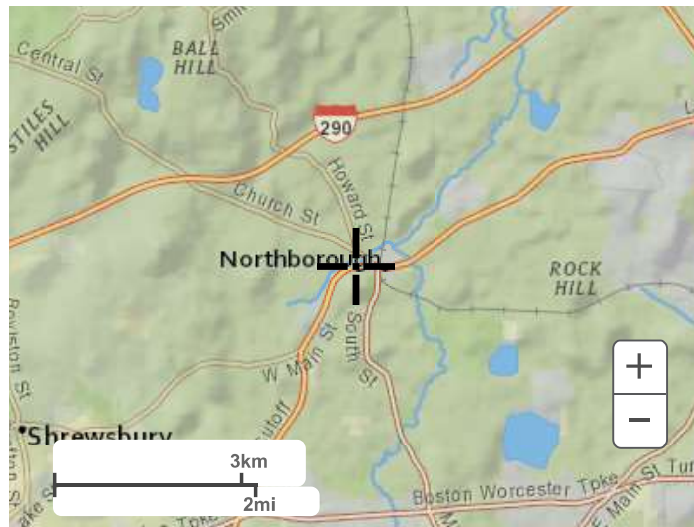
PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.3195°, Longitude: -71.6465°



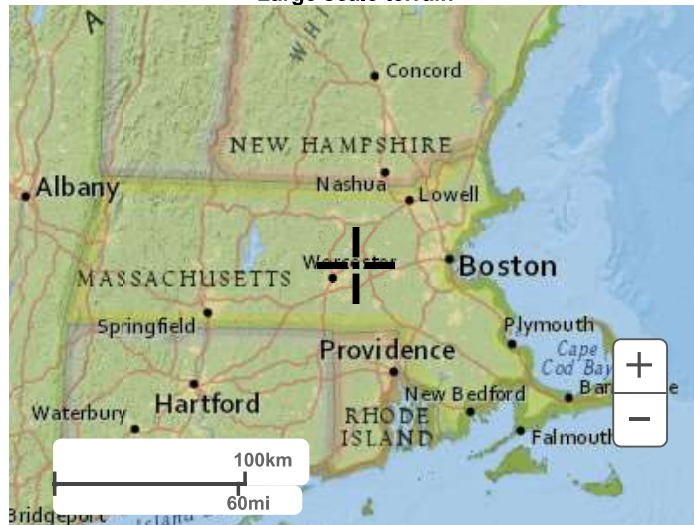
[Back to Top](#)

Maps & aerials

Small scale terrain



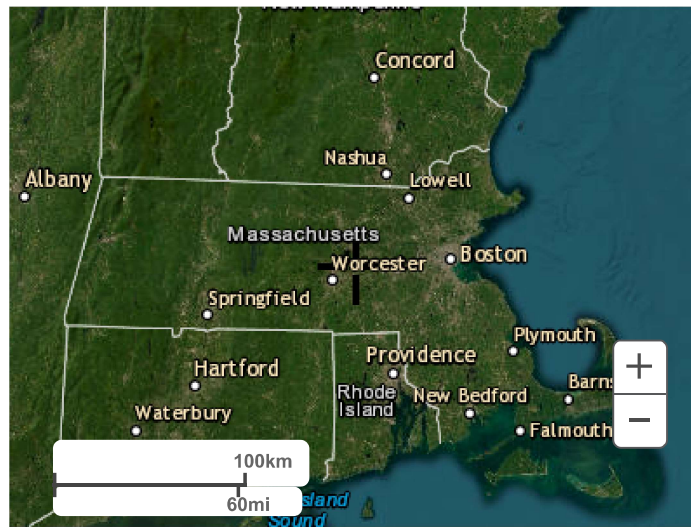
Large scale terrain



Large scale map



Large scale aerial



[Back to Top](#)

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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the [Massachusetts Stormwater Handbook](#). The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

¹ The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

² For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- New development
- Redevelopment
- Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- No disturbance to any Wetland Resource Areas
- Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- Reduced Impervious Area (Redevelopment Only)
- Minimizing disturbance to existing trees and shrubs
- LID Site Design Credit Requested:
 - Credit 1
 - Credit 2
 - Credit 3
- Use of "country drainage" versus curb and gutter conveyance and pipe
- Bioretention Cells (includes Rain Gardens)
- Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- Treebox Filter
- Water Quality Swale
- Grass Channel
- Green Roof
- Other (describe): _____

Standard 1: No New Untreated Discharges

- No new untreated discharges
- Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- Soil Analysis provided.
- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - Static
 - Simple Dynamic
 - Dynamic Field¹
- Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

¹ 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
 - The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The ½" or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated.
- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.
- The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-1**
 SHEET 1 OF 10

Property Owner: Town of Northborough
 Project: Northborough Fire Station Contractor: Northborough DPW
 Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW
 Date of Test Hole: 2/21/2024 7:45am
 Soil Evaluator: C. Webber State / Date of Exam: MA
 Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Fill	0-38"											
C1	38-71"			10yr 6/4	10yr 6/8 (C)				Fine Sandy Loam	Massive	Friable	15% G 10% C 5% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 71"
 Depth to Groundwater or Seepage: N/A Depth to Impervious or Limiting Layer: 71" (boulders)
 Estimated Seasonal High Water Table: 298.17 Surface Elevation of Test Pit (approximate): 303

COMMENTS:
 Brick @ 36", asphalt at 13"
 Heavy redox @ 58"

TEST HOLE NO. **TP-1**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-2**
 SHEET 2 OF 10

Property Owner: Town of Northborough
 Project: Northborough Fire Station Contractor: Northborough DPW
 Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW
 Date of Test Hole: 2/21/2024 8:30am
 Soil Evaluator: C. Webber State / Date of Exam: MA
 Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Fill	0-35"											
C1	35-50"			10yr 6/3					Fine Sandy Loam	Massive	Friable	15% G 10% C 5% S
C2	50-67"			10yr 7/1					Fine Sandy Loam	Massive	Friable	15% G 10% C 5% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 67"
 Depth to Groundwater or Seepage: 67" Depth to Impervious or Limiting Layer: N/A
 Estimated Seasonal High Water Table: 300.42 Surface Elevation of Test Pit (approximate): 306

COMMENTS:
 Clay pipe @39", broken
 Various fill material down to 35", fly ash as well
 Ponding @ 67"

TEST HOLE NO. **TP-2**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-3**
 SHEET 3 OF 10

Property Owner: Town of Northborough
 Project: Northborough Fire Station Contractor: Northborough DPW
 Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW
 Date of Test Hole: 2/21/2024 9:00am
 Soil Evaluator: C. Webber State / Date of Exam: MA
 Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-12"			10yr 4/2					Sandy Loam	Massive	Friable	5% G 5% C 0% S
Bw	12-28"			10yr 5/6					Sandy Loam	Massive	Friable	10% G 5% C 0% S
C1	28-84"			10 yr 5/3					Rocky Sandy Loam	Massive	Friable	15% G 10% C 5% S
C2	84-120"			10 yr 7/2					Loamy Sand	Massive	Friable	5% G 5% C 0% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 120"
 Depth to Groundwater or Seepage: N/A Depth to Impervious or Limiting Layer: N/A
 Estimated Seasonal High Water Table: 301 Surface Elevation of Test Pit (approximate): 311

COMMENTS:
 (none)

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-4**
 SHEET 4 OF 10

Property Owner: Town of Northborough

Project: Northborough Fire Station Contractor: Northborough DPW

Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW

Date of Test Hole: 2/21/2024 1:15pm

Soil Evaluator: C. Webber State / Date of Exam: MA

Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Fill	0-55"			10yr 5/3								
C	55-72"			10yr 6/4	10yr 5/8 (C)				Find Sandy Loam	Massive	Friable	10% G 5% C 0% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 72"

Depth to Groundwater or Seepage: 72" (ponding) Depth to Impervious or Limiting Layer: N/A

Estimated Seasonal High Water Table: 304.08 Surface Elevation of Test Pit (approximate): 309.5

COMMENTS:
 Very bouldery throughout. Brick, concrete throughout fill layer
 Ponding @ 72"
 Redox @ 65"

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-5**
 SHEET 5 OF 10

Property Owner: Town of Northborough
 Project: Northborough Fire Station Contractor: Northborough DPW
 Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW
 Date of Test Hole: 2/21/2024 1:45pm
 Soil Evaluator: C. Webber State / Date of Exam: MA
 Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-13"			10yr 4/2					Sandy Loam	Massive	Friable	10% G 5% C 0% S
C	13-68"			10yr 5/3	10yr 5/6 (C) 10yr 5/2 (D)				Sandy Loam	Massive	Friable	10% G 5% C 0% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 68"
 Depth to Groundwater or Seepage: N/A Depth to Impervious or Limiting Layer: N/A
 Estimated Seasonal High Water Table: 313.33 Surface Elevation of Test Pit (approximate): 319

COMMENTS:
 Redox @ 21", inconsistant

TEST HOLE NO. **TP-5**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-6**
 SHEET 6 OF 10

Property Owner: Town of Northborough
 Project: Northborough Fire Station Contractor: Northborough DPW
 Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW
 Date of Test Hole: 2/21/2024 12:45pm
 Soil Evaluator: C. Webber State / Date of Exam: MA
 Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-14"			10yr 2/2					Sandy Loam	Massive	Friable	10% G 10% C 10% S
C	14-45"			10yr 5/4					Sandy Loam	Massive	Friable	10% G 10% C 10% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 45"
 Depth to Groundwater or Seepage: 45" Depth to Impervious or Limiting Layer: N/A
 Estimated Seasonal High Water Table: 306.75 Surface Elevation of Test Pit (approximate): 310.5

COMMENTS:
 Ponding @ 45", steady weeping

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-7**
 SHEET 7 OF 10

Property Owner: Town of Northborough
 Project: Northborough Fire Station Contractor: Northborough DPW
 Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW
 Date of Test Hole: 2/21/2024 11:15am
 Soil Evaluator: C. Webber State / Date of Exam: MA
 Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-10"			10yr 4/2					Sandy Loam	Massive	Friable	10% G 5% C 5% S
C1	10-25"			10yr 2/2					Sandy Loam	Massive	Friable	10% G 5% C 5% S
C2	25-53"			10yr 6/4	10yr 5/8 (c) 10yr 7/1 (D)				Sandy Loam	Massive	Friable	10% G 5% C 5% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 55"
 Depth to Groundwater or Seepage: 55" Depth to Impervious or Limiting Layer: N/A
 Estimated Seasonal High Water Table: 305 Surface Elevation of Test Pit (approximate): 308

COMMENTS:
 Redox @ 36", consistant
 Weeping @ 55"

TEST HOLE NO. **TP-7**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-8**
 SHEET 8 OF 10

Property Owner: Town of Northborough
 Project: Northborough Fire Station Contractor: Northborough DPW
 Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW
 Date of Test Hole: 2/21/2024 10:30am
 Soil Evaluator: C. Webber State / Date of Exam: MA
 Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-10"			10yr 3/2					Fine Sandy Loam	Massive	Friable	10% G 5% C 5% S
Bw	10-23"			10yr 5/4					Fine Sandy Loam	Massive	Friable	10% G 5% C 5% S
C1	23-37"			10yr 2/2					Fine Sandy Loam	Massive	Friable	5% G 0% C 0% S
C2	37-69"			10yr 6/4	10yr 5/6 (C)				Fine Sandy Loam	Massive	Friable	5% G 0% C 0% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 69"
 Depth to Groundwater or Seepage: 55" Depth to Impervious or Limiting Layer: N/A
 Estimated Seasonal High Water Table: 300.42 Surface Elevation of Test Pit (approximate): 305

COMMENTS:
 Weeping @ 55"
 Redox @ 40", inconsistant

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-9**
 SHEET 9 OF 10

Property Owner: Town of Northborough
 Project: Northborough Fire Station Contractor: Northborough DPW
 Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW
 Date of Test Hole: 2/21/2024 10:00am
 Soil Evaluator: C. Webber State / Date of Exam: MA
 Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Fill	0-39"											
C	39-66"			10yr 5/3					Fine Sandy Loam	Massive	Friable	15% G 10% C 10% S

Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 66"
 Depth to Groundwater or Seepage: 66" Depth to Impervious or Limiting Layer: N/A
 Estimated Seasonal High Water Table: 296.5 Surface Elevation of Test Pit (approximate): 302

COMMENTS:
 Asphalt pieces down to 33", many boulders throughout
 Ponding @ 66"

TEST HOLE NO. **TP-9**

PARE CORPORATION

8 BLACKSTONE VALLEY PLACE, LINCOLN, RHODE ISLAND
 ENGINEERS *** PLANNERS *** CONSULTANTS

TEST HOLE NO. **TP-10**
 SHEET 10 OF 10

Property Owner: Town of Northborough
 Project: Northborough Fire Station Contractor: Northborough DPW
 Property Location: 65 W Main St Northborough MA Excavator: Northborough DPW
 Date of Test Hole: 2/21/2024 2:15pm
 Soil Evaluator: C. Webber State / Date of Exam: MA
 Weather: Sunny Shaded: Yes No

SAMPLE DESCRIPTION

Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox Description			Texture	Structure	Consistence	Percent Gravel Cobbles Stone
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Con.				
Ap	0-11"			10yr 3/2					Sandy Loam	Massive	Friable	10% G 5% C 5% S
Bw	11-23"			10yr 6/4					Sandy Loam	Massive	Friable	10% G 5% C 5% S
C	23-84"			10yr 5/4	10yr 5/6 C 10yr 6/2 (D)				Fine Sandy Loam	Massive	Friable	10% G 5% C 5% S

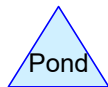
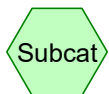
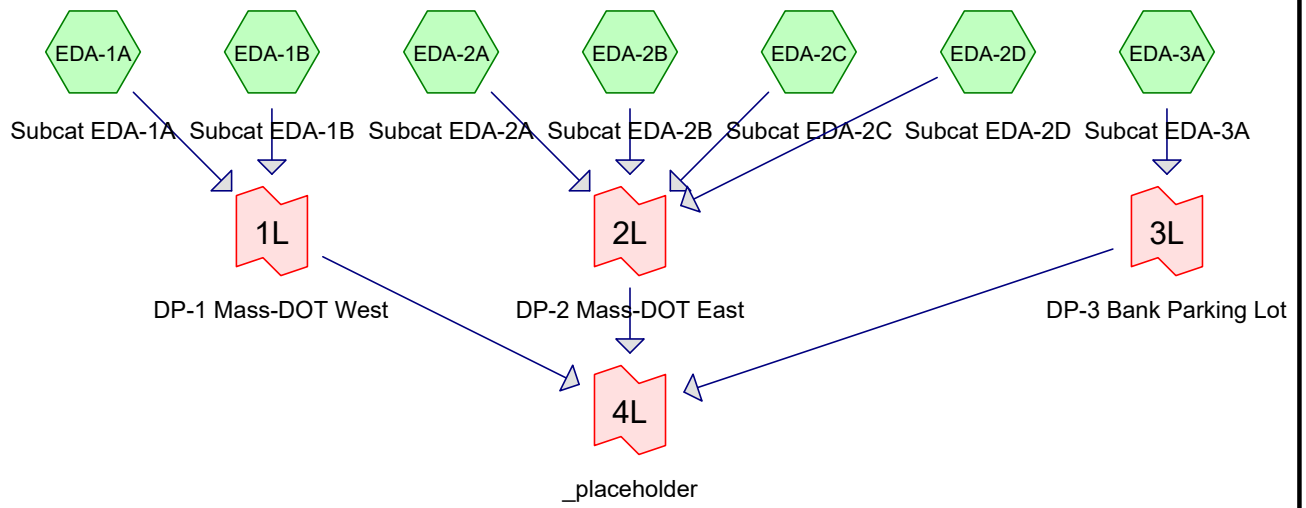
Soil Class: Merrimac / Paxton fsl Total Depth of Test Hole: 84" (machine limit)
 Depth to Groundwater or Seepage: 33" Depth to Impervious or Limiting Layer: N/A
 Estimated Seasonal High Water Table: 324.42 Surface Elevation of Test Pit (approximate): 327.5

COMMENTS:
 Redox @ 37", around pit
 Weeping @ 33", left side of pit only (slow, minor)

Town of Northborough
NORTHBOROUGH FIRE STATION

APPENDIX B

**Hydrologic Calculations - Existing and Proposed Conditions
Hydraulic Design Table**



Ex Hydro

Prepared by Pare Corporation

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23141.00 Existing Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 2

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=0.37"
Tc=6.0 min CN=58 Runoff=0.05 cfs 166 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=0.78"
Tc=6.0 min CN=68 Runoff=0.03 cfs 73 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=0.56"
Flow Length=582' Tc=11.7 min CN=63 Runoff=1.99 cfs 6,704 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.27"
Tc=6.0 min CN=55 Runoff=0.07 cfs 336 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=0.78"
Flow Length=136' Tc=6.0 min CN=68 Runoff=0.63 cfs 1,436 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=2.83"
Tc=6.0 min CN=96 Runoff=0.68 cfs 1,615 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=0.37"
Tc=6.0 min CN=58 Runoff=0.01 cfs 43 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.08 cfs 239 cf
Primary=0.08 cfs 239 cf

Link 2L: DP-2 Mass-DOT East Inflow=2.91 cfs 10,091 cf
Primary=2.91 cfs 10,091 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.01 cfs 43 cf
Primary=0.01 cfs 43 cf

Link 4L: _placeholder Inflow=2.99 cfs 10,373 cf
Primary=2.99 cfs 10,373 cf

Total Runoff Area = 196,431 sf Runoff Volume = 10,373 cf Average Runoff Depth = 0.63"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf

Ex Hydro

Prepared by Pare Corporation

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23141.00 Existing Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 3

Summary for Subcatchment EDA-1A: Subcat EDA-1A

Runoff = 0.05 cfs @ 12.16 hrs, Volume= 166 cf, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
2,546	61	>75% Grass cover, Good, HSG B
2,838	55	Woods, Good, HSG B
5,384	58	Weighted Average
5,384	58	100.00% Pervious Area

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

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23141.00 Existing Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 4

Summary for Subcatchment EDA-1B: Subcat EDA-1B

Runoff = 0.03 cfs @ 12.14 hrs, Volume= 73 cf, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
911	61	>75% Grass cover, Good, HSG B
214	98	Paved parking, HSG B
1,125	68	Weighted Average
911	61	80.98% Pervious Area
214	98	19.02% Impervious Area

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

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23141.00 Existing Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 5

Summary for Subcatchment EDA-2A: Subcat EDA-2A

Runoff = 1.99 cfs @ 12.23 hrs, Volume= 6,704 cf, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
40,064	61	>75% Grass cover, Good, HSG B
14,578	98	Paved parking, HSG B
6,125	98	Roofs, HSG B
84,026	55	Woods, Good, HSG B
144,794	63	Weighted Average
124,091	57	85.70% Pervious Area
20,704	98	14.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	25	0.3600	0.19		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.28"
2.4	25	0.2800	0.17		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.28"
6.1	378	0.1693	1.03		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
0.6	74	0.0743	1.91		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
0.4	80	0.0250	3.21		Shallow Concentrated Flow, Paved Kv= 20.3 fps
11.7	582	Total			

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23141.00 Existing Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 6

Summary for Subcatchment EDA-2B: Subcat EDA-2B

Runoff = 0.07 cfs @ 12.19 hrs, Volume= 336 cf, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
14,672	55	Woods, Good, HSG B
14,672	55	100.00% Pervious Area

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

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 7

Summary for Subcatchment EDA-2C: Subcat EDA-2C

Runoff = 0.63 cfs @ 12.14 hrs, Volume= 1,436 cf, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
12,544	61	>75% Grass cover, Good, HSG B
2,235	98	Paved parking, HSG B
2,780	98	Roofs, HSG B
4,633	55	Woods, Good, HSG B
22,192	68	Weighted Average
17,178	59	77.40% Pervious Area
5,015	98	22.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.4	50	0.2600	0.19		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.28"
0.6	32	0.1250	0.88		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
0.4	54	0.1204	2.43		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
5.4	136	Total, Increased to minimum Tc = 6.0 min			

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23141.00 Existing Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 8

Summary for Subcatchment EDA-2D: Subcat EDA-2D

Runoff = 0.68 cfs @ 12.13 hrs, Volume= 1,615 cf, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
378	61	>75% Grass cover, Good, HSG B
6,476	98	Paved parking, HSG B
6,854	96	Weighted Average
378	61	5.52% Pervious Area
6,476	98	94.48% Impervious Area

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

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23141.00 Existing Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 9

Summary for Subcatchment EDA-3A: Subcat EDA-3A

Runoff = 0.01 cfs @ 12.16 hrs, Volume= 43 cf, Depth= 0.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
760	61	>75% Grass cover, Good, HSG B
649	55	Woods, Good, HSG B
1,409	58	Weighted Average
1,409	58	100.00% Pervious Area

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

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23141.00 Existing Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 10

Summary for Link 1L: DP-1 Mass-DOT West

Inflow Area = 6,509 sf, 3.29% Impervious, Inflow Depth = 0.44" for 2-year Storm event
Inflow = 0.08 cfs @ 12.16 hrs, Volume= 239 cf
Primary = 0.08 cfs @ 12.16 hrs, Volume= 239 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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Page 11

Summary for Link 2L: DP-2 Mass-DOT East

Inflow Area = 188,513 sf, 17.08% Impervious, Inflow Depth = 0.64" for 2-year Storm event
Inflow = 2.91 cfs @ 12.19 hrs, Volume= 10,091 cf
Primary = 2.91 cfs @ 12.19 hrs, Volume= 10,091 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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Page 12

Summary for Link 3L: DP-3 Bank Parking Lot

Inflow Area = 1,409 sf, 0.00% Impervious, Inflow Depth = 0.37" for 2-year Storm event
Inflow = 0.01 cfs @ 12.16 hrs, Volume= 43 cf
Primary = 0.01 cfs @ 12.16 hrs, Volume= 43 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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Page 13

Summary for Link 4L: _placeholder

Inflow Area = 196,431 sf, 16.50% Impervious, Inflow Depth = 0.63" for 2-year Storm event
Inflow = 2.99 cfs @ 12.19 hrs, Volume= 10,373 cf
Primary = 2.99 cfs @ 12.19 hrs, Volume= 10,373 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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23141.00 Existing Conditions 10, 25, 100-yr Storm
NOAA 24-hr A 10-year Storm Rainfall=5.02"

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Page 1

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=1.18"
Tc=6.0 min CN=58 Runoff=0.23 cfs 529 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=1.89"
Tc=6.0 min CN=68 Runoff=0.08 cfs 178 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=1.52"
Flow Length=582' Tc=11.7 min CN=63 Runoff=6.65 cfs 18,359 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=55 Runoff=0.51 cfs 1,210 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=1.89"
Flow Length=136' Tc=6.0 min CN=68 Runoff=1.64 cfs 3,502 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=4.55"
Tc=6.0 min CN=96 Runoff=1.06 cfs 2,600 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=1.18"
Tc=6.0 min CN=58 Runoff=0.06 cfs 139 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.32 cfs 707 cf
Primary=0.32 cfs 707 cf

Link 2L: DP-2 Mass-DOT East Inflow=8.92 cfs 25,672 cf
Primary=8.92 cfs 25,672 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.06 cfs 139 cf
Primary=0.06 cfs 139 cf

Link 4L: _placeholder Inflow=9.37 cfs 26,518 cf
Primary=9.37 cfs 26,518 cf

Total Runoff Area = 196,431 sf Runoff Volume = 26,518 cf Average Runoff Depth = 1.62"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf

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23141.00 Existing Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 25-year Storm Rainfall=6.10"

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Page 2

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=58 Runoff=0.37 cfs 816 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=2.70"
Tc=6.0 min CN=68 Runoff=0.12 cfs 253 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=2.25"
Flow Length=582' Tc=11.7 min CN=63 Runoff=10.09 cfs 27,108 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=1.58"
Tc=6.0 min CN=55 Runoff=0.86 cfs 1,926 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=2.70"
Flow Length=136' Tc=6.0 min CN=68 Runoff=2.34 cfs 4,989 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=5.63"
Tc=6.0 min CN=96 Runoff=1.29 cfs 3,214 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=58 Runoff=0.10 cfs 214 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.49 cfs 1,069 cf
Primary=0.49 cfs 1,069 cf

Link 2L: DP-2 Mass-DOT East Inflow=13.49 cfs 37,237 cf
Primary=13.49 cfs 37,237 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.10 cfs 214 cf
Primary=0.10 cfs 214 cf

Link 4L: _placeholder Inflow=14.03 cfs 38,520 cf
Primary=14.03 cfs 38,520 cf

Total Runoff Area = 196,431 sf Runoff Volume = 38,520 cf Average Runoff Depth = 2.35"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf

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23141.00 Existing Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 100-year Storm Rainfall=7.77"

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Page 3

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=2.95"
Tc=6.0 min CN=58 Runoff=0.62 cfs 1,322 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=4.04"
Tc=6.0 min CN=68 Runoff=0.18 cfs 379 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=3.49"
Flow Length=582' Tc=11.7 min CN=63 Runoff=15.89 cfs 42,096 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=55 Runoff=1.49 cfs 3,213 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=4.04"
Flow Length=136' Tc=6.0 min CN=68 Runoff=3.49 cfs 7,477 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=7.29"
Tc=6.0 min CN=96 Runoff=1.66 cfs 4,165 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=2.95"
Tc=6.0 min CN=58 Runoff=0.16 cfs 346 cf

Link 1L: DP-1 Mass-DOT West Inflow=0.79 cfs 1,701 cf
Primary=0.79 cfs 1,701 cf

Link 2L: DP-2 Mass-DOT East Inflow=21.00 cfs 56,950 cf
Primary=21.00 cfs 56,950 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.16 cfs 346 cf
Primary=0.16 cfs 346 cf

Link 4L: _placeholder Inflow=21.87 cfs 58,998 cf
Primary=21.87 cfs 58,998 cf

Total Runoff Area = 196,431 sf Runoff Volume = 58,998 cf Average Runoff Depth = 3.60"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf

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23141.00 Existing Conditions WQv 1.2" Storm

NOAA 24-hr A WQv 1.2" Rainfall=1.20"

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Page 1

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EDA-1A: Subcat EDA-1A Runoff Area=5,384 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=58/0 Runoff=0.00 cfs 0 cf

Subcatchment EDA-1B: Subcat EDA-1B Runoff Area=1,125 sf 19.02% Impervious Runoff Depth=0.19"
Tc=6.0 min CN=61/98 Runoff=0.01 cfs 18 cf

Subcatchment EDA-2A: Subcat EDA-2A Runoff Area=144,794 sf 14.30% Impervious Runoff Depth=0.14"
Flow Length=582' Tc=11.7 min CN=57/98 Runoff=0.60 cfs 1,701 cf

Subcatchment EDA-2B: Subcat EDA-2B Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=55/0 Runoff=0.00 cfs 0 cf

Subcatchment EDA-2C: Subcat EDA-2C Runoff Area=22,192 sf 22.60% Impervious Runoff Depth=0.22"
Flow Length=136' Tc=6.0 min CN=59/98 Runoff=0.18 cfs 412 cf

Subcatchment EDA-2D: Subcat EDA-2D Runoff Area=6,854 sf 94.48% Impervious Runoff Depth=0.93"
Tc=6.0 min CN=61/98 Runoff=0.23 cfs 532 cf

Subcatchment EDA-3A: Subcat EDA-3A Runoff Area=1,409 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=58/0 Runoff=0.00 cfs 0 cf

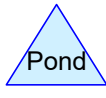
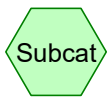
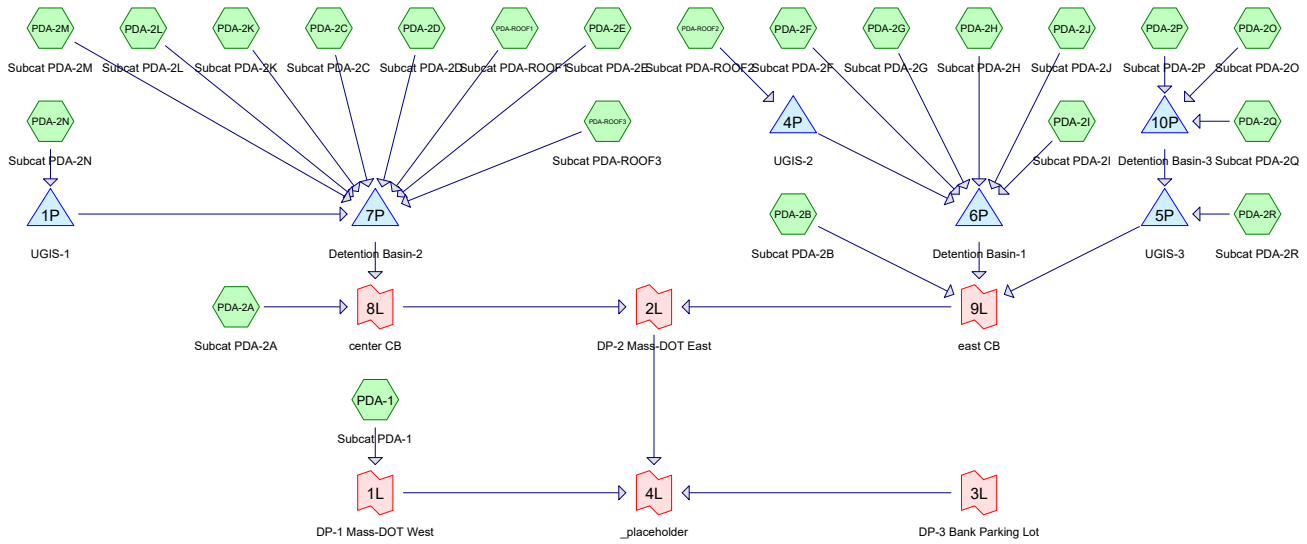
Link 1L: DP-1 Mass-DOT West Inflow=0.01 cfs 18 cf
Primary=0.01 cfs 18 cf

Link 2L: DP-2 Mass-DOT East Inflow=0.95 cfs 2,644 cf
Primary=0.95 cfs 2,644 cf

Link 3L: DP-3 Bank Parking Lot Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link 4L: _placeholder Inflow=0.96 cfs 2,662 cf
Primary=0.96 cfs 2,662 cf

Total Runoff Area = 196,431 sf Runoff Volume = 2,662 cf Average Runoff Depth = 0.16"
83.50% Pervious = 164,023 sf 16.50% Impervious = 32,408 sf



Routing Diagram for Pro Hydro
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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 2

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPDA-1: Subcat PDA-1	Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=1.68" Tc=6.0 min CN=83 Runoff=0.07 cfs 159 cf
SubcatchmentPDA-2A: Subcat PDA-2A	Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=1.68" Tc=6.0 min CN=83 Runoff=0.21 cfs 446 cf
SubcatchmentPDA-2B: Subcat PDA-2B	Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=2.62" Tc=6.0 min CN=94 Runoff=0.16 cfs 378 cf
SubcatchmentPDA-2C: Subcat PDA-2C	Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=1.03" Tc=6.0 min CN=73 Runoff=0.24 cfs 512 cf
SubcatchmentPDA-2D: Subcat PDA-2D	Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=0.68" Tc=6.0 min CN=66 Runoff=0.06 cfs 133 cf
SubcatchmentPDA-2E: Subcat PDA-2E	Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=3.05" Tc=6.0 min CN=98 Runoff=0.34 cfs 846 cf
SubcatchmentPDA-2F: Subcat PDA-2F	Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=2.62" Tc=6.0 min CN=94 Runoff=0.39 cfs 890 cf
SubcatchmentPDA-2G: Subcat PDA-2G	Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=1.83" Tc=6.0 min CN=85 Runoff=0.23 cfs 485 cf
SubcatchmentPDA-2H: Subcat PDA-2H	Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=2.62" Tc=6.0 min CN=94 Runoff=0.34 cfs 791 cf
SubcatchmentPDA-2I: Subcat PDA-2I	Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=0.48" Tc=6.0 min CN=61 Runoff=0.04 cfs 119 cf
SubcatchmentPDA-2J: Subcat PDA-2J	Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=2.62" Tc=6.0 min CN=94 Runoff=1.40 cfs 3,242 cf
SubcatchmentPDA-2K: Subcat PDA-2K	Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=0.60" Tc=6.0 min CN=64 Runoff=0.11 cfs 263 cf
SubcatchmentPDA-2L: Subcat PDA-2L	Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=2.52" Tc=6.0 min CN=93 Runoff=1.24 cfs 2,816 cf
SubcatchmentPDA-2M: Subcat PDA-2M	Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=1.83" Tc=6.0 min CN=85 Runoff=0.53 cfs 1,142 cf
SubcatchmentPDA-2N: Subcat PDA-2N	Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=0.48" Tc=6.0 min CN=61 Runoff=0.07 cfs 185 cf
SubcatchmentPDA-2O: Subcat PDA-2O	Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=0.31" Flow Length=391' Tc=9.3 min CN=56 Runoff=0.31 cfs 1,505 cf

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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 3

SubcatchmentPDA-2P: Subcat PDA-2P	Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.27" Tc=6.0 min CN=55 Runoff=0.07 cfs 336 cf
SubcatchmentPDA-2Q: Subcat PDA-2Q	Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=0.78" Tc=6.0 min CN=68 Runoff=0.63 cfs 1,436 cf
SubcatchmentPDA-2R: Subcat PDA-2R	Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=0.48" Tc=6.0 min CN=61 Runoff=0.02 cfs 63 cf
SubcatchmentPDA-ROOF1: Subcat	Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=3.05" Tc=6.0 min CN=98 Runoff=0.72 cfs 1,794 cf
SubcatchmentPDA-ROOF2: Subcat	Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=3.05" Tc=6.0 min CN=98 Runoff=1.21 cfs 3,019 cf
SubcatchmentPDA-ROOF3: Subcat	Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=3.05" Tc=6.0 min CN=98 Runoff=0.27 cfs 665 cf
Pond 1P: UGIS-1	Peak Elev=299.17' Storage=41 cf Inflow=0.07 cfs 185 cf Discarded=0.02 cfs 185 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 185 cf
Pond 4P: UGIS-2	Peak Elev=300.15' Storage=255 cf Inflow=1.21 cfs 3,019 cf Discarded=0.01 cfs 766 cf Primary=1.17 cfs 2,252 cf Outflow=1.18 cfs 3,019 cf
Pond 5P: UGIS-3	Peak Elev=300.91' Storage=741 cf Inflow=0.61 cfs 3,354 cf Discarded=0.04 cfs 1,987 cf Primary=0.63 cfs 1,366 cf Outflow=0.66 cfs 3,354 cf
Pond 6P: Detention Basin-1	Peak Elev=297.30' Storage=3,586 cf Inflow=3.55 cfs 7,779 cf Outflow=1.02 cfs 7,742 cf
Pond 7P: Detention Basin-2	Peak Elev=298.23' Storage=3,303 cf Inflow=3.48 cfs 8,171 cf Outflow=1.12 cfs 8,126 cf
Pond 10P: Detention Basin-3	Peak Elev=310.65' Storage=157 cf Inflow=0.91 cfs 3,278 cf Outflow=0.59 cfs 3,291 cf
Link 1L: DP-1 Mass-DOT West	Inflow=0.07 cfs 159 cf Primary=0.07 cfs 159 cf
Link 2L: DP-2 Mass-DOT East	Inflow=2.77 cfs 18,058 cf Primary=2.77 cfs 18,058 cf
Link 3L: DP-3 Bank Parking Lot	Primary=0.00 cfs 0 cf
Link 4L: _placeholder	Inflow=2.78 cfs 18,217 cf Primary=2.78 cfs 18,217 cf
Link 8L: center CB	Inflow=1.20 cfs 8,571 cf Primary=1.20 cfs 8,571 cf

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Page 4

Link 9L: east CB

Inflow=1.65 cfs 9,487 cf
Primary=1.65 cfs 9,487 cf

Total Runoff Area = 196,433 sf Runoff Volume = 21,226 cf Average Runoff Depth = 1.30"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

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Page 5

Summary for Subcatchment PDA-1: Subcat PDA-1

Runoff = 0.07 cfs @ 12.13 hrs, Volume= 159 cf, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
453	61	>75% Grass cover, Good, HSG B
689	98	Paved parking, HSG B
1,142	83	Weighted Average
453	61	39.69% Pervious Area
689	98	60.31% Impervious Area

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

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Page 6

Summary for Subcatchment PDA-2A: Subcat PDA-2A

Runoff = 0.21 cfs @ 12.13 hrs, Volume= 446 cf, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,311	61	>75% Grass cover, Good, HSG B
1,883	98	Paved parking, HSG B
3,194	83	Weighted Average
1,311	61	41.04% Pervious Area
1,883	98	58.96% Impervious Area

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

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Page 7

Summary for Subcatchment PDA-2B: Subcat PDA-2B

Runoff = 0.16 cfs @ 12.13 hrs, Volume= 378 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
172	61	>75% Grass cover, Good, HSG B
1,558	98	Paved parking, HSG B
1,730	94	Weighted Average
172	61	9.92% Pervious Area
1,558	98	90.08% Impervious Area

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

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Page 8

Summary for Subcatchment PDA-2C: Subcat PDA-2C

Runoff = 0.24 cfs @ 12.14 hrs, Volume= 512 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
4,030	61	>75% Grass cover, Good, HSG B
1,884	98	Paved parking, HSG B
30	98	Roofs, HSG B
5,944	73	Weighted Average
4,030	61	67.79% Pervious Area
1,914	98	32.21% Impervious Area

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

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Page 9

Summary for Subcatchment PDA-2D: Subcat PDA-2D

Runoff = 0.06 cfs @ 12.15 hrs, Volume= 133 cf, Depth= 0.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
2,003	61	>75% Grass cover, Good, HSG B
326	98	Paved parking, HSG B
2,329	66	Weighted Average
2,003	61	85.98% Pervious Area
326	98	14.02% Impervious Area

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

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Page 10

Summary for Subcatchment PDA-2E: Subcat PDA-2E

Runoff = 0.34 cfs @ 12.13 hrs, Volume= 846 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
3,332	98	Paved parking, HSG B
3,332	98	100.00% Impervious Area

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

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Page 11

Summary for Subcatchment PDA-2F: Subcat PDA-2F

Runoff = 0.39 cfs @ 12.13 hrs, Volume= 890 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
390	61	>75% Grass cover, Good, HSG B
3,683	98	Paved parking, HSG B
4,072	94	Weighted Average
390	61	9.57% Pervious Area
3,683	98	90.43% Impervious Area

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

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Page 12

Summary for Subcatchment PDA-2G: Subcat PDA-2G

Runoff = 0.23 cfs @ 12.13 hrs, Volume= 485 cf, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,112	61	>75% Grass cover, Good, HSG B
2,078	98	Paved parking, HSG B
3,190	85	Weighted Average
1,112	61	34.86% Pervious Area
2,078	98	65.14% Impervious Area

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

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Page 13

Summary for Subcatchment PDA-2H: Subcat PDA-2H

Runoff = 0.34 cfs @ 12.13 hrs, Volume= 791 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
384	61	>75% Grass cover, Good, HSG B
3,237	98	Paved parking, HSG B
3,620	94	Weighted Average
384	61	10.60% Pervious Area
3,237	98	89.40% Impervious Area

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

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Page 14

Summary for Subcatchment PDA-2I: Subcat PDA-2I

Runoff = 0.04 cfs @ 12.15 hrs, Volume= 119 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
2,949	61	>75% Grass cover, Good, HSG B
37	98	Paved parking, HSG B
2,986	61	Weighted Average
2,949	61	98.77% Pervious Area
37	98	1.23% Impervious Area

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

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Page 15

Summary for Subcatchment PDA-2J: Subcat PDA-2J

Runoff = 1.40 cfs @ 12.13 hrs, Volume= 3,242 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,539	61	>75% Grass cover, Good, HSG B
13,302	98	Paved parking, HSG B
14,841	94	Weighted Average
1,539	61	10.37% Pervious Area
13,302	98	89.63% Impervious Area

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

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Page 16

Summary for Subcatchment PDA-2K: Subcat PDA-2K

Runoff = 0.11 cfs @ 12.15 hrs, Volume= 263 cf, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
4,848	61	>75% Grass cover, Good, HSG B
432	98	Paved parking, HSG B
3	98	Roofs, HSG B
5,283	64	Weighted Average
4,848	61	91.77% Pervious Area
435	98	8.23% Impervious Area

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

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Page 17

Summary for Subcatchment PDA-2L: Subcat PDA-2L

Runoff = 1.24 cfs @ 12.13 hrs, Volume= 2,816 cf, Depth= 2.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,637	61	>75% Grass cover, Good, HSG B
11,758	98	Paved parking, HSG B
13,395	93	Weighted Average
1,637	61	12.22% Pervious Area
11,758	98	87.78% Impervious Area

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

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 18

Summary for Subcatchment PDA-2M: Subcat PDA-2M

Runoff = 0.53 cfs @ 12.13 hrs, Volume= 1,142 cf, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
2,605	61	>75% Grass cover, Good, HSG B
4,889	98	Paved parking, HSG B
9	55	Woods, Good, HSG B
7,503	85	Weighted Average
2,614	61	34.84% Pervious Area
4,889	98	65.16% Impervious Area

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

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 19

Summary for Subcatchment PDA-2N: Subcat PDA-2N

Runoff = 0.07 cfs @ 12.15 hrs, Volume= 185 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
4,609	61	>75% Grass cover, Good, HSG B
52	55	Woods, Good, HSG B
4,661	61	Weighted Average
4,661	61	100.00% Pervious Area

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

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Page 20

Summary for Subcatchment PDA-20: Subcat PDA-20

Runoff = 0.31 cfs @ 12.24 hrs, Volume= 1,505 cf, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
11,200	61	>75% Grass cover, Good, HSG B
47,992	55	Woods, Good, HSG B
59,192	56	Weighted Average
59,192	56	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	25	0.3600	0.19		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.28"
2.4	25	0.2800	0.17		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.28"
4.1	260	0.1769	1.05		Shallow Concentrated Flow, Forest w/Heavy Litter Kv= 2.5 fps
0.6	81	0.1099	2.32		Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps
9.3	391	Total			

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Page 21

Summary for Subcatchment PDA-2P: Subcat PDA-2P

Runoff = 0.07 cfs @ 12.19 hrs, Volume= 336 cf, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
14,672	55	Woods, Good, HSG B
14,672	55	100.00% Pervious Area

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

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Page 22

Summary for Subcatchment PDA-2Q: Subcat PDA-2Q

Runoff = 0.63 cfs @ 12.14 hrs, Volume= 1,436 cf, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
12,545	61	>75% Grass cover, Good, HSG B
2,235	98	Paved parking, HSG B
2,780	98	Roofs, HSG B
4,634	55	Woods, Good, HSG B
22,194	68	Weighted Average
17,179	59	77.41% Pervious Area
5,015	98	22.59% Impervious Area

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

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 23

Summary for Subcatchment PDA-2R: Subcat PDA-2R

Runoff = 0.02 cfs @ 12.15 hrs, Volume= 63 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1,575	61	>75% Grass cover, Good, HSG B
3	55	Woods, Good, HSG B
1,578	61	Weighted Average
1,578	61	100.00% Pervious Area

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

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Page 24

Summary for Subcatchment PDA-ROOF1: Subcat PDA-ROOF1

Runoff = 0.72 cfs @ 12.13 hrs, Volume= 1,794 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
11	61	>75% Grass cover, Good, HSG B
7,054	98	Roofs, HSG B
7,065	98	Weighted Average
11	61	0.16% Pervious Area
7,054	98	99.84% Impervious Area

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

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Page 25

Summary for Subcatchment PDA-ROOF2: Subcat PDA-ROOF2

Runoff = 1.21 cfs @ 12.13 hrs, Volume= 3,019 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
1	61	>75% Grass cover, Good, HSG B
26	98	Paved parking, HSG B
11,860	98	Roofs, HSG B
11,888	98	Weighted Average
1	61	0.01% Pervious Area
11,886	98	99.99% Impervious Area

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

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Page 26

Summary for Subcatchment PDA-ROOF3: Subcat PDA-ROOF3

Runoff = 0.27 cfs @ 12.13 hrs, Volume= 665 cf, Depth= 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 NOAA 24-hr A 2-year Storm Rainfall=3.28"

Area (sf)	CN	Description
24	61	>75% Grass cover, Good, HSG B
2	98	Paved parking, HSG B
2,593	98	Roofs, HSG B
2,620	98	Weighted Average
24	61	0.93% Pervious Area
2,596	98	99.07% Impervious Area

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

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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 27

Summary for Pond 1P: UGIS-1

Inflow Area = 4,661 sf, 0.00% Impervious, Inflow Depth = 0.48" for 2-year Storm event
Inflow = 0.07 cfs @ 12.15 hrs, Volume= 185 cf
Outflow = 0.02 cfs @ 12.66 hrs, Volume= 185 cf, Atten= 77%, Lag= 30.1 min
Discarded = 0.02 cfs @ 12.66 hrs, Volume= 185 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 299.17' @ 12.66 hrs Surf.Area= 617 sf Storage= 41 cf

Plug-Flow detention time= 19.7 min calculated for 185 cf (100% of inflow)
Center-of-Mass det. time= 19.7 min (891.6 - 871.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	299.00'	396 cf	61.67"W x 10.00"L x 2.04"H Field A 1,259 cf Overall - 268 cf Embedded = 991 cf x 40.0% Voids
#2A	299.50'	268 cf	Cultec C-100HD x 18 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 18 rows
		664 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	299.00'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 296.50' Phase-In= 0.01'
#2	Primary	299.50'	12.0" Round Culvert L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 299.50' / 299.25' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	300.50'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.02 cfs @ 12.66 hrs HW=299.17' (Free Discharge)

↑1=Exfiltration (Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=299.00' TW=297.50' (Dynamic Tailwater)

↑2=Culvert (Controls 0.00 cfs)

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

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Pond 1P: UGIS-1 - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 18 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

1 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length

18 Rows x 36.0" Wide + 4.0" Spacing x 17 + 12.0" Side Stone x 2 = 61.67' Base Width

6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

18 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 18 Rows = 268.1 cf Chamber Storage

1,259.0 cf Field - 268.1 cf Chambers = 991.0 cf Stone x 40.0% Voids = 396.4 cf Stone Storage

Chamber Storage + Stone Storage = 664.4 cf = 0.015 af

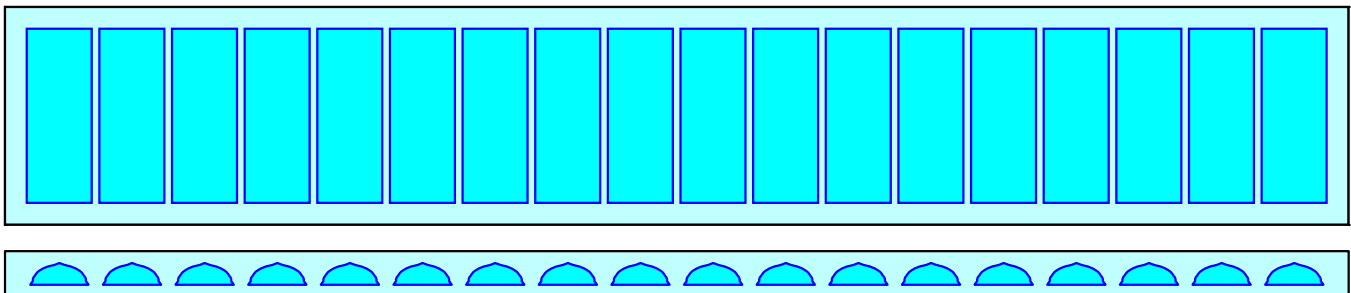
Overall Storage Efficiency = 52.8%

Overall System Size = 10.00' x 61.67' x 2.04'

18 Chambers

46.6 cy Field

36.7 cy Stone



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Page 29

Stage-Discharge for Pond 1P: UGIS-1

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
299.00	0.00	0.00	0.00
299.05	0.01	0.01	0.00
299.10	0.02	0.02	0.00
299.15	0.02	0.02	0.00
299.20	0.02	0.02	0.00
299.25	0.02	0.02	0.00
299.30	0.02	0.02	0.00
299.35	0.02	0.02	0.00
299.40	0.02	0.02	0.00
299.45	0.02	0.02	0.00
299.50	0.02	0.02	0.00
299.55	0.02	0.02	0.00
299.60	0.02	0.02	0.00
299.65	0.02	0.02	0.00
299.70	0.02	0.02	0.00
299.75	0.02	0.02	0.00
299.80	0.02	0.02	0.00
299.85	0.02	0.02	0.00
299.90	0.02	0.02	0.00
299.95	0.02	0.02	0.00
300.00	0.02	0.02	0.00
300.05	0.02	0.02	0.00
300.10	0.02	0.02	0.00
300.15	0.02	0.02	0.00
300.20	0.02	0.02	0.00
300.25	0.02	0.02	0.00
300.30	0.02	0.02	0.00
300.35	0.02	0.02	0.00
300.40	0.02	0.02	0.00
300.45	0.02	0.02	0.00
300.50	0.02	0.02	0.00
300.55	0.21	0.02	0.18
300.60	0.54	0.02	0.51
300.65	0.97	0.02	0.94
300.70	1.48	0.02	1.45
300.75	2.05	0.02	2.02
300.80	2.65	0.03	2.62
300.85	2.65	0.03	2.62
300.90	2.75	0.03	2.73
300.95	2.86	0.03	2.83
301.00	2.96	0.03	2.93

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Page 30

Stage-Area-Storage for Pond 1P: UGIS-1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
299.00	617	0
299.05	617	12
299.10	617	25
299.15	617	37
299.20	617	49
299.25	617	62
299.30	617	74
299.35	617	86
299.40	617	99
299.45	617	111
299.50	617	123
299.55	617	147
299.60	617	170
299.65	617	194
299.70	617	216
299.75	617	239
299.80	617	262
299.85	617	285
299.90	617	307
299.95	617	329
300.00	617	351
300.05	617	372
300.10	617	393
300.15	617	414
300.20	617	434
300.25	617	453
300.30	617	471
300.35	617	488
300.40	617	504
300.45	617	518
300.50	617	531
300.55	617	543
300.60	617	556
300.65	617	568
300.70	617	580
300.75	617	593
300.80	617	605
300.85	617	617
300.90	617	630
300.95	617	642
301.00	617	654

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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 31

Summary for Pond 4P: UGIS-2

Inflow Area = 11,888 sf, 99.99% Impervious, Inflow Depth = 3.05" for 2-year Storm event
 Inflow = 1.21 cfs @ 12.13 hrs, Volume= 3,019 cf
 Outflow = 1.18 cfs @ 12.14 hrs, Volume= 3,019 cf, Atten= 2%, Lag= 1.1 min
 Discarded = 0.01 cfs @ 12.14 hrs, Volume= 766 cf
 Primary = 1.17 cfs @ 12.14 hrs, Volume= 2,252 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 300.15' @ 12.14 hrs Surf.Area= 292 sf Storage= 255 cf

Plug-Flow detention time= 39.4 min calculated for 3,017 cf (100% of inflow)
 Center-of-Mass det. time= 39.5 min (792.3 - 752.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	298.50'	245 cf	11.67'W x 25.00'L x 2.54'H Field A 741 cf Overall - 128 cf Embedded = 613 cf x 40.0% Voids
#2A	299.50'	128 cf	Cultec C-100HD x 9 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 3 rows
		374 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	298.50'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 296.50' Phase-In= 0.01'
#2	Primary	299.50'	12.0" Round Culvert L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 299.50' / 298.75' S= 0.0150 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Primary	300.50'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Discarded OutFlow Max=0.01 cfs @ 12.14 hrs HW=300.14' (Free Discharge)

↑1=Exfiltration (Controls 0.01 cfs)

Primary OutFlow Max=1.15 cfs @ 12.14 hrs HW=300.14' TW=297.14' (Dynamic Tailwater)

↑2=Culvert (Inlet Controls 1.15 cfs @ 2.15 fps)

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

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Pond 4P: UGIS-2 - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 3 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

3 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 23.00' Row Length +12.0" End Stone x 2 = 25.00' Base Length

3 Rows x 36.0" Wide + 4.0" Spacing x 2 + 12.0" Side Stone x 2 = 11.67' Base Width

12.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.54' Field Height

9 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 3 Rows = 128.4 cf Chamber Storage

741.3 cf Field - 128.4 cf Chambers = 612.9 cf Stone x 40.0% Voids = 245.2 cf Stone Storage

Chamber Storage + Stone Storage = 373.6 cf = 0.009 af

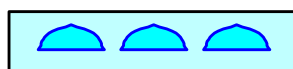
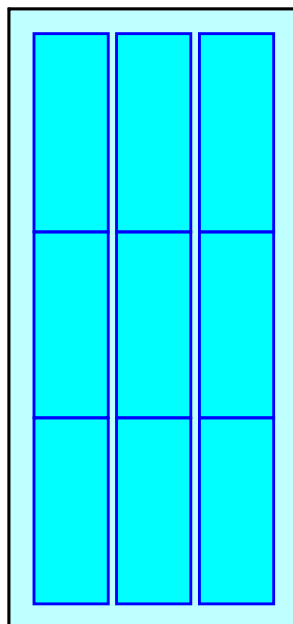
Overall Storage Efficiency = 50.4%

Overall System Size = 25.00' x 11.67' x 2.54'

9 Chambers

27.5 cy Field

22.7 cy Stone



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Page 33

Stage-Discharge for Pond 4P: UGIS-2

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
298.50	0.00	0.00	0.00
298.55	0.01	0.01	0.00
298.60	0.01	0.01	0.00
298.65	0.01	0.01	0.00
298.70	0.01	0.01	0.00
298.75	0.01	0.01	0.00
298.80	0.01	0.01	0.00
298.85	0.01	0.01	0.00
298.90	0.01	0.01	0.00
298.95	0.01	0.01	0.00
299.00	0.01	0.01	0.00
299.05	0.01	0.01	0.00
299.10	0.01	0.01	0.00
299.15	0.01	0.01	0.00
299.20	0.01	0.01	0.00
299.25	0.01	0.01	0.00
299.30	0.01	0.01	0.00
299.35	0.01	0.01	0.00
299.40	0.01	0.01	0.00
299.45	0.01	0.01	0.00
299.50	0.01	0.01	0.00
299.55	0.02	0.01	0.01
299.60	0.05	0.01	0.03
299.65	0.09	0.01	0.08
299.70	0.15	0.01	0.13
299.75	0.22	0.01	0.21
299.80	0.30	0.01	0.29
299.85	0.40	0.01	0.39
299.90	0.51	0.01	0.50
299.95	0.63	0.01	0.62
300.00	0.76	0.01	0.75
300.05	0.89	0.01	0.88
300.10	1.04	0.01	1.02
300.15	1.18	0.01	1.17
300.20	1.33	0.01	1.32
300.25	1.48	0.01	1.47
300.30	1.63	0.01	1.62
300.35	1.78	0.01	1.76
300.40	1.91	0.01	1.90
300.45	2.03	0.01	2.02
300.50	2.12	0.01	2.11
300.55	2.41	0.01	2.40
300.60	2.84	0.01	2.83
300.65	3.37	0.01	3.35
300.70	3.96	0.01	3.95
300.75	4.62	0.01	4.61
300.80	5.34	0.01	5.32
300.85	6.11	0.01	6.09
300.90	6.92	0.02	6.90
300.95	7.77	0.02	7.76
301.00	8.67	0.02	8.65

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Page 34

Stage-Area-Storage for Pond 4P: UGIS-2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
298.50	292	0
298.55	292	6
298.60	292	12
298.65	292	17
298.70	292	23
298.75	292	29
298.80	292	35
298.85	292	41
298.90	292	47
298.95	292	52
299.00	292	58
299.05	292	64
299.10	292	70
299.15	292	76
299.20	292	82
299.25	292	88
299.30	292	93
299.35	292	99
299.40	292	105
299.45	292	111
299.50	292	117
299.55	292	128
299.60	292	139
299.65	292	150
299.70	292	161
299.75	292	172
299.80	292	183
299.85	292	193
299.90	292	204
299.95	292	215
300.00	292	225
300.05	292	235
300.10	292	245
300.15	292	255
300.20	292	264
300.25	292	273
300.30	292	282
300.35	292	290
300.40	292	298
300.45	292	304
300.50	292	310
300.55	292	316
300.60	292	322
300.65	292	328
300.70	292	334
300.75	292	340
300.80	292	345
300.85	292	351
300.90	292	357
300.95	292	363
301.00	292	369

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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 35

Summary for Pond 5P: UGIS-3

Inflow Area = 97,637 sf, 5.14% Impervious, Inflow Depth = 0.41" for 2-year Storm event
 Inflow = 0.61 cfs @ 12.30 hrs, Volume= 3,354 cf
 Outflow = 0.66 cfs @ 12.47 hrs, Volume= 3,354 cf, Atten= 0%, Lag= 9.8 min
 Discarded = 0.04 cfs @ 12.47 hrs, Volume= 1,987 cf
 Primary = 0.63 cfs @ 12.47 hrs, Volume= 1,366 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 300.91' @ 12.47 hrs Surf.Area= 896 sf Storage= 741 cf

Plug-Flow detention time= 159.5 min calculated for 3,354 cf (100% of inflow)
 Center-of-Mass det. time= 159.5 min (1,038.2 - 878.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	299.50'	574 cf	16.00'W x 56.00'L x 2.04'H Field A 1,829 cf Overall - 395 cf Embedded = 1,435 cf x 40.0% Voids
#2A	300.00'	395 cf	Cultec C-100HD x 28 Inside #1 Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap Row Length Adjustment= +0.50' x 1.86 sf x 4 rows
		969 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	299.50'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 297.50' Phase-In= 0.01'
#2	Primary	299.50'	12.0" Round Culvert L= 3.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 299.50' / 299.25' S= 0.0833 '/' Cc= 0.900 n= 0.009 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	300.80'	5.0' long x 1.00' rise Sharp-Crested Rectangular Weir 2 End Contraction(s) 1.0' Crest Height

Discarded OutFlow Max=0.04 cfs @ 12.47 hrs HW=300.91' (Free Discharge)

↑1=Exfiltration (Controls 0.04 cfs)

Primary OutFlow Max=0.57 cfs @ 12.47 hrs HW=300.91' TW=0.00' (Dynamic Tailwater)

↑2=Culvert (Passes 0.57 cfs of 2.84 cfs potential flow)

↑3=Sharp-Crested Rectangular Weir(Weir Controls 0.57 cfs @ 1.08 fps)

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Pond 5P: UGIS-3 - Chamber Wizard Field A

Chamber Model = Cultec C-100HD (Cultec Contactor® 100HD)

Effective Size= 32.1"W x 12.0"H => 1.86 sf x 7.50'L = 14.0 cf

Overall Size= 36.0"W x 12.5"H x 8.00'L with 0.50' Overlap

Row Length Adjustment= +0.50' x 1.86 sf x 4 rows

36.0" Wide + 4.0" Spacing = 40.0" C-C Row Spacing

7 Chambers/Row x 7.50' Long +0.50' Row Adjustment = 53.00' Row Length +18.0" End Stone x 2 = 56.00' Base Length

4 Rows x 36.0" Wide + 4.0" Spacing x 3 + 18.0" Side Stone x 2 = 16.00' Base Width

6.0" Stone Base + 12.5" Chamber Height + 6.0" Stone Cover = 2.04' Field Height

28 Chambers x 14.0 cf +0.50' Row Adjustment x 1.86 sf x 4 Rows = 394.6 cf Chamber Storage

1,829.3 cf Field - 394.6 cf Chambers = 1,434.7 cf Stone x 40.0% Voids = 573.9 cf Stone Storage

Chamber Storage + Stone Storage = 968.5 cf = 0.022 af

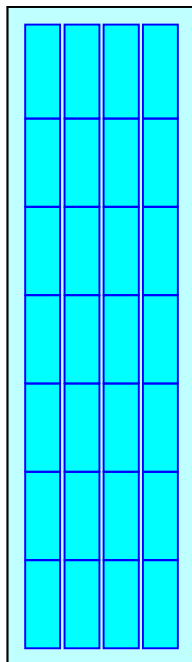
Overall Storage Efficiency = 52.9%

Overall System Size = 56.00' x 16.00' x 2.04'

28 Chambers

67.8 cy Field

53.1 cy Stone



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Page 37

Stage-Discharge for Pond 5P: UGIS-3

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
299.50	0.00	0.00	0.00
299.55	0.02	0.02	0.00
299.60	0.02	0.02	0.00
299.65	0.02	0.02	0.00
299.70	0.02	0.02	0.00
299.75	0.02	0.02	0.00
299.80	0.02	0.02	0.00
299.85	0.02	0.02	0.00
299.90	0.03	0.03	0.00
299.95	0.03	0.03	0.00
300.00	0.03	0.03	0.00
300.05	0.03	0.03	0.00
300.10	0.03	0.03	0.00
300.15	0.03	0.03	0.00
300.20	0.03	0.03	0.00
300.25	0.03	0.03	0.00
300.30	0.03	0.03	0.00
300.35	0.03	0.03	0.00
300.40	0.03	0.03	0.00
300.45	0.03	0.03	0.00
300.50	0.03	0.03	0.00
300.55	0.03	0.03	0.00
300.60	0.03	0.03	0.00
300.65	0.03	0.03	0.00
300.70	0.03	0.03	0.00
300.75	0.03	0.03	0.00
300.80	0.03	0.03	0.00
300.85	0.22	0.04	0.18
300.90	0.56	0.04	0.52
300.95	1.00	0.04	0.96
301.00	1.52	0.04	1.49
301.05	2.12	0.04	2.09
301.10	2.79	0.04	2.75
301.15	3.24	0.04	3.20
301.20	3.31	0.04	3.27
301.25	3.38	0.04	3.34
301.30	3.44	0.04	3.40
301.35	3.51	0.04	3.47
301.40	3.57	0.04	3.53
301.45	3.64	0.04	3.60
301.50	3.70	0.04	3.66
301.55	3.76	0.04	3.72
301.60	3.82	0.04	3.78
301.65	3.88	0.04	3.83
301.70	3.94	0.04	3.89
301.75	3.99	0.04	3.95
301.80	4.05	0.05	4.01

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Page 38

Stage-Area-Storage for Pond 5P: UGIS-3

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
299.50	896	0
299.55	896	18
299.60	896	36
299.65	896	54
299.70	896	72
299.75	896	90
299.80	896	108
299.85	896	125
299.90	896	143
299.95	896	161
300.00	896	179
300.05	896	214
300.10	896	248
300.15	896	282
300.20	896	315
300.25	896	349
300.30	896	382
300.35	896	415
300.40	896	448
300.45	896	480
300.50	896	512
300.55	896	543
300.60	896	574
300.65	896	604
300.70	896	633
300.75	896	661
300.80	896	687
300.85	896	712
300.90	896	735
300.95	896	756
301.00	896	774
301.05	896	792
301.10	896	810
301.15	896	828
301.20	896	846
301.25	896	864
301.30	896	882
301.35	896	900
301.40	896	918
301.45	896	936
301.50	896	954
301.55	896	969
301.60	896	969
301.65	896	969
301.70	896	969
301.75	896	969
301.80	896	969

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 39

Summary for Pond 6P: Detention Basin-1

Inflow Area = 40,597 sf, 84.30% Impervious, Inflow Depth = 2.30" for 2-year Storm event
 Inflow = 3.55 cfs @ 12.13 hrs, Volume= 7,779 cf
 Outflow = 1.02 cfs @ 12.35 hrs, Volume= 7,742 cf, Atten= 71%, Lag= 12.7 min
 Primary = 1.02 cfs @ 12.35 hrs, Volume= 7,742 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 297.30' @ 12.35 hrs Surf.Area= 5,278 sf Storage= 3,586 cf

Plug-Flow detention time= 121.9 min calculated for 7,737 cf (99% of inflow)
 Center-of-Mass det. time= 120.6 min (890.4 - 769.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	296.50'	0 cf	41.38'W x 127.56'L x 2.67'H Field A 14,074 cf Overall - 14,074 cf Embedded = 0 cf x 40.0% Voids
#2A	296.50'	8,991 cf	StormTrap ST1 SingleTrap 2-0x 54 Inside #1 Inside= 82.7"W x 24.0"H => 11.84 sf x 14.06'L = 166.5 cf Outside= 82.7"W x 32.0"H => 18.39 sf x 14.06'L = 258.6 cf 54 Chambers in 6 Rows 41.38' x 126.56' Core + 0.00' x 0.50' Border = 41.38' x 127.56' System
		8,991 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	296.50'	12.0" Round Culvert L= 34.8' Ke= 0.900 Inlet / Outlet Invert= 296.50' / 296.30' S= 0.0057 '/' Cc= 0.900 n= 0.009, Flow Area= 0.79 sf
#2	Device 1	296.50'	5.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	296.75'	6.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 1	298.25'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=1.02 cfs @ 12.35 hrs HW=297.30' TW=0.00' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 1.02 cfs of 1.61 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 0.50 cfs @ 3.70 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 0.52 cfs @ 2.63 fps)
- ↑ **4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

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Pond 6P: Detention Basin-1 - Chamber Wizard Field A

Chamber Model = StormTrapST1 SingleTrap 2-0 (StormTrapST1 SingleTrap®Type VI)

Inside= 82.7"W x 24.0"H => 11.84 sf x 14.06'L = 166.5 cf

Outside= 82.7"W x 32.0"H => 18.39 sf x 14.06'L = 258.6 cf

9 Chambers/Row x 14.06' Long = 126.56' Row Length +6.0" Border x 2 = 127.56' Base Length

6 Rows x 82.7" Wide = 41.38' Base Width

32.0" Chamber Height = 2.67' Field Height

54 Chambers x 166.5 cf = 8,991.0 cf Chamber Storage

54 Chambers x 258.6 cf + 110.3 cf Border = 14,074.4 cf Displacement

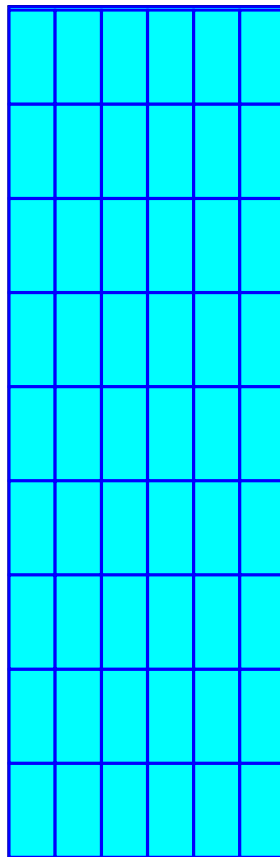
Chamber Storage = 8,991.0 cf = 0.206 af

Overall Storage Efficiency = 63.9%

Overall System Size = 127.56' x 41.38' x 2.67'

54 Chambers (plus border)

521.3 cy Field



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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 41

Stage-Discharge for Pond 6P: Detention Basin-1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
296.50	0.00	297.52	1.27	298.54	3.70
296.52	0.00	297.54	1.29	298.56	3.73
296.54	0.00	297.56	1.31	298.58	3.75
296.56	0.01	297.58	1.33	298.60	3.78
296.58	0.02	297.60	1.35	298.62	3.80
296.60	0.03	297.62	1.37	298.64	3.82
296.62	0.04	297.64	1.39	298.66	3.85
296.64	0.05	297.66	1.41	298.68	3.87
296.66	0.07	297.68	1.43	298.70	3.89
296.68	0.08	297.70	1.44	298.72	3.92
296.70	0.10	297.72	1.46	298.74	3.94
296.72	0.12	297.74	1.48	298.76	3.96
296.74	0.14	297.76	1.50	298.78	3.98
296.76	0.16	297.78	1.51	298.80	4.01
296.78	0.18	297.80	1.53	298.82	4.03
296.80	0.20	297.82	1.55	298.84	4.05
296.82	0.23	297.84	1.56	298.86	4.07
296.84	0.26	297.86	1.58	298.88	4.09
296.86	0.29	297.88	1.60	298.90	4.12
296.88	0.32	297.90	1.61	298.92	4.14
296.90	0.36	297.92	1.63	298.94	4.16
296.92	0.38	297.94	1.65	298.96	4.18
296.94	0.42	297.96	1.66	298.98	4.20
296.96	0.45	297.98	1.68	299.00	4.22
296.98	0.49	298.00	1.69	299.02	4.24
297.00	0.52	298.02	1.71	299.04	4.26
297.02	0.56	298.04	1.72	299.06	4.29
297.04	0.59	298.06	1.74	299.08	4.31
297.06	0.63	298.08	1.75	299.10	4.33
297.08	0.67	298.10	1.77	299.12	4.35
297.10	0.71	298.12	1.78	299.14	4.37
297.12	0.74	298.14	1.79	299.16	4.39
297.14	0.78	298.16	1.81		
297.16	0.82	298.18	1.82		
297.18	0.85	298.20	1.84		
297.20	0.89	298.22	1.85		
297.22	0.92	298.24	1.87		
297.24	0.94	298.26	1.90		
297.26	0.97	298.28	1.98		
297.28	1.00	298.30	2.09		
297.30	1.02	298.32	2.22		
297.32	1.05	298.34	2.37		
297.34	1.07	298.36	2.54		
297.36	1.10	298.38	2.72		
297.38	1.12	298.40	2.92		
297.40	1.14	298.42	3.12		
297.42	1.17	298.44	3.34		
297.44	1.19	298.46	3.57		
297.46	1.21	298.48	3.63		
297.48	1.23	298.50	3.66		
297.50	1.25	298.52	3.68		

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 42

Stage-Area-Storage for Pond 6P: Detention Basin-1

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
296.50	0	297.52	4,585	298.54	8,991
296.52	90	297.54	4,675	298.56	8,991
296.54	180	297.56	4,765	298.58	8,991
296.56	270	297.58	4,855	298.60	8,991
296.58	360	297.60	4,945	298.62	8,991
296.60	450	297.62	5,035	298.64	8,991
296.62	539	297.64	5,125	298.66	8,991
296.64	629	297.66	5,215	298.68	8,991
296.66	719	297.68	5,305	298.70	8,991
296.68	809	297.70	5,395	298.72	8,991
296.70	899	297.72	5,485	298.74	8,991
296.72	989	297.74	5,574	298.76	8,991
296.74	1,079	297.76	5,664	298.78	8,991
296.76	1,169	297.78	5,754	298.80	8,991
296.78	1,259	297.80	5,844	298.82	8,991
296.80	1,349	297.82	5,934	298.84	8,991
296.82	1,439	297.84	6,024	298.86	8,991
296.84	1,528	297.86	6,114	298.88	8,991
296.86	1,618	297.88	6,204	298.90	8,991
296.88	1,708	297.90	6,294	298.92	8,991
296.90	1,798	297.92	6,384	298.94	8,991
296.92	1,888	297.94	6,474	298.96	8,991
296.94	1,978	297.96	6,563	298.98	8,991
296.96	2,068	297.98	6,653	299.00	8,991
296.98	2,158	298.00	6,743	299.02	8,991
297.00	2,248	298.02	6,833	299.04	8,991
297.02	2,338	298.04	6,923	299.06	8,991
297.04	2,428	298.06	7,013	299.08	8,991
297.06	2,517	298.08	7,103	299.10	8,991
297.08	2,607	298.10	7,193	299.12	8,991
297.10	2,697	298.12	7,283	299.14	8,991
297.12	2,787	298.14	7,373	299.16	8,991
297.14	2,877	298.16	7,463		
297.16	2,967	298.18	7,552		
297.18	3,057	298.20	7,642		
297.20	3,147	298.22	7,732		
297.22	3,237	298.24	7,822		
297.24	3,327	298.26	7,912		
297.26	3,417	298.28	8,002		
297.28	3,506	298.30	8,092		
297.30	3,596	298.32	8,182		
297.32	3,686	298.34	8,272		
297.34	3,776	298.36	8,362		
297.36	3,866	298.38	8,452		
297.38	3,956	298.40	8,541		
297.40	4,046	298.42	8,631		
297.42	4,136	298.44	8,721		
297.44	4,226	298.46	8,811		
297.46	4,316	298.48	8,901		
297.48	4,406	298.50	8,991		
297.50	4,496	298.52	8,991		

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 43

Summary for Pond 7P: Detention Basin-2

Inflow Area = 52,134 sf, 61.96% Impervious, Inflow Depth = 1.88" for 2-year Storm event
Inflow = 3.48 cfs @ 12.13 hrs, Volume= 8,171 cf
Outflow = 1.12 cfs @ 12.32 hrs, Volume= 8,126 cf, Atten= 68%, Lag= 11.1 min
Primary = 1.12 cfs @ 12.32 hrs, Volume= 8,126 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 298.23' @ 12.32 hrs Surf.Area= 5,278 sf Storage= 3,303 cf

Plug-Flow detention time= 119.6 min calculated for 8,126 cf (99% of inflow)
Center-of-Mass det. time= 116.0 min (895.8 - 779.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	297.50'	0 cf	41.38'W x 127.56'L x 2.67'H Field A 14,074 cf Overall - 14,074 cf Embedded = 0 cf x 40.0% Voids
#2A	297.50'	8,991 cf	StormTrap ST1 SingleTrap 2-0x 54 Inside #1 Inside= 82.7"W x 24.0"H => 11.84 sf x 14.06'L = 166.5 cf Outside= 82.7"W x 32.0"H => 18.39 sf x 14.06'L = 258.6 cf 54 Chambers in 6 Rows 41.38' x 126.56' Core + 0.00' x 0.50' Border = 41.38' x 127.56' System
		8,991 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	297.50'	12.0" Round Culvert L= 50.0' Ke= 0.900 Inlet / Outlet Invert= 297.50' / 297.25' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	299.20'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Device 1	297.50'	6.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 1	297.75'	6.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.12 cfs @ 12.32 hrs HW=298.23' TW=0.00' (Dynamic Tailwater)

- ↑ **1=Culvert** (Passes 1.12 cfs of 1.28 cfs potential flow)
- ↑ **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
- ↑ **3=Orifice/Grate** (Orifice Controls 0.66 cfs @ 3.35 fps)
- ↑ **4=Orifice/Grate** (Orifice Controls 0.46 cfs @ 2.37 fps)

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Pond 7P: Detention Basin-2 - Chamber Wizard Field A

Chamber Model = StormTrapST1 SingleTrap 2-0 (StormTrapST1 SingleTrap®Type VI)

Inside= 82.7"W x 24.0"H => 11.84 sf x 14.06'L = 166.5 cf

Outside= 82.7"W x 32.0"H => 18.39 sf x 14.06'L = 258.6 cf

9 Chambers/Row x 14.06' Long = 126.56' Row Length +6.0" Border x 2 = 127.56' Base Length

6 Rows x 82.7" Wide = 41.38' Base Width

32.0" Chamber Height = 2.67' Field Height

54 Chambers x 166.5 cf = 8,991.0 cf Chamber Storage

54 Chambers x 258.6 cf + 110.3 cf Border = 14,074.4 cf Displacement

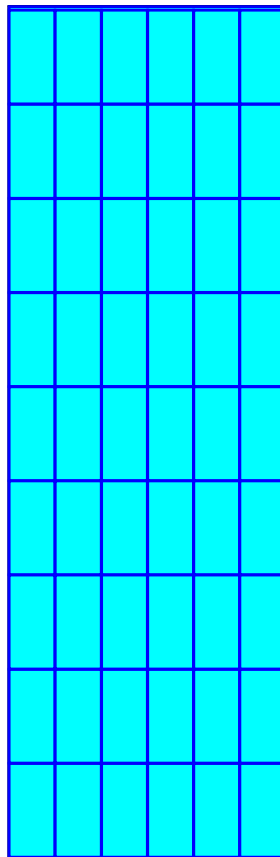
Chamber Storage = 8,991.0 cf = 0.206 af

Overall Storage Efficiency = 63.9%

Overall System Size = 127.56' x 41.38' x 2.67'

54 Chambers (plus border)

521.3 cy Field



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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 45

Stage-Discharge for Pond 7P: Detention Basin-2

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
297.50	0.00	298.52	1.51	299.54	3.70
297.52	0.00	298.54	1.54	299.56	3.73
297.54	0.00	298.56	1.56	299.58	3.75
297.56	0.01	298.58	1.58	299.60	3.78
297.58	0.02	298.60	1.60	299.62	3.80
297.60	0.03	298.62	1.63	299.64	3.82
297.62	0.04	298.64	1.65	299.66	3.85
297.64	0.06	298.66	1.67	299.68	3.87
297.66	0.07	298.68	1.69	299.70	3.89
297.68	0.09	298.70	1.71	299.72	3.92
297.70	0.11	298.72	1.73	299.74	3.94
297.72	0.13	298.74	1.75	299.76	3.96
297.74	0.16	298.76	1.77	299.78	3.98
297.76	0.18	298.78	1.79	299.80	4.01
297.78	0.21	298.80	1.81	299.82	4.03
297.80	0.24	298.82	1.83	299.84	4.05
297.82	0.27	298.84	1.85	299.86	4.07
297.84	0.31	298.86	1.87	299.88	4.09
297.86	0.35	298.88	1.89	299.90	4.12
297.88	0.39	298.90	1.91	299.92	4.14
297.90	0.43	298.92	1.93	299.94	4.16
297.92	0.47	298.94	1.95	299.96	4.18
297.94	0.51	298.96	1.97	299.98	4.20
297.96	0.56	298.98	1.98	300.00	4.22
297.98	0.60	299.00	2.00	300.02	4.24
298.00	0.64	299.02	2.02	300.04	4.26
298.02	0.68	299.04	2.04	300.06	4.29
298.04	0.73	299.06	2.06	300.08	4.31
298.06	0.77	299.08	2.07	300.10	4.33
298.08	0.81	299.10	2.09	300.12	4.35
298.10	0.86	299.12	2.11	300.14	4.37
298.12	0.90	299.14	2.12	300.16	4.39
298.14	0.94	299.16	2.14		
298.16	0.98	299.18	2.16		
298.18	1.02	299.20	2.17		
298.20	1.06	299.22	2.24		
298.22	1.10	299.24	2.34		
298.24	1.13	299.26	2.46		
298.26	1.16	299.28	2.61		
298.28	1.19	299.30	2.77		
298.30	1.22	299.32	2.95		
298.32	1.25	299.34	3.14		
298.34	1.28	299.36	3.34		
298.36	1.31	299.38	3.51		
298.38	1.33	299.40	3.53		
298.40	1.36	299.42	3.56		
298.42	1.39	299.44	3.58		
298.44	1.41	299.46	3.61		
298.46	1.44	299.48	3.63		
298.48	1.46	299.50	3.66		
298.50	1.49	299.52	3.68		

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

Printed 3/15/2024

Page 46

Stage-Area-Storage for Pond 7P: Detention Basin-2

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
297.50	0	298.52	4,585	299.54	8,991
297.52	90	298.54	4,675	299.56	8,991
297.54	180	298.56	4,765	299.58	8,991
297.56	270	298.58	4,855	299.60	8,991
297.58	360	298.60	4,945	299.62	8,991
297.60	450	298.62	5,035	299.64	8,991
297.62	539	298.64	5,125	299.66	8,991
297.64	629	298.66	5,215	299.68	8,991
297.66	719	298.68	5,305	299.70	8,991
297.68	809	298.70	5,395	299.72	8,991
297.70	899	298.72	5,485	299.74	8,991
297.72	989	298.74	5,574	299.76	8,991
297.74	1,079	298.76	5,664	299.78	8,991
297.76	1,169	298.78	5,754	299.80	8,991
297.78	1,259	298.80	5,844	299.82	8,991
297.80	1,349	298.82	5,934	299.84	8,991
297.82	1,439	298.84	6,024	299.86	8,991
297.84	1,528	298.86	6,114	299.88	8,991
297.86	1,618	298.88	6,204	299.90	8,991
297.88	1,708	298.90	6,294	299.92	8,991
297.90	1,798	298.92	6,384	299.94	8,991
297.92	1,888	298.94	6,474	299.96	8,991
297.94	1,978	298.96	6,563	299.98	8,991
297.96	2,068	298.98	6,653	300.00	8,991
297.98	2,158	299.00	6,743	300.02	8,991
298.00	2,248	299.02	6,833	300.04	8,991
298.02	2,338	299.04	6,923	300.06	8,991
298.04	2,428	299.06	7,013	300.08	8,991
298.06	2,517	299.08	7,103	300.10	8,991
298.08	2,607	299.10	7,193	300.12	8,991
298.10	2,697	299.12	7,283	300.14	8,991
298.12	2,787	299.14	7,373	300.16	8,991
298.14	2,877	299.16	7,463		
298.16	2,967	299.18	7,552		
298.18	3,057	299.20	7,642		
298.20	3,147	299.22	7,732		
298.22	3,237	299.24	7,822		
298.24	3,327	299.26	7,912		
298.26	3,417	299.28	8,002		
298.28	3,506	299.30	8,092		
298.30	3,596	299.32	8,182		
298.32	3,686	299.34	8,272		
298.34	3,776	299.36	8,362		
298.36	3,866	299.38	8,452		
298.38	3,956	299.40	8,541		
298.40	4,046	299.42	8,631		
298.42	4,136	299.44	8,721		
298.44	4,226	299.46	8,811		
298.46	4,316	299.48	8,901		
298.48	4,406	299.50	8,991		
298.50	4,496	299.52	8,991		

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 47

Summary for Pond 10P: Detention Basin-3

Inflow Area = 96,059 sf, 5.22% Impervious, Inflow Depth = 0.41" for 2-year Storm event
 Inflow = 0.91 cfs @ 12.17 hrs, Volume= 3,278 cf
 Outflow = 0.59 cfs @ 12.31 hrs, Volume= 3,291 cf, Atten= 34%, Lag= 8.6 min
 Primary = 0.59 cfs @ 12.31 hrs, Volume= 3,291 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 310.65' @ 12.31 hrs Surf.Area= 1,191 sf Storage= 157 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 1.4 min (878.9 - 877.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	310.00'	0 cf	20.69'W x 57.58'L x 8.17'H Field A 9,729 cf Overall - 9,729 cf Embedded = 0 cf x 40.0% Voids
#2A	310.00'	7,512 cf	StormTrap ST1 DoubleTrap 7-0x 12 Inside #1 Inside= 82.7"W x 84.0"H => 44.52 sf x 14.06'L = 626.0 cf Outside= 82.7"W x 98.0"H => 56.32 sf x 14.06'L = 791.9 cf 3 Rows adjusted for 406.0 cf perimeter wall 20.69' x 56.25' Core + 0.00' x 0.67' Border = 20.69' x 57.58' System
		7,512 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	310.00'	12.0" Round Culvert L= 200.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 310.00' / 300.00' S= 0.0500 '/' Cc= 0.900 n= 0.009 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	310.00'	6.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	313.35'	5.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Device 1	316.50'	Custom Weir/Orifice, Cv= 2.62 (C= 3.28) Head (feet) 0.00 0.50 Width (feet) 5.00 5.00

Primary OutFlow Max=0.59 cfs @ 12.31 hrs HW=310.64' TW=300.56' (Dynamic Tailwater)

- 1=Culvert (Passes 0.59 cfs of 1.16 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.59 cfs @ 3.03 fps)
- 3=Orifice/Grate (Controls 0.00 cfs)
- 4=Custom Weir/Orifice (Controls 0.00 cfs)

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Pond 10P: Detention Basin-3 - Chamber Wizard Field A

Chamber Model = StormTrapST1 DoubleTrap 7-0 (StormTrapST1 DoubleTrap®Type I/III/VI)

Inside= 82.7"W x 84.0"H => 44.52 sf x 14.06'L = 626.0 cf

Outside= 82.7"W x 98.0"H => 56.32 sf x 14.06'L = 791.9 cf

3 Rows adjusted for 406.0 cf perimeter wall

4 Chambers/Row x 14.06' Long = 56.25' Row Length +8.0" Border x 2 = 57.58' Base Length

3 Rows x 82.7" Wide = 20.69' Base Width

98.0" Chamber Height = 8.17' Field Height

20.0 cf Sidewall x 4 x 2 + 41.0 cf Endwall x 3 x 2 = 406.0 cf Perimeter Wall

12 Chambers x 626.0 cf - 406.0 cf Perimeter wall = 7,105.9 cf Chamber Storage

12 Chambers x 791.9 cf + 225.3 cf Border = 9,728.6 cf Displacement

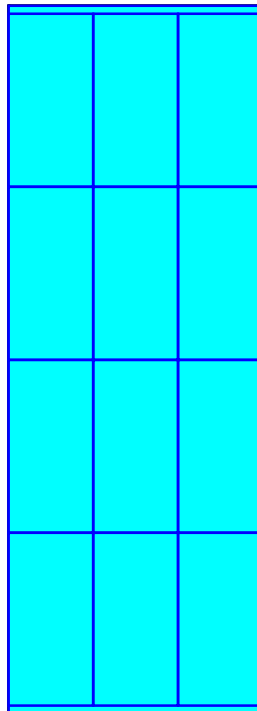
Chamber Storage = 7,105.9 cf = 0.163 af

Overall Storage Efficiency = 73.0%

Overall System Size = 57.58' x 20.69' x 8.17'

12 Chambers (plus border)

360.3 cy Field



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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 49

Stage-Discharge for Pond 10P: Detention Basin-3

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
310.00	0.00	312.55	1.43	315.10	2.90	317.65	7.98
310.05	0.01	312.60	1.45	315.15	2.92	317.70	8.01
310.10	0.03	312.65	1.46	315.20	2.94	317.75	8.04
310.15	0.07	312.70	1.48	315.25	2.97	317.80	8.07
310.20	0.11	312.75	1.49	315.30	2.99	317.85	8.09
310.25	0.17	312.80	1.51	315.35	3.01	317.90	8.12
310.30	0.23	312.85	1.52	315.40	3.04	317.95	8.15
310.35	0.30	312.90	1.54	315.45	3.06	318.00	8.18
310.40	0.36	312.95	1.55	315.50	3.08	318.05	8.20
310.45	0.43	313.00	1.57	315.55	3.10	318.10	8.23
310.50	0.47	313.05	1.58	315.60	3.12	318.15	8.26
310.55	0.52	313.10	1.60	315.65	3.15		
310.60	0.56	313.15	1.61	315.70	3.17		
310.65	0.60	313.20	1.62	315.75	3.19		
310.70	0.63	313.25	1.64	315.80	3.21		
310.75	0.67	313.30	1.65	315.85	3.23		
310.80	0.70	313.35	1.66	315.90	3.25		
310.85	0.73	313.40	1.69	315.95	3.27		
310.90	0.76	313.45	1.72	316.00	3.29		
310.95	0.79	313.50	1.76	316.05	3.31		
311.00	0.82	313.55	1.82	316.10	3.33		
311.05	0.85	313.60	1.88	316.15	3.35		
311.10	0.87	313.65	1.94	316.20	3.37		
311.15	0.90	313.70	2.00	316.25	3.39		
311.20	0.92	313.75	2.06	316.30	3.41		
311.25	0.95	313.80	2.10	316.35	3.43		
311.30	0.97	313.85	2.15	316.40	3.45		
311.35	0.99	313.90	2.19	316.45	3.47		
311.40	1.01	313.95	2.23	316.50	3.49		
311.45	1.04	314.00	2.27	316.55	3.69		
311.50	1.06	314.05	2.30	316.60	4.05		
311.55	1.08	314.10	2.34	316.65	4.50		
311.60	1.10	314.15	2.37	316.70	5.03		
311.65	1.12	314.20	2.40	316.75	5.63		
311.70	1.14	314.25	2.44	316.80	6.29		
311.75	1.16	314.30	2.47	316.85	7.01		
311.80	1.18	314.35	2.50	316.90	7.55		
311.85	1.20	314.40	2.53	316.95	7.58		
311.90	1.21	314.45	2.56	317.00	7.61		
311.95	1.23	314.50	2.59	317.05	7.64		
312.00	1.25	314.55	2.61	317.10	7.67		
312.05	1.27	314.60	2.64	317.15	7.70		
312.10	1.29	314.65	2.67	317.20	7.73		
312.15	1.30	314.70	2.70	317.25	7.76		
312.20	1.32	314.75	2.72	317.30	7.79		
312.25	1.34	314.80	2.75	317.35	7.81		
312.30	1.35	314.85	2.77	317.40	7.84		
312.35	1.37	314.90	2.80	317.45	7.87		
312.40	1.39	314.95	2.82	317.50	7.90		
312.45	1.40	315.00	2.85	317.55	7.93		
312.50	1.42	315.05	2.87	317.60	7.96		

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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 50

Stage-Area-Storage for Pond 10P: Detention Basin-3

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
310.00	0	315.10	4,936
310.10	0	315.20	5,044
310.20	0	315.30	5,151
310.30	0	315.40	5,258
310.40	0	315.50	5,366
310.50	0	315.60	5,473
310.60	107	315.70	5,580
310.70	215	315.80	5,688
310.80	322	315.90	5,795
310.90	429	316.00	5,902
311.00	537	316.10	6,010
311.10	644	316.20	6,117
311.20	751	316.30	6,224
311.30	859	316.40	6,332
311.40	966	316.50	6,439
311.50	1,073	316.60	6,546
311.60	1,180	316.70	6,653
311.70	1,288	316.80	6,761
311.80	1,395	316.90	6,868
311.90	1,502	317.00	6,975
312.00	1,610	317.10	7,083
312.10	1,717	317.20	7,190
312.20	1,824	317.30	7,297
312.30	1,932	317.40	7,405
312.40	2,039	317.50	7,512
312.50	2,146	317.60	7,512
312.60	2,254	317.70	7,512
312.70	2,361	317.80	7,512
312.80	2,468	317.90	7,512
312.90	2,576	318.00	7,512
313.00	2,683	318.10	7,512
313.10	2,790		
313.20	2,897		
313.30	3,005		
313.40	3,112		
313.50	3,219		
313.60	3,327		
313.70	3,434		
313.80	3,541		
313.90	3,649		
314.00	3,756		
314.10	3,863		
314.20	3,971		
314.30	4,078		
314.40	4,185		
314.50	4,293		
314.60	4,400		
314.70	4,507		
314.80	4,614		
314.90	4,722		
315.00	4,829		

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 51

Summary for Link 1L: DP-1 Mass-DOT West

Inflow Area = 1,142 sf, 60.31% Impervious, Inflow Depth = 1.68" for 2-year Storm event
Inflow = 0.07 cfs @ 12.13 hrs, Volume= 159 cf
Primary = 0.07 cfs @ 12.13 hrs, Volume= 159 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 52

Summary for Link 2L: DP-2 Mass-DOT East

Inflow Area = 195,291 sf, 38.40% Impervious, Inflow Depth > 1.11" for 2-year Storm event
Inflow = 2.77 cfs @ 12.46 hrs, Volume= 18,058 cf
Primary = 2.77 cfs @ 12.46 hrs, Volume= 18,058 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 53

Summary for Link 3L: DP-3 Bank Parking Lot

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 54

Summary for Link 4L: _placeholder

Inflow Area = 196,433 sf, 38.52% Impervious, Inflow Depth > 1.11" for 2-year Storm event
Inflow = 2.78 cfs @ 12.46 hrs, Volume= 18,217 cf
Primary = 2.78 cfs @ 12.46 hrs, Volume= 18,217 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 55

Summary for Link 8L: center CB

Inflow Area = 55,328 sf, 61.79% Impervious, Inflow Depth > 1.86" for 2-year Storm event
Inflow = 1.20 cfs @ 12.26 hrs, Volume= 8,571 cf
Primary = 1.20 cfs @ 12.26 hrs, Volume= 8,571 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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23141.00 Proposed Conditions 2-yr Storm
NOAA 24-hr A 2-year Storm Rainfall=3.28"

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Page 56

Summary for Link 9L: east CB

Inflow Area = 139,963 sf, 29.15% Impervious, Inflow Depth > 0.81" for 2-year Storm event
Inflow = 1.65 cfs @ 12.46 hrs, Volume= 9,487 cf
Primary = 1.65 cfs @ 12.46 hrs, Volume= 9,487 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

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23141.00 Proposed Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 10-year Storm Rainfall=5.02"

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Page 1

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPDA-1: Subcat PDA-1	Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=3.19" Tc=6.0 min CN=83 Runoff=0.14 cfs 304 cf
SubcatchmentPDA-2A: Subcat PDA-2A	Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=3.19" Tc=6.0 min CN=83 Runoff=0.39 cfs 850 cf
SubcatchmentPDA-2B: Subcat PDA-2B	Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=4.33" Tc=6.0 min CN=94 Runoff=0.26 cfs 624 cf
SubcatchmentPDA-2C: Subcat PDA-2C	Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=2.30" Tc=6.0 min CN=73 Runoff=0.53 cfs 1,137 cf
SubcatchmentPDA-2D: Subcat PDA-2D	Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=1.74" Tc=6.0 min CN=66 Runoff=0.16 cfs 338 cf
SubcatchmentPDA-2E: Subcat PDA-2E	Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=4.78" Tc=6.0 min CN=98 Runoff=0.52 cfs 1,328 cf
SubcatchmentPDA-2F: Subcat PDA-2F	Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=4.33" Tc=6.0 min CN=94 Runoff=0.62 cfs 1,469 cf
SubcatchmentPDA-2G: Subcat PDA-2G	Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=3.39" Tc=6.0 min CN=85 Runoff=0.41 cfs 900 cf
SubcatchmentPDA-2H: Subcat PDA-2H	Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=4.33" Tc=6.0 min CN=94 Runoff=0.55 cfs 1,306 cf
SubcatchmentPDA-2I: Subcat PDA-2I	Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=1.38" Tc=6.0 min CN=61 Runoff=0.16 cfs 344 cf
SubcatchmentPDA-2J: Subcat PDA-2J	Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=4.33" Tc=6.0 min CN=94 Runoff=2.24 cfs 5,352 cf
SubcatchmentPDA-2K: Subcat PDA-2K	Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=1.59" Tc=6.0 min CN=64 Runoff=0.32 cfs 702 cf
SubcatchmentPDA-2L: Subcat PDA-2L	Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=4.22" Tc=6.0 min CN=93 Runoff=2.00 cfs 4,708 cf
SubcatchmentPDA-2M: Subcat PDA-2M	Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=3.39" Tc=6.0 min CN=85 Runoff=0.96 cfs 2,117 cf
SubcatchmentPDA-2N: Subcat PDA-2N	Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=1.38" Tc=6.0 min CN=61 Runoff=0.24 cfs 537 cf
SubcatchmentPDA-2O: Subcat PDA-2O	Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=1.05" Flow Length=391' Tc=9.3 min CN=56 Runoff=1.87 cfs 5,189 cf

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23141.00 Proposed Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 10-year Storm Rainfall=5.02"

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Page 2

SubcatchmentPDA-2P: Subcat PDA-2P	Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.99" Tc=6.0 min CN=55 Runoff=0.51 cfs 1,210 cf
SubcatchmentPDA-2Q: Subcat PDA-2Q	Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=1.89" Tc=6.0 min CN=68 Runoff=1.64 cfs 3,503 cf
SubcatchmentPDA-2R: Subcat PDA-2R	Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=1.38" Tc=6.0 min CN=61 Runoff=0.08 cfs 182 cf
SubcatchmentPDA-ROOF1: Subcat	Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=4.78" Tc=6.0 min CN=98 Runoff=1.11 cfs 2,816 cf
SubcatchmentPDA-ROOF2: Subcat	Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=4.78" Tc=6.0 min CN=98 Runoff=1.86 cfs 4,738 cf
SubcatchmentPDA-ROOF3: Subcat	Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=4.78" Tc=6.0 min CN=98 Runoff=0.41 cfs 1,044 cf
Pond 1P: UGIS-1	Peak Elev=299.77' Storage=246 cf Inflow=0.24 cfs 537 cf Discarded=0.02 cfs 537 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 537 cf
Pond 4P: UGIS-2	Peak Elev=300.37' Storage=293 cf Inflow=1.86 cfs 4,738 cf Discarded=0.01 cfs 883 cf Primary=1.82 cfs 3,855 cf Outflow=1.83 cfs 4,738 cf
Pond 5P: UGIS-3	Peak Elev=300.99' Storage=772 cf Inflow=1.40 cfs 10,095 cf Discarded=0.04 cfs 2,293 cf Primary=1.40 cfs 7,801 cf Outflow=1.44 cfs 10,095 cf
Pond 6P: Detention Basin-1	Peak Elev=297.79' Storage=5,786 cf Inflow=5.77 cfs 13,226 cf Outflow=1.52 cfs 13,188 cf
Pond 7P: Detention Basin-2	Peak Elev=298.73' Storage=5,518 cf Inflow=6.01 cfs 14,191 cf Outflow=1.74 cfs 14,145 cf
Pond 10P: Detention Basin-3	Peak Elev=312.39' Storage=2,026 cf Inflow=3.86 cfs 9,902 cf Outflow=1.38 cfs 9,913 cf
Link 1L: DP-1 Mass-DOT West	Inflow=0.14 cfs 304 cf Primary=0.14 cfs 304 cf
Link 2L: DP-2 Mass-DOT East	Inflow=4.89 cfs 36,608 cf Primary=4.89 cfs 36,608 cf
Link 3L: DP-3 Bank Parking Lot	Primary=0.00 cfs 0 cf
Link 4L: _placeholder	Inflow=5.07 cfs 36,912 cf Primary=5.07 cfs 36,912 cf
Link 8L: center CB	Inflow=1.90 cfs 14,994 cf Primary=1.90 cfs 14,994 cf

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23141.00 Proposed Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 10-year Storm Rainfall=5.02"

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Page 3

Link 9L: east CB

Inflow=2.99 cfs 21,613 cf

Primary=2.99 cfs 21,613 cf

Total Runoff Area = 196,433 sf Runoff Volume = 40,697 cf Average Runoff Depth = 2.49"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

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23141.00 Proposed Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 25-year Storm Rainfall=6.10"

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Page 4

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPDA-1: Subcat PDA-1	Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=4.18" Tc=6.0 min CN=83 Runoff=0.18 cfs 398 cf
SubcatchmentPDA-2A: Subcat PDA-2A	Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=4.18" Tc=6.0 min CN=83 Runoff=0.50 cfs 1,114 cf
SubcatchmentPDA-2B: Subcat PDA-2B	Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=5.40" Tc=6.0 min CN=94 Runoff=0.32 cfs 778 cf
SubcatchmentPDA-2C: Subcat PDA-2C	Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=3.17" Tc=6.0 min CN=73 Runoff=0.73 cfs 1,571 cf
SubcatchmentPDA-2D: Subcat PDA-2D	Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=2.51" Tc=6.0 min CN=66 Runoff=0.23 cfs 488 cf
SubcatchmentPDA-2E: Subcat PDA-2E	Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=5.86" Tc=6.0 min CN=98 Runoff=0.64 cfs 1,628 cf
SubcatchmentPDA-2F: Subcat PDA-2F	Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=5.40" Tc=6.0 min CN=94 Runoff=0.76 cfs 1,831 cf
SubcatchmentPDA-2G: Subcat PDA-2G	Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=4.40" Tc=6.0 min CN=85 Runoff=0.52 cfs 1,169 cf
SubcatchmentPDA-2H: Subcat PDA-2H	Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=5.40" Tc=6.0 min CN=94 Runoff=0.67 cfs 1,628 cf
SubcatchmentPDA-2I: Subcat PDA-2I	Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=2.07" Tc=6.0 min CN=61 Runoff=0.24 cfs 516 cf
SubcatchmentPDA-2J: Subcat PDA-2J	Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=5.40" Tc=6.0 min CN=94 Runoff=2.76 cfs 6,673 cf
SubcatchmentPDA-2K: Subcat PDA-2K	Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=2.33" Tc=6.0 min CN=64 Runoff=0.48 cfs 1,028 cf
SubcatchmentPDA-2L: Subcat PDA-2L	Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=5.28" Tc=6.0 min CN=93 Runoff=2.47 cfs 5,895 cf
SubcatchmentPDA-2M: Subcat PDA-2M	Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=4.40" Tc=6.0 min CN=85 Runoff=1.23 cfs 2,749 cf
SubcatchmentPDA-2N: Subcat PDA-2N	Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=2.07" Tc=6.0 min CN=61 Runoff=0.37 cfs 805 cf
SubcatchmentPDA-2O: Subcat PDA-2O	Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=1.66" Flow Length=391' Tc=9.3 min CN=56 Runoff=3.14 cfs 8,167 cf

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23141.00 Proposed Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 25-year Storm Rainfall=6.10"

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Page 5

SubcatchmentPDA-2P: Subcat PDA-2P	Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=1.58" Tc=6.0 min CN=55 Runoff=0.86 cfs 1,926 cf
SubcatchmentPDA-2Q: Subcat PDA-2Q	Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=2.70" Tc=6.0 min CN=68 Runoff=2.34 cfs 4,990 cf
SubcatchmentPDA-2R: Subcat PDA-2R	Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=2.07" Tc=6.0 min CN=61 Runoff=0.13 cfs 273 cf
SubcatchmentPDA-ROOF1: Subcat	Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=5.86" Tc=6.0 min CN=98 Runoff=1.35 cfs 3,451 cf
SubcatchmentPDA-ROOF2: Subcat	Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=5.86" Tc=6.0 min CN=98 Runoff=2.27 cfs 5,807 cf
SubcatchmentPDA-ROOF3: Subcat	Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=5.86" Tc=6.0 min CN=98 Runoff=0.50 cfs 1,280 cf
Pond 1P: UGIS-1	Peak Elev=300.18' Storage=424 cf Inflow=0.37 cfs 805 cf Discarded=0.02 cfs 805 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 805 cf
Pond 4P: UGIS-2	Peak Elev=300.53' Storage=314 cf Inflow=2.27 cfs 5,807 cf Discarded=0.01 cfs 918 cf Primary=2.24 cfs 4,888 cf Outflow=2.25 cfs 5,807 cf
Pond 5P: UGIS-3	Peak Elev=301.06' Storage=796 cf Inflow=2.25 cfs 15,370 cf Discarded=0.04 cfs 2,343 cf Primary=2.21 cfs 13,027 cf Outflow=2.25 cfs 15,370 cf
Pond 6P: Detention Basin-1	Peak Elev=298.10' Storage=7,198 cf Inflow=7.16 cfs 16,705 cf Outflow=1.77 cfs 16,667 cf
Pond 7P: Detention Basin-2	Peak Elev=299.06' Storage=7,016 cf Inflow=7.62 cfs 18,091 cf Outflow=2.06 cfs 18,044 cf
Pond 10P: Detention Basin-3	Peak Elev=313.94' Storage=3,688 cf Inflow=6.17 cfs 15,084 cf Outflow=2.22 cfs 15,098 cf
Link 1L: DP-1 Mass-DOT West	Inflow=0.18 cfs 398 cf Primary=0.18 cfs 398 cf
Link 2L: DP-2 Mass-DOT East	Inflow=6.25 cfs 49,629 cf Primary=6.25 cfs 49,629 cf
Link 3L: DP-3 Bank Parking Lot	Primary=0.00 cfs 0 cf
Link 4L: _placeholder	Inflow=6.30 cfs 50,028 cf Primary=6.30 cfs 50,028 cf
Link 8L: center CB	Inflow=2.27 cfs 19,157 cf Primary=2.27 cfs 19,157 cf

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23141.00 Proposed Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 25-year Storm Rainfall=6.10"

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Page 6

Link 9L: east CB

Inflow=4.07 cfs 30,472 cf

Primary=4.07 cfs 30,472 cf

Total Runoff Area = 196,433 sf Runoff Volume = 54,165 cf Average Runoff Depth = 3.31"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

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23141.00 Proposed Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 100-year Storm Rainfall=7.77"

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Page 7

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPDA-1: Subcat PDA-1	Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=5.76" Tc=6.0 min CN=83 Runoff=0.24 cfs 548 cf
SubcatchmentPDA-2A: Subcat PDA-2A	Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=5.76" Tc=6.0 min CN=83 Runoff=0.68 cfs 1,532 cf
SubcatchmentPDA-2B: Subcat PDA-2B	Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=7.05" Tc=6.0 min CN=94 Runoff=0.41 cfs 1,017 cf
SubcatchmentPDA-2C: Subcat PDA-2C	Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=4.61" Tc=6.0 min CN=73 Runoff=1.05 cfs 2,282 cf
SubcatchmentPDA-2D: Subcat PDA-2D	Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=3.82" Tc=6.0 min CN=66 Runoff=0.35 cfs 741 cf
SubcatchmentPDA-2E: Subcat PDA-2E	Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=7.53" Tc=6.0 min CN=98 Runoff=0.81 cfs 2,091 cf
SubcatchmentPDA-2F: Subcat PDA-2F	Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=7.05" Tc=6.0 min CN=94 Runoff=0.97 cfs 2,393 cf
SubcatchmentPDA-2G: Subcat PDA-2G	Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=5.99" Tc=6.0 min CN=85 Runoff=0.70 cfs 1,593 cf
SubcatchmentPDA-2H: Subcat PDA-2H	Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=7.05" Tc=6.0 min CN=94 Runoff=0.87 cfs 2,128 cf
SubcatchmentPDA-2I: Subcat PDA-2I	Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=3.27" Tc=6.0 min CN=61 Runoff=0.38 cfs 814 cf
SubcatchmentPDA-2J: Subcat PDA-2J	Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=7.05" Tc=6.0 min CN=94 Runoff=3.55 cfs 8,723 cf
SubcatchmentPDA-2K: Subcat PDA-2K	Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=3.60" Tc=6.0 min CN=64 Runoff=0.74 cfs 1,584 cf
SubcatchmentPDA-2L: Subcat PDA-2L	Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=6.93" Tc=6.0 min CN=93 Runoff=3.18 cfs 7,741 cf
SubcatchmentPDA-2M: Subcat PDA-2M	Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=5.99" Tc=6.0 min CN=85 Runoff=1.64 cfs 3,746 cf
SubcatchmentPDA-2N: Subcat PDA-2N	Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=3.27" Tc=6.0 min CN=61 Runoff=0.60 cfs 1,270 cf
SubcatchmentPDA-2O: Subcat PDA-2O	Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=2.73" Flow Length=391' Tc=9.3 min CN=56 Runoff=5.39 cfs 13,484 cf

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NOAA 24-hr A 100-year Storm Rainfall=7.77"

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Page 8

SubcatchmentPDA-2P: Subcat PDA-2P	Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=2.63" Tc=6.0 min CN=55 Runoff=1.49 cfs 3,213 cf
SubcatchmentPDA-2Q: Subcat PDA-2Q	Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=4.04" Tc=6.0 min CN=68 Runoff=3.49 cfs 7,477 cf
SubcatchmentPDA-2R: Subcat PDA-2R	Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=3.27" Tc=6.0 min CN=61 Runoff=0.20 cfs 430 cf
SubcatchmentPDA-ROOF1: Subcat	Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=7.53" Tc=6.0 min CN=98 Runoff=1.72 cfs 4,434 cf
SubcatchmentPDA-ROOF2: Subcat	Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=7.53" Tc=6.0 min CN=98 Runoff=2.89 cfs 7,460 cf
SubcatchmentPDA-ROOF3: Subcat	Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=7.53" Tc=6.0 min CN=98 Runoff=0.64 cfs 1,644 cf
Pond 1P: UGIS-1	Peak Elev=300.54' Storage=542 cf Inflow=0.60 cfs 1,270 cf Discarded=0.02 cfs 1,048 cf Primary=0.15 cfs 222 cf Outflow=0.18 cfs 1,270 cf
Pond 4P: UGIS-2	Peak Elev=300.62' Storage=324 cf Inflow=2.89 cfs 7,460 cf Discarded=0.01 cfs 955 cf Primary=2.91 cfs 6,505 cf Outflow=2.92 cfs 7,460 cf
Pond 5P: UGIS-3	Peak Elev=301.46' Storage=939 cf Inflow=3.81 cfs 24,613 cf Discarded=0.04 cfs 2,426 cf Primary=3.61 cfs 22,187 cf Outflow=3.65 cfs 24,613 cf
Pond 6P: Detention Basin-1	Peak Elev=298.46' Storage=8,800 cf Inflow=9.37 cfs 22,156 cf Outflow=3.54 cfs 22,118 cf
Pond 7P: Detention Basin-2	Peak Elev=299.47' Storage=8,846 cf Inflow=10.14 cfs 24,486 cf Outflow=3.62 cfs 24,439 cf
Pond 10P: Detention Basin-3	Peak Elev=316.57' Storage=6,517 cf Inflow=10.15 cfs 24,174 cf Outflow=3.75 cfs 24,183 cf
Link 1L: DP-1 Mass-DOT West	Inflow=0.24 cfs 548 cf Primary=0.24 cfs 548 cf
Link 2L: DP-2 Mass-DOT East	Inflow=10.83 cfs 71,293 cf Primary=10.83 cfs 71,293 cf
Link 3L: DP-3 Bank Parking Lot	Primary=0.00 cfs 0 cf
Link 4L: _placeholder	Inflow=10.91 cfs 71,841 cf Primary=10.91 cfs 71,841 cf
Link 8L: center CB	Inflow=4.07 cfs 25,971 cf Primary=4.07 cfs 25,971 cf

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23141.00 Proposed Conditions 10, 25, 100-yr Storm

NOAA 24-hr A 100-year Storm Rainfall=7.77"

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Page 9

Link 9L: east CB

Inflow=6.98 cfs 45,321 cf

Primary=6.98 cfs 45,321 cf

Total Runoff Area = 196,433 sf Runoff Volume = 76,346 cf Average Runoff Depth = 4.66"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

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23141.00 Proposed Conditions WQv 1.2" Storm

NOAA 24-hr A WQv 1.2" Rainfall=1.20"

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Page 1

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentPDA-1: Subcat PDA-1	Runoff Area=1,142 sf 60.31% Impervious Runoff Depth=0.59" Tc=6.0 min CN=61/98 Runoff=0.02 cfs 57 cf
SubcatchmentPDA-2A: Subcat PDA-2A	Runoff Area=3,194 sf 58.96% Impervious Runoff Depth=0.58" Tc=6.0 min CN=61/98 Runoff=0.07 cfs 155 cf
SubcatchmentPDA-2B: Subcat PDA-2B	Runoff Area=1,730 sf 90.08% Impervious Runoff Depth=0.89" Tc=6.0 min CN=61/98 Runoff=0.05 cfs 128 cf
SubcatchmentPDA-2C: Subcat PDA-2C	Runoff Area=5,944 sf 32.21% Impervious Runoff Depth=0.32" Tc=6.0 min CN=61/98 Runoff=0.07 cfs 157 cf
SubcatchmentPDA-2D: Subcat PDA-2D	Runoff Area=2,329 sf 14.02% Impervious Runoff Depth=0.14" Tc=6.0 min CN=61/98 Runoff=0.01 cfs 27 cf
SubcatchmentPDA-2E: Subcat PDA-2E	Runoff Area=3,332 sf 100.00% Impervious Runoff Depth=0.99" Tc=6.0 min CN=0/98 Runoff=0.12 cfs 274 cf
SubcatchmentPDA-2F: Subcat PDA-2F	Runoff Area=4,072 sf 90.43% Impervious Runoff Depth=0.89" Tc=6.0 min CN=61/98 Runoff=0.13 cfs 302 cf
SubcatchmentPDA-2G: Subcat PDA-2G	Runoff Area=3,190 sf 65.14% Impervious Runoff Depth=0.64" Tc=6.0 min CN=61/98 Runoff=0.07 cfs 171 cf
SubcatchmentPDA-2H: Subcat PDA-2H	Runoff Area=3,620 sf 89.40% Impervious Runoff Depth=0.88" Tc=6.0 min CN=61/98 Runoff=0.11 cfs 266 cf
SubcatchmentPDA-2I: Subcat PDA-2I	Runoff Area=2,986 sf 1.23% Impervious Runoff Depth=0.01" Tc=6.0 min CN=61/98 Runoff=0.00 cfs 3 cf
SubcatchmentPDA-2J: Subcat PDA-2J	Runoff Area=14,841 sf 89.63% Impervious Runoff Depth=0.88" Tc=6.0 min CN=61/98 Runoff=0.47 cfs 1,093 cf
SubcatchmentPDA-2K: Subcat PDA-2K	Runoff Area=5,283 sf 8.23% Impervious Runoff Depth=0.08" Tc=6.0 min CN=61/98 Runoff=0.02 cfs 36 cf
SubcatchmentPDA-2L: Subcat PDA-2L	Runoff Area=13,395 sf 87.78% Impervious Runoff Depth=0.87" Tc=6.0 min CN=61/98 Runoff=0.41 cfs 966 cf
SubcatchmentPDA-2M: Subcat PDA-2M	Runoff Area=7,503 sf 65.16% Impervious Runoff Depth=0.64" Tc=6.0 min CN=61/98 Runoff=0.17 cfs 402 cf
SubcatchmentPDA-2N: Subcat PDA-2N	Runoff Area=4,661 sf 0.00% Impervious Runoff Depth=0.00" Tc=6.0 min CN=61/0 Runoff=0.00 cfs 0 cf
SubcatchmentPDA-2O: Subcat PDA-2O	Runoff Area=59,192 sf 0.00% Impervious Runoff Depth=0.00" Flow Length=391' Tc=9.3 min CN=56/0 Runoff=0.00 cfs 0 cf

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23141.00 Proposed Conditions WQv 1.2" Storm

NOAA 24-hr A WQv 1.2" Rainfall=1.20"

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Page 2

SubcatchmentPDA-2P: Subcat PDA-2P	Runoff Area=14,672 sf 0.00% Impervious Runoff Depth=0.00" Tc=6.0 min CN=55/0 Runoff=0.00 cfs 0 cf
SubcatchmentPDA-2Q: Subcat PDA-2Q	Runoff Area=22,194 sf 22.59% Impervious Runoff Depth=0.22" Tc=6.0 min CN=59/98 Runoff=0.18 cfs 412 cf
SubcatchmentPDA-2R: Subcat PDA-2R	Runoff Area=1,578 sf 0.00% Impervious Runoff Depth=0.00" Tc=6.0 min CN=61/0 Runoff=0.00 cfs 0 cf
SubcatchmentPDA-ROOF1: Subcat	Runoff Area=7,065 sf 99.84% Impervious Runoff Depth=0.98" Tc=6.0 min CN=61/98 Runoff=0.25 cfs 579 cf
SubcatchmentPDA-ROOF2: Subcat	Runoff Area=11,888 sf 99.99% Impervious Runoff Depth=0.99" Tc=6.0 min CN=61/98 Runoff=0.42 cfs 976 cf
SubcatchmentPDA-ROOF3: Subcat	Runoff Area=2,620 sf 99.07% Impervious Runoff Depth=0.98" Tc=6.0 min CN=61/98 Runoff=0.09 cfs 213 cf
Pond 1P: UGIS-1	Peak Elev=299.00' Storage=0 cf Inflow=0.00 cfs 0 cf Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf
Pond 4P: UGIS-2	Peak Elev=299.85' Storage=193 cf Inflow=0.42 cfs 976 cf Discarded=0.01 cfs 457 cf Primary=0.38 cfs 519 cf Outflow=0.39 cfs 976 cf
Pond 5P: UGIS-3	Peak Elev=299.91' Storage=148 cf Inflow=0.18 cfs 412 cf Discarded=0.03 cfs 412 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 412 cf
Pond 6P: Detention Basin-1	Peak Elev=296.80' Storage=1,340 cf Inflow=1.16 cfs 2,354 cf Outflow=0.20 cfs 2,319 cf
Pond 7P: Detention Basin-2	Peak Elev=297.81' Storage=1,377 cf Inflow=1.14 cfs 2,653 cf Outflow=0.25 cfs 2,610 cf
Pond 10P: Detention Basin-3	Peak Elev=310.26' Storage=0 cf Inflow=0.18 cfs 412 cf Outflow=0.18 cfs 412 cf
Link 1L: DP-1 Mass-DOT West	Inflow=0.02 cfs 57 cf Primary=0.02 cfs 57 cf
Link 2L: DP-2 Mass-DOT East	Inflow=0.47 cfs 5,212 cf Primary=0.47 cfs 5,212 cf
Link 3L: DP-3 Bank Parking Lot	Primary=0.00 cfs 0 cf
Link 4L: _placeholder	Inflow=0.48 cfs 5,268 cf Primary=0.48 cfs 5,268 cf
Link 8L: center CB	Inflow=0.26 cfs 2,764 cf Primary=0.26 cfs 2,764 cf

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23141.00 Proposed Conditions WQv 1.2" Storm

NOAA 24-hr A WQv 1.2" Rainfall=1.20"

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Page 3

Link 9L: east CB

Inflow=0.21 cfs 2,447 cf

Primary=0.21 cfs 2,447 cf

Total Runoff Area = 196,433 sf Runoff Volume = 6,215 cf Average Runoff Depth = 0.38"
61.48% Pervious = 120,761 sf 38.52% Impervious = 75,671 sf

Hydraulic Design Table (25-year Design Storm)

Date 3/18/2023

Initials AJM

From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Total Drop	Average Slope	Pipe Diameter or Height	Manning's Roughness	Peak Flow	Max Flow Velocity	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio
Column1	Column2	(ft)	(ft)3	(ft)5	(ft)7	(%)	(inches)	Column10	(cfs)16	(ft/sec)	(cfs)17	Column18	Column19
DB-2	OCS-03	29.79	297.50	297.34	0.16	0.5400	12.000	0.0120	2.74	4.68	2.83	0.97	0.89
DB-01	OCS-02	34.77	296.50	296.27	0.23	0.6600	12.000	0.0120	1.82	2.79	3.14	0.58	0.99
OCS-04	OCS-02	12.49	297.30	297.00	0.30	2.4000	12.000	0.0150	2.23	4.91	4.79	0.47	0.56
UGIS-02	OCS-01	9.28	299.50	299.15	0.35	3.7700	12.000	0.0150	2.24	5.50	6.00	0.37	0.52
UGIS-01	OCS-06	5.79	299.50	299.35	0.15	2.5900	12.000	0.0150	0.00	0.00	4.97	0.00	0.00
OCS-06	DMH-01	19.26	298.10	297.85	0.25	1.3000	12.000	0.0150	0.00	0.00	3.52	0.00	0.11
AD-10	DMH-13	7.77	304.00	303.90	0.10	1.2900	12.000	0.0150	0.22	1.34	3.50	0.06	0.36
OCS-05	DMH-13	78.26	309.95	305.25	4.70	6.0100	12.000	0.0150	2.17	7.85	7.57	0.29	0.38
CB-01	DMH-01	32.94	298.00	297.80	0.20	0.6100	12.000	0.0120	0.27	1.84	3.01	0.09	0.25
DMH-05	Out-1Pipe - (104)	22.29	297.65	297.50	0.15	0.6700	12.000	0.0120	0.11	1.79	3.17	0.04	0.13
CB-08	AS-05	12.50	297.40	296.70	0.70	5.6000	12.000	0.0120	0.41	4.59	9.13	0.04	0.17
AS-05	Out-1Pipe - (106)	8.73	296.60	296.50	0.10	1.1500	12.000	0.0120	0.41	2.82	4.13	0.10	0.24
AD-04	Out-1Pipe - (19)	42.51	297.80	297.50	0.30	0.7100	12.000	0.0120	0.10	1.78	3.24	0.03	0.12
CB-05	DMH-04	49.66	298.15	297.90	0.25	0.5000	12.000	0.0120	0.48	0.85	2.74	0.18	0.88
AD-13	AD-12	43.65	324.00	322.10	1.90	4.3500	12.000	0.0120	0.31	4.71	8.05	0.04	0.14
AD-12	AD-11	190.82	322.00	312.10	9.90	5.1900	12.000	0.0120	0.57	1.20	8.79	0.07	0.59
AD-11	Out-01	6.98	313.40	313.30	0.10	1.4300	12.000	0.0120	3.10	4.94	4.62	0.67	0.74
CB-02	DMH-01	33.38	298.00	297.80	0.20	0.6000	12.000	0.0120	0.11	1.05	2.99	0.04	0.20
CB-06	DMH-07	43.51	297.10	296.85	0.25	0.5700	12.000	0.0120	0.76	1.65	2.93	0.26	0.66
AF-03	Out-1Pipe - (32)	8.31	296.55	296.50	0.05	0.6000	12.000	0.0120	1.60	3.22	2.99	0.54	0.60
AS-03	AF-03	6.27	296.80	296.72	0.08	1.2800	12.000	0.0120	1.60	3.48	4.36	0.37	0.58
DMH-07	AS-03	9.85	296.85	296.80	0.05	0.5100	12.000	0.0120	1.61	2.73	2.75	0.59	0.71
CB-07	DMH-07	26.37	297.00	296.85	0.15	0.5700	12.000	0.0120	0.90	1.98	2.91	0.31	0.72
CB-10	DMH-08	29.02	297.00	296.85	0.15	0.5200	12.000	0.0120	0.45	1.62	2.77	0.16	0.39
CB-03	DMH-02	21.62	297.75	297.60	0.15	0.6900	12.000	0.0120	0.36	1.97	3.22	0.11	0.38
AD-15	AD-16	100.82	319.50	308.60	10.90	10.8100	12.000	0.0120	0.11	4.95	12.69	0.01	0.07
AD-06	AD-07	16.01	298.65	298.45	0.20	1.2500	12.000	0.0120	0.02	0.83	4.31	0.01	0.08
AD-07	DMH-06	39.40	298.45	298.05	0.40	1.0200	12.000	0.0120	0.08	1.52	3.89	0.02	0.12
DMH-06	DMH-05	73.93	298.05	297.65	0.40	0.5400	12.000	0.0120	0.11	1.72	2.84	0.04	0.14
AD-05	DMH-06	27.22	298.35	298.05	0.30	1.1000	12.000	0.0120	0.04	1.16	4.05	0.01	0.11

Hydraulic Design Table (25-year Design Storm)

Date 3/18/2023

Initials AJM

From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation	Outlet Invert Elevation	Total Drop (ft)	Average Slope (%)	Pipe Diameter or Height (inches)	Manning's Roughness	Peak Flow (cfs)	Max Flow Velocity (ft/sec)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio
Column1	Column2	(ft)	(ft)3	(ft)5	(ft)7	(%)	(inches)	Column10	(cfs)16	(ft/sec)	(cfs)17	Column18	Column19
AD-03	Out-1Pipe - (67)	31.56	297.80	297.50	0.30	0.9500	12.000	0.0120	0.04	1.47	3.76	0.01	0.07
AD-16	DMH-11	39.84	308.50	299.65	8.85	22.2200	12.000	0.0120	0.22	6.76	18.19	0.01	0.09
DMH-01	DMH-02	26.13	297.80	297.60	0.20	0.7700	12.000	0.0120	0.36	1.45	3.38	0.11	0.36
AS-06	Out-1Pipe - (75)	4.95	297.55	297.50	0.05	1.0100	12.000	0.0120	0.70	3.03	3.88	0.18	0.33
DMH-02	AS-06	5.95	297.60	297.55	0.05	0.8400	12.000	0.0120	0.70	2.29	3.54	0.20	0.41
DMH-11	Out-1Pipe - (76)	6.20	299.55	299.50	0.05	0.8100	12.000	0.0120	0.22	2.11	3.47	0.06	0.19
DMH-12	AD-15	60.78	322.00	319.50	2.50	4.1100	12.000	0.0120	0.04	1.88	7.83	0.01	0.09
AD-14	DMH-12	16.25	322.75	322.00	0.75	4.6200	12.000	0.0120	0.05	2.35	8.29	0.01	0.08
CB-04	DMH-04	7.62	297.95	297.90	0.05	0.6600	12.000	0.0120	1.05	1.35	3.13	0.34	0.99
AF-02	Out-1Pipe - (80)	10.21	297.60	297.50	0.10	0.9800	12.000	0.0120	2.31	4.17	3.82	0.60	0.66
AS-02	AF-02	5.71	297.80	297.77	0.03	0.5300	12.000	0.0120	2.31	3.53	2.80	0.83	0.78
DMH-04	AS-02	11.59	297.90	297.80	0.10	0.8600	12.000	0.0120	2.31	3.01	3.59	0.64	0.95
AD-01	DMH-10	7.62	298.05	298.00	0.05	0.6600	12.000	0.0120	0.53	1.17	3.13	0.17	0.68
AD-02	DMH-10	75.70	298.40	298.00	0.40	0.5300	12.000	0.0120	0.39	1.05	2.81	0.14	0.51
DMH-10	AS-01	7.88	298.00	297.95	0.05	0.6300	12.000	0.0120	1.35	2.52	3.08	0.44	0.65
AF-01	Out-1Pipe - (85)	20.02	297.73	297.50	0.23	1.1500	12.000	0.0120	1.35	3.99	4.14	0.33	0.44
AS-01	AF-01	6.99	297.95	297.90	0.05	0.7200	12.000	0.0120	1.35	3.26	3.27	0.41	0.52
OCS-03	Out-1Pipe - (88)	25.65	297.34	297.21	0.13	0.5100	12.000	0.0150	2.06	3.34	2.20	0.94	0.73
OCS-01	Out-1Pipe - (91)	17.12	296.80	296.50	0.30	1.7500	12.000	0.0120	2.38	5.16	5.11	0.47	0.58
AF-04	Out-1Pipe - (92)	6.50	296.55	296.50	0.05	0.7700	12.000	0.0120	0.72	2.86	3.38	0.21	0.36
AS-04	AF-04	6.36	296.80	296.72	0.08	1.2600	12.000	0.0120	0.72	3.27	4.33	0.17	0.32
DMH-08	AS-04	5.70	296.85	296.80	0.05	0.8800	12.000	0.0120	0.72	2.42	3.61	0.20	0.40
CB-09	DMH-08	15.80	296.95	296.85	0.10	0.6300	12.000	0.0120	0.28	1.39	3.07	0.09	0.40
OCS-02	Out-1Pipe - (95)	8.26	296.27	296.02	0.25	3.0300	12.000	0.0150	4.03	5.83	5.37	0.75	0.82
AD-08	Out-1Pipe - (97)	7.97	296.60	296.50	0.10	1.2600	12.000	0.0120	0.04	1.58	4.32	0.01	0.07
DMH-13	Out-1Pipe - (98)	109.73	303.90	300.00	3.90	3.5500	12.000	0.0120	2.22	7.70	7.28	0.31	0.40
AD-09	Out-1Pipe - (99)	6.17	296.60	296.50	0.10	1.6200	12.000	0.0120	0.04	1.69	4.91	0.01	0.07

**Town of Northborough
NORTHBOROUGH FIRE STATION**

APPENDIX C

**Channel Capacity Calculations
Stormwater Treatment – TSS & Phosphorus Calculations
Proprietary Systems Calculations
Underground Infiltration System Calculations
Mounding Analysis Calculations
Recharge Volume Calculations**



PROJECT	Northborough Fire Station	PROJECT NUMBER	
SUBJECT	Channel Capacity		23141.00
COMPUTATIONS BY	AJM	DATE	13-Mar
CHECK BY		DATE	

Stormwater Conveyance Channel Design - Behind Retaining Wall

Purpose: To size the depth of flow within a Trapezoidal Swale

ROADWAY SWALE - MAXIMUM FLOW & SLOPE

Using Manning's Equation

Channel Geometry

Input:

b =	2	ft
d =	1.5	ft
Z = e/d =	3	(e.g. 3:1 - input "3")
e =	4.5	ft
T =	11	ft
Area =	9.75	sf
Wetted Perimeter =	11.49	ft
Hyd Radius =	0.85	ft
Q25 * =	5.43	cfs*
S =	0.030	
n ** =	0.030	
V =	3.8	fps (from below)
d required =	0.43	ft
d provided =	1.50	ft* ok!

*From PDA-3 from HydroCAD

*The town of Northborough requires there to be at least 1' of free board for swales

Solve through Trial and Error

d (ft)	A (SF)	P (ft)	R (ft)	V (fps)	Q (cfs)
0.40	1.28	4.53	0.28	3.69	4.73
0.41	1.32	4.59	0.29	3.74	4.96
0.42	1.37	4.66	0.29	3.79	5.19
0.43	1.41	4.72	0.30	3.84	5.44
0.44	1.46	4.78	0.31	3.89	5.68
0.45	1.51	4.85	0.31	3.94	5.94
0.46	1.55	4.91	0.32	3.99	6.20
0.47	1.60	4.97	0.32	4.03	6.46

$$A = (b+2*d)*d$$

$$Pw = b+2*y*(1+z^2)^{0.5}$$

* From Proposed Hydrology

** Avg. of natural channels, good condition and natural channels with stones and weeds (CEN Ref Manual, A-35)



PROJECT	Northborough Fire Station	PROJECT NUMBER	23141.00
SUBJECT	Stormwater Treatment Area		
COMPUTATIONS BY	SWL	DATE	3/15/2024
CHECK BY	JAJ	DATE	3/15/2024

Stormwater Treatment Area Calculation - Area Required

Total Project Area	196,433	ft ²	4.51	acres
Total Existing Impervious Area within LOD	31,857	ft ²	0.73	acres
Total Proposed Impervious area within LOD	75,709	ft ²	1.74	acres
Off Site Impervious (PDA-1, 2A, 2B, 2Q)	9,145	ft ²	0.21	acres
Impervious Area Treatment Requirement	66564	ft²	1.53	acres

<u>BMP Descriptions</u>	Phosphorus Removal Efficiency	TSS Removal Efficiency
(1) Aqua Swirl*	0.0%	93.3%
(2) Aqua Filter**	88.6%	0.0%
(3) Underground Infiltration Field***	67.5%	88.2%

*AquaShield Statement of Qualifications Table 3

**AquaShield Statement of Qualifications Table 4

***BATT Calculations Provided

<u>Phosphorus</u>	<u>Total Area</u>	<u>Total Imp.</u>	<u>BMP</u>	<u>Efficiency</u>	<u>% Reduction</u>
PDA-1	1142	0	-	0.00	0.00
PDA-2A	3194	0	-	0.00	0.00
PDA-2B	1730	0	-	0.00	0.00
PDA-2C	5944	1914	-	0.00	0.00
PDA-2D	2329	326	1	0.89	0.00
PDA-2E	3332	3332	1	0.89	0.04
PDA-2F	4072	3683	1	0.89	0.05
PDA-2G	3190	2078	1	0.89	0.03
PDA-2H	3620	3237	1	0.89	0.04
PDA-2I	2986	37	-	0.00	0.00
PDA-2J	14841	13302	1	0.89	0.18
PDA-2K	5283	435	-	0.00	0.00
PDA-2L	13395	11758	1	0.89	0.16
PDA-2M	7503	4889	1	0.89	0.07
PDA-2N	4661	0	3	0.00	0.00
PDA-2O	59192	0	-	0.00	0.00
PDA-2P	14672	0	-	0.00	0.00
PDA-2Q	22194	0	-	0.00	0.00
PDA-2R	1578	0	3	0.00	0.00
PDA-ROOF1	7065	7065	1	0.89	0.09
PDA-ROOF2	11888	11888	3	0.68	0.12
PDA-ROOF3	2620	2620	1	0.89	0.03
Total		66564			81.7%

<u>TSS</u>	<u>Total Area</u>	<u>Total Imp.</u>	<u>BMP</u>	<u>Efficiency</u>	<u>% Reduction</u>
PDA-1	1142	0	-	0.00	0.00
PDA-2A	3194	0	-	0.00	0.00
PDA-2B	1730	0	-	0.00	0.00
PDA-2C	5944	1914	2	0.93	0.03
PDA-2D	2329	326	2	0.93	0.00
PDA-2E	3332	3332	2	0.93	0.05
PDA-2F	4072	3683	2	0.93	0.05
PDA-2G	3190	2078	2	0.93	0.03
PDA-2H	3620	3237	2	0.93	0.05
PDA-2I	2986	37	-	0.00	0.00
PDA-2J	14841	13302	2	0.93	0.19
PDA-2K	5283	435	-	0.00	0.00
PDA-2L	13395	11758	2	0.93	0.16
PDA-2M	7503	4889	2	0.93	0.07
PDA-2N	4661	0	3	0.00	0.00
PDA-2O	59192	0	-	0.00	0.00
PDA-2P	14672	0	-	0.00	0.00

<i>PDA-2Q</i>	22194	0	-	0.00	0.00
<i>PDA-2R</i>	1578	0	3	0.00	0.00
<i>PDA-ROOF1</i>	7065	7065	2	0.93	0.10
<i>PDA-ROOF2</i>	11888	11888	3	0.88	0.16
<i>PDA-ROOF3</i>	2620	2620	2	0.93	0.04
Total		66564			<u>91.7%</u>



Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station

Structure ID: DMH-09

Water Quality Flow (cfs) to be treated

HDS req'd

AF rows

AF unit

Aqua-Filter HDS Sizing

AS Model	ID		Area (sf)	WQF	
	(in)	(ft)		(gpm)	(cfs) ¹
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
24	288	5760	12.83
26	312	6240	13.90

For further questions please contact:

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Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station

Structure ID: DMH-08 replace with AS-2 only

Flow (cfs) to be treated

HDS req'd

AF rows

AF unit

Aqua-Filter HDS Sizing

AS Model	ID		Area (sf)	WQF	
	(in)	(ft)		(gpm)	(cfs) ¹
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
24	288	5760	12.83
26	312	6240	13.90

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Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station

Structure ID: DMH-07

Flow (cfs) to be treated

HDS req'd

AF rows

AF unit

Aqua-Filter HDS Sizing

AS	ID		Area	WQF	
Model	(in)	(ft)	(sf)	(gpm)	(cfs) ¹
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
24	288	5760	12.83
26	312	6240	13.90

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Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station

Structure ID: DMH-02 replace with AS-2 only

Flow (cfs) to be treated

HDS req'd

AF rows

AF unit

Aqua-Filter HDS Sizing

AS Model	ID		Area (sf)	WQF	
	(in)	(ft)		(gpm)	(cfs) ¹
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Rows	Area (sf)	Loading Rate	
		20 (gpm)	gpm/sf (cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
24	288	5760	12.83
26	312	6240	13.90

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Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station

Structure ID: DMH-04 replace with AS-2 only

Flow (cfs) to be treated

HDS req'd

AF rows

AF unit

Aqua-Filter HDS Sizing

AS Model	ID		Area (sf)	WQF	
	(in)	(ft)		(gpm)	(cfs) ¹
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
24	288	5760	12.83
26	312	6240	13.90

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Aqua-Filter™ Design Worksheet

Project Name: Northborough Fire Station

Structure ID: DMH-XX

Flow (cfs) to be treated

HDS req'd

AF rows

AF unit

Aqua-Filter HDS Sizing

AS Model	ID		Area (sf)	WQF	
	(in)	(ft)		(gpm)	(cfs) ¹
AS-2	30	2.5	4.91	245.4	0.55
AS-3	42	3.5	9.62	481.1	1.07
AS-4	54	4.5	15.90	795.2	1.77
AS-5	66	5.5	23.76	1187.9	2.65
AS-6	78	6.5	33.18	1659.2	3.70
AS-7	90	7.5	44.18	2208.9	4.92
AS-8	102	8.5	56.75	2837.3	6.32
AS-9	114	9.5	70.88	3544.1	7.90
AS-10	126	10.5	86.59	4329.5	9.65
AS-11	138	11.5	103.87	5193.4	11.57
AS-12	150	12.5	122.72	6135.9	13.67
AS-13	156	13.0	132.73	6636.6	14.79

AquaFilter Sizing

Loading Rate		20	gpm/sf
Rows	Area (sf)	(gpm)	(cfs)
1	12	240	0.53
2	24	480	1.07
3	36	720	1.60
4	48	960	2.14
5	60	1200	2.67
6	72	1440	3.21
7	84	1680	3.74
8	96	1920	4.28
9	108	2160	4.81
10	120	2400	5.35
11	132	2640	5.88
12	144	2880	6.42
13	156	3120	6.95
14	168	3360	7.49
15	180	3600	8.02
16	192	3840	8.56
17	204	4080	9.09
18	216	4320	9.63
19	228	4560	10.16
20	240	4800	10.69
22	264	5280	11.76
24	288	5760	12.83
26	312	6240	13.90

For further questions please contact:

Pasquale Napolitano
 pnapolitano@aquashieldinc.com
 (207) 807-1327

State	MASSACHUSETTS
Municipality	NORTHBOROUGH
Permit Type	Local
Permit Number	na
Major Watershed	CONCORD
TP Load Reduction Target	N/A
TN Load Reduction Target	N/A
TSS Load Reduction Target	N/A

Table 1. Project Summary Credit for NORTHBOROUGH, MASSACHUSETTS

Project Type	Removed Phosphorus Load (lb/yr)	Removed Nitrogen Load (lb/yr)	Removed Sediment Load (lb/yr)
Structural	0.28	3.43	105.67
Non-Structural	0	0	0
Land Use Conversion	0	0	0
Total	0.28	3.43	105.67

Table 2. Structural Project Summary for NORTHBOROUGH, MASSACHUSETTS

Project ID	BMP Type	BMP Storage Capacity (ft ³)/ Filter Depth (in.)	Phosphorus BMP Efficiency (%)	Nitrogen BMP Efficiency (%)	Sediment BMP Efficiency (%)	Removed Phosphorus Load (lb/yr)	Removed Nitrogen Load (lb/yr)	Removed Sediment Load (lb/yr)	Impervious Area Treated (ac)	Runoff Depth (in.)
PDA-ROOF2	INFILTRATION TRENCH	355	67.59	89.09	88.21	0.28	3.43	105.67	0.2729	0.36

Table 3. Non-Structural Project Summary for NORTHBOROUGH, MASSACHUSETTS

There are no non-structural BMPs.

Table 4. Land Use Conversion Project Summary for NORTHBOROUGH, MASSACHUSETTS

There are no land use conversion projects.



PROJECT	Northborough Fire Station	PROJECT NUMBER	23141.00
SUBJECT	Infiltration Practices		
COMPUTATIONS BY	AJM	DATE	3/6/2024
CHECK BY		DATE	

Underground Infiltration System 1 Calculation

Infiltration System

Total Area to Infiltration System = 4,172 SF
 Total Impervious Area = 0 SF

Water Quality Volume (WQV)

WQV = Impervious Area x 1.0 inches = 0 CF
Required WQV Volume (including pretreatment) = 0 CF
 Volume provided in UGIS = 531 CF
Total Volume = 531 CF

Pretreatment

Separator Row
 0.1" x Impervious Area = 0 CF
 Required Pretreatment Volume = 0 CF
Volume Provided = 0 CF* *no separator row is proposed for UGIS-1

Drawdown within 72 hours

Time = (Provided Volume) / (K x Bottom Area)
 Provided Volume = 531 CF
 K = saturated hydraulic conductivity = 2.04 FT/DAY
 Bottom Area (Average) = 650 SF
 Time (hrs) = 10 hrs < 48 hrs



PROJECT	NorthBorough Fire Station	PROJECT NUMBER	23141.00
SUBJECT	Infiltration Practices		
COMPUTATIONS BY	AJM	DATE	3/6/2024
CHECK BY		DATE	

Underground Infiltration System 2 Calculation

Infiltration System

Total Area to Infiltration System =	11,855	SF
Total Trafficked Impervious Area =	0	SF

Water Quality Volume (WQV)

WQV = Impervious Area x 1.0 inches =	0	CF
Required WQV Volume (including pretreatment) =	0	CF
Volume provided in UGIS =	273	CF
Total Volume =	273	CF

Pretreatment

<u>Separator Row</u>		
0.1" x Impervious Area =	0	CF
Required Pretreatment Volume =	0	CF
Volume Provided =	0	CF*

*Runoff directed to this system is from non-pollutant loading impervious (roof runoff), therefore pretreatment is not required for this system

Drawdown within 72 hours

Time = (Provided Volume) / (K x Bottom Area)			
Provided Volume =	273	CF	
K = saturated hydraulic conductivity =	2.04	FT/DAY	
Bottom Area (Average) =	292	SF	
Time (hrs) =	11	hrs	< 48 hrs



PROJECT	Northborough Fire Station	PROJECT NUMBER	23141.00
SUBJECT	Infiltration Practices		
COMPUTATIONS BY	AJM	DATE	3/6/2024
CHECK BY		DATE	

Underground Infiltration System 3 Calculation

Infiltration System

Total Area to Infiltration System =	133,266	SF
Total Impervious Area =	6,064	SF

Water Quality Volume (WQV)

WQV = Impervious Area x 1.0 inches =	505	CF	
Required WQV Volume (including pretreatment) =	505	CF	* Impervious area directed to this UGIS is from offsite flow, therefore water quality treatment is not required for this system
Volume provided in UGIS =	718	CF	
Total Volume =	718	CF	* Water Quality Volume displayed is additional treatment of offsite impervious

Pretreatment

<u>Pretreatment</u>			
0.1" x Impervious Area =	51	CF	* Pre-treatment achieved through flow path, drainage channel, and conveyance structure sumps
Required Pretreatment Volume =	51	CF	
Volume Provided =	>51	CF*	

Drawdown within 72 hours

Time = (Provided Volume) / (K x Bottom Area)			
Provided Volume =	718	CF	
K = saturated hydraulic conductivity =	2.04	FT/DAY	
Bottom Area (Average) =	817	SF	
Time (hrs) =	10	hrs	< 48 hrs

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0)), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

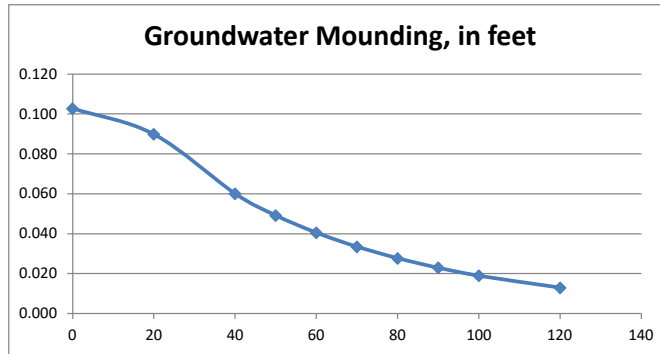
Input Values		use consistent units (e.g. feet & days or inches & hours)	Conversion Table		
			inch/hour	feet/day	
0.0860	R	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.330	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
20.40	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).
25.700	x	1/2 length of basin (x direction, in feet)			
25.700	y	1/2 width of basin (y direction, in feet)	hours	days	
3.000	t	duration of infiltration period (days)	36	1.50	
32.500	hi(0)	initial thickness of saturated zone (feet)			
32.603	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)			
0.103	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)			

Ground-water Mounding, in feet

Distance from center of basin in x direction, in feet	
0	0.103
20	0.090
40	0.060
50	0.049
60	0.041
70	0.034
80	0.028
90	0.023
100	0.019
120	0.013



Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

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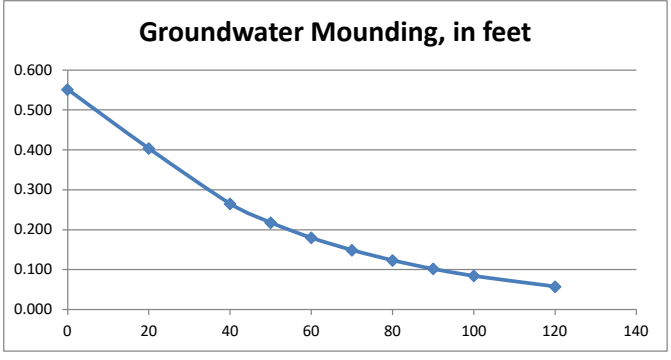
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Input Values		use consistent units (e.g. feet & days or inches & hours)	Conversion Table		
			inch/hour	feet/day	
0.8750	R	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.330	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
20.40	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).
11.670	x	1/2 length of basin (x direction, in feet)			
25.000	y	1/2 width of basin (y direction, in feet)	hours	days	
3.000	t	duration of infiltration period (days)	36	1.50	
31.500	hi(0)	initial thickness of saturated zone (feet)			
32.052	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)			
0.552	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)			

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.552	0
0.404	20
0.266	40
0.218	50
0.180	60
0.149	70
0.124	80
0.102	90
0.085	100
0.058	120



Re-Calculate Now



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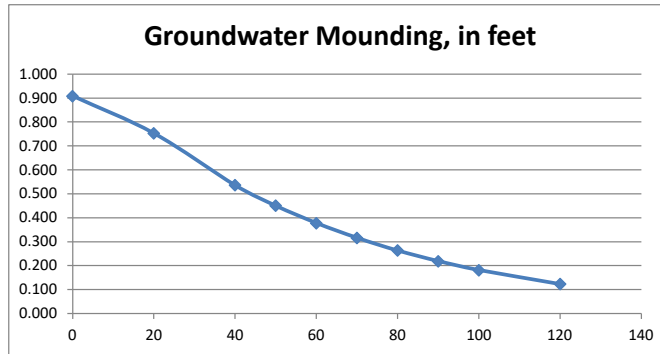
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Input Values		use consistent units (e.g. feet & days or inches & hours)	Conversion Table		
			inch/hour	feet/day	
0.6700	R	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.330	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
20.10	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).
16.000	x	1/2 length of basin (x direction, in feet)			
56.000	y	1/2 width of basin (y direction, in feet)	hours	days	
3.000	t	duration of infiltration period (days)	36	1.50	
31.500	hi(0)	initial thickness of saturated zone (feet)			
32.409	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)			
0.909	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)			

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.909	0
0.753	20
0.537	40
0.451	50
0.378	60
0.317	70
0.264	80
0.220	90
0.182	100
0.124	120



Re-Calculate Now



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PROJECT	Northborough Fire Station	PROJECT NUMBER	23141.00
SUBJECT	Required Recharge Volume		
COMPUTATIONS BY	AJM	DATE	3/6/2024
CHECK BY		DATE	

Groundwater Recharge Calculation

A. Resources:

MassDEP Stormwater Handbook, 2008 Volume 1 & 3

B. Data:

	HSG A	HSG B	HSG C	HSG D	Total
Existing Impervious Area (SF)	0	31,857	0	0	31,857
Proposed Impervious Area (SF)	0	66,564	0	0	66,564
Net Increase (SF)	0	34,707	0	0	34,707

*9,145 SF Off-Site Impervious not included

C. Equation

$$R_v = F \times \text{Impervious Area}$$

R_v = Require Recharge Volume, Ft³

F = Target Depth Factor

Impervious Area = net impervious area

Target Depth Factor For Each Soil Group

Hydrologic Group	Target Depth Factor (F)
A	0.60 inches
B	0.35 inches
C	0.25 inches
D	0.10 inches

C. Calculations:

Required Recharge Volume:

Soil Group	Impervious Area (SF)	Required Volume (CF)
A	0	0
B	34,707	1012
C	0	0
D	0	0
Total	34,707	1012

Provided Recharge Volume

BMP Provided Recharge*	
UGIS-1	531 CF
UGIS-2	273 CF
UGIS-3	718 CF
Total	1522 CF
Required	1012 CF

*Recharge volumes take from HydroCAD, Volume is taken from the volume stored below the lowest outlet, volume infiltrated during the storm event is not included

**Town of Northborough
NORTHBOROUGH FIRE STATION**

APPENDIX D

**H1.0 Existing Hydrology
H2.0 Proposed Hydrology**



SCALE ADJUSTMENT GUIDE
 0" 1"
 BAR IS ONE INCH ON ORIGINAL DRAWING

Northborough New Fire Station
 63 West Main Street
 Town of Northborough, MA

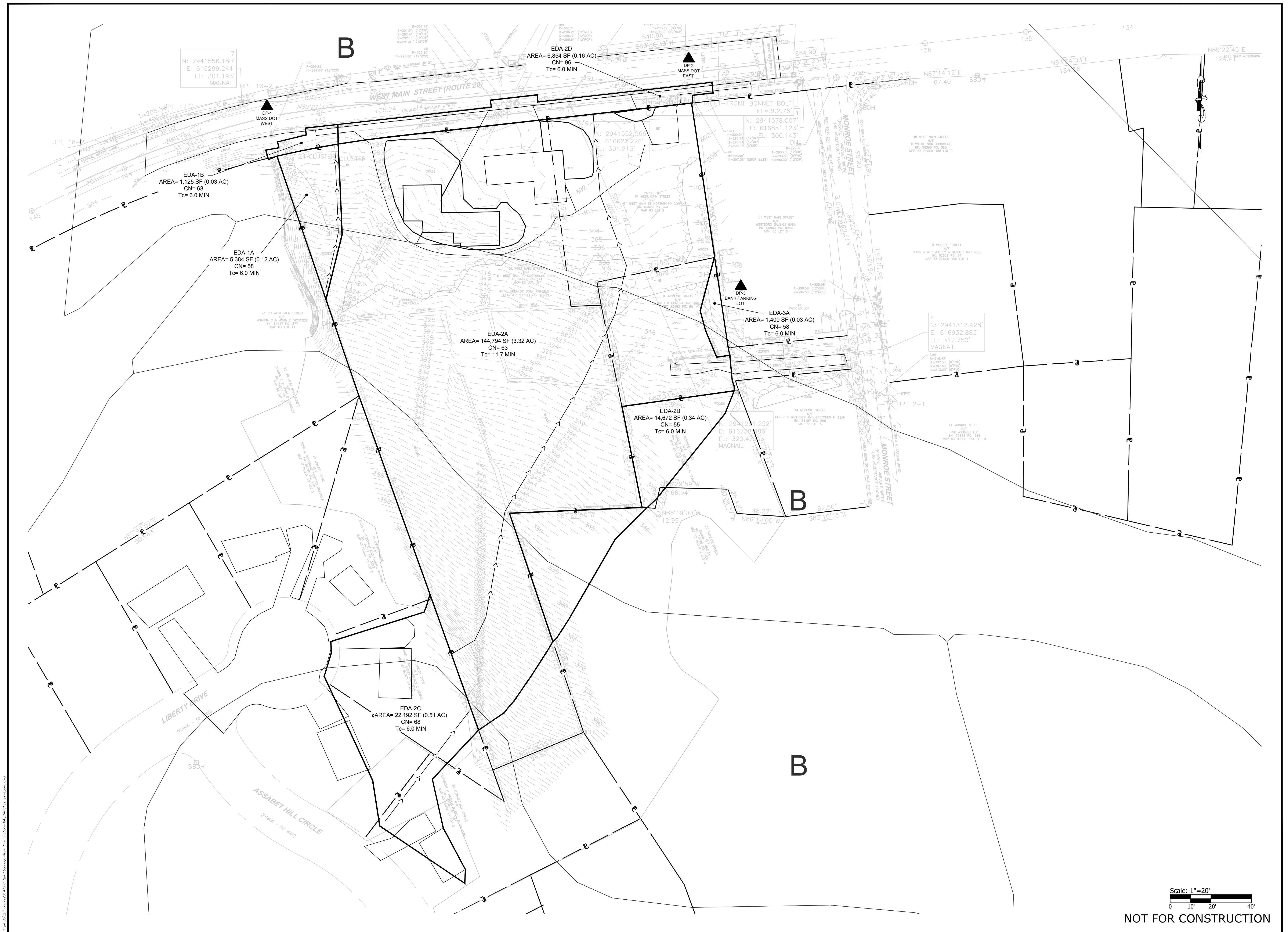
REVISIONS:

NO.	DATE	DESCRIPTION

PROJECT NO.: 23141.00
 DATE: MARCH 18, 2024
 SCALE:
 DESIGNED BY:
 CHECKED BY:
 DRAWN BY: AKL
 APPROVED BY:
 DRAWING TITLE:

EXISTING HYDROLOGY

DRAWING NO.: H1.0
 SHEET NO. OF



10/20/2024 12:58:11 PM 23141.00 - Northborough - New Fire Station - H1.0 - 1/2" = 20' - 1/2" = 20' - 1/2" = 20'

