Drainage Report:

42 Park Street
Ayer, MA

Submitted to:

Town of Ayer
Planning Board

September 1, 2023(Revised November 6, 2023)

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Mixed-Use Development
42 Park Street
Ayer, Massachusetts
STORM WATER MANAGEMENT DESIGN
September 1, 2023 (Revised November 6, 2023)

INTRODUCTION

The project site is approximately 0.48 acres in size and is located in the General Business District at 42 Park Street. The site is partially developed and contains a multi-family home that is currently vacant with a asphalt driveway. The site is bounded by Park Street (Route 111) to the east, a commercial property which is the site of Jiffy Lube to the south, the Boston and Maine Railroad to the west, and commercial property to the north. Refer to **Figure 1** for the Locus Plan.

The proposed project includes the renovation of the existing multi-family structure and construction of an addition to the existing structure with associated site improvements. These site improvements include the construction of 12 parking spaces, installation of new drainage improvements, utility connections, site grading, and the installation of new lighting and landscaping. Proposed stormwater runoff with be collected by catch basins and be conveyed through a water quality unit to the proposed infiltration basin located on the northwestern portion of the property.

The hydrologic study area is comprised of approximately 0.51 acres. Based on the USDA Natural Resources Conservation Service soil survey the site is comprised of a mix of Merimac-Urban Land Complex, which is a Hydrologic Soil Group (HSG) "A" Soil, and Urban land. Based on the soil survey the proposed infiltration basin is located within the HSG "A" Soil, thus an infiltration rate of 2.41 was used in the drainage analysis. Refer to **Appendix A** for the NRCS soil survey.

EXISTING CONDITIONS

As described above, the existing site is partially developed and is comprised of approximately 0.34 acres of grass, 0.08 acres of pavement, 0.04 acres of rooftop, and 0.05 acres of wood. The existing site is made up of one watershed area.

Area 1 includes the entire hydrologic study area. This area sheet flows from the eastern side of the property across to the western side of the property, which is considered Point of Analysis 1 (POA-1). Refer to **Figure 2**– Existing Watershed Plan.

PROPOSED CONDITIONS

Under proposed conditions, the site is comprised of approximately 0.21 acres of grass, 0.03 acres of concrete, 0.15 acres of pavement, 0.08 acres of rooftop, and 0.04 acres of woods. The post-development run-off rates will be mitigated to less than the pre-development run-off rates for all design storm events. The proposed site is comprised of 3 watershed areas.

Area 1 includes the entire rooftop area of the proposed building. This area is collected through the roof leader system and is conveyed to the proposed infiltration basin. The infiltration basin ultimately discharges to the western side of the property. This area is considered Point of Analysis 1 (POA-1).

Area 2 includes the proposed developed area including the drive aisles, parking fields, and proposed infiltration basin. This area sheet flows to the proposed catch basins and is conveyed through a water quality unit to the proposed infiltration basin, which ultimately discharges to POA-1.

Area 3 includes the remaining area that is located downslope of the proposed development. This area sheets off to POA-1.Refer to **Figure 3**– Proposed Watershed Plan.

STORMWATER MANAGEMENT

The proposed drainage design was based on the Massachusetts Department of Environmental Protection (MADEP) Stormwater Management Standards (Stormwater Policy, latest edition). The standards have been revised to promote increased stormwater recharge, the treatment of more runoff from polluting land uses, pollution prevention, the removal of illicit discharges to the stormwater management systems, and improved operation and maintenance of stormwater best management practices (BMP's). In addition to the MADEP Policy, the project was designed to meet the Town of Ayer Stormwater Bylaws which require that the project provide 90% TSS removal and 60% Phosphorus removal for new development in addition to meeting the 10 MADEP Stormwater Standards. The following summarizes the proposed project's compliance with both the MADEP Stormwater Management Standards and the City of Leominster Stormwater Bylaws.

Standard #1 Untreated Storm Water: No new untreated storm water conveyances have been proposed to discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. Storm water Best Management Practices (BMP's), such as deep sump catch basins, water quality unit and at grade infiltration basin are proposed within the project to provide stormwater quality control prior to discharging runoff from the site.

Standard #2 Post-Development Peak Discharge Rates: BMP's have been developed to attenuate the peak discharge rates for the 2, 10, 25, and 100 year, 24-hour storm events. Refer to **Table 1** for the pre- and post-development peak discharge rates.

Standard #3 Recharge to Groundwater: The project site is located within Hydrologic Soil Group (HSG) "A" classified soils. Per MA DEP standards, recharge is required to eliminate or minimize the loss of annual recharge to groundwater using environmentally sensitive site design, BMP's and good operation and maintenance. The required recharge volume for the proposed project is 0.013 AC-FT. For the 2-year storm event, the at grade infiltration basin will provide approximately 0.049 AC-FT of recharge to groundwater. Refer to the HydroCAD model in **Appendix B**. In addition, the project will provide approximately 1,046 CF of volume (>1" water quality volume) below the outlet to the infiltration basin. Because the at grade basin is located within an "A" soil, the water quality volume will draw down within 25 hours after the end of the storm event. Refer to **Appendix A** for the recharge calculations and drawdown analysis.

Standard #4 80 Percent TSS Removal: Based on the proposed stormwater management system design, the proposed BMP's will remove more than 90% of the Total Suspended Solids (TSS) and 60% of Phosphorus from the stormwater runoff discharging from the site to meet compliance with the Town of Ayer Stormwater Bylaws. This is being achieved through the use of a water quality inlet units, and an at below grade infiltration basin prior to infiltrating. These BMP's are sized to capture in excess of the required water quality volume. As noted above, the proposed infiltration basin will treat the required water quality volume, which will be provided below the outlets in the basin. Refer to **Appendix A** for the Water Quality Volume calculations and the TSS Removal Worksheet.

Standard #5 Higher Potential Pollutant Loads: The proposed project is not classified by the DEP as a source for higher pollutant loads.

Standard #6 Protection of Critical Areas: The project site is not considered a critical area as defined by the MA DEP.

Standard #7 Redevelopment Project: The project is not considered a redevelopment site.

Standard #8 Erosion/Sediment Control: Erosion and sediment controls are incorporated into the project design to prevent erosion, control sediment movement, and stabilize exposed soils during construction. During construction, control practices will be utilized such as the placement of straw wattles, silt fencing, and the implementation of soil stabilization practices. These control measures will be periodically checked and maintained as necessary throughout the entire construction duration.

Standard #9 Operation/Maintenance Plan: A long term operation and maintenance plan has been developed to ensure the stormwater management system will function as designed. See **Appendix A** for the Operation and Maintenance Plan.

Standard #10 Illicit Discharges to Stormwater Management System: The Stormwater Management System associated with the development has been designed such that prior to storm water runoff discharging from the site, it is treated through a series of best management practices. To the Engineer's knowledge, there are no known or designed non-storm water discharges that are or will be connected to the storm water collection system that would convey pollutants directly to groundwater or surface waters. Refer to **Appendix A** for the Illicit Discharge Compliance Statement.

The proposed design meets **all** applicable DEP Stormwater Management Standards and the Town of Grafton Stormwater Bylaws. Refer to **Appendix A** for the MADEP Stormwater Checklist.

DRAINAGE COLLECTION SYSTEM DESIGN

The proposed drain pipe network is composed of deep sump catch basin and manholes that will collect runoff from the parking and landscaped areas within the proposed development and convey it to the proposed infiltration basin. The pipe layout is depicted on the Grading and Drainage Plan in the plan set.

Pipe sizes were determined using the Rational Method to determine contributing flows to catch basin, as well as the Manning's Equation to calculate pipe flows (refer to **Appendix A** for pipe sizing calculations.)

The following criteria were used to design the pipe network:

- Manholes are provided at all changes in direction or changes in pipe size.
- Pipe sizes are based on flows for the 25-year storm frequency.
- Storm drain pipes shall be HDPE unless otherwise noted.
- Pipe flow velocities are maintained at a maximum of 12 fps.

STORMWATER QUANTITY

Due to the proposed increase in impervious area, the project will require BMP's for infiltration and detention in order to comply with Standards # 2 and #3 of the DEP Stormwater Management Policy. The stormwater facilities proposed will an at grade infiltration basins. The proposed basin will recharge the required water quality volume in

addition to attenuating the peak runoff rates for the 2, 10, 25 and 100-year, 24-hour storm events.

Hydrologic analyses were performed utilizing the computer program, HydroCAD©. In order to determine the peak rate of discharge for existing and proposed conditions, runoff hydrographs were generated for the 2, 10, 25, and 100-year, 24-hour storm events using the SCS TR-20 Method and Type III rainfall distribution. Precipitation amounts utilized in the analysis are as defined by NRCC Extreme Precipitation Data (refer to **Appendix A** for the NRCC Precipitation Tables and **Appendix B** for the existing and proposed HydroCAD models). Under proposed conditions, the post development runoff hydrographs were flood routed through the proposed stormwater management facilities.

Table 1 compares peak runoff rates for the 2-, 10-, 25-, and 100-year storm events for existing and proposed conditions.

Table 1 Comparison of Peak Runoff Rates

Storm Event	Existing Flow (cfs)	Proposed Flow (cfs)
	POA-1	POA-1
2-Year	0.01	0.00
10-Year	0.16	0.00
25-Year	0.42	0.03
100-Year	1.15	0.67

As shown in Table 1, peak runoff rates under proposed conditions are less than existing conditions for the 2-, 10-, 25- and 100-year storm events. Therefore, the proposed stormwater design complies with Standard #2 of the MA DEP Stormwater Management Policy.

STORMWATER QUALITY

All stormwater runoff will be treated to address water quality concerns through the use of DEP approved BMP's. The following BMP's will be provided on-site and when combined will achieve an excess of 90% TSS removal: deep sump hooded catch basins, water quality unit and an at grade infiltration basin. (See **Appendix A** for TSS Removal Worksheets

Water Quality Units

The proposed design of the on-site drainage system will incorporate a Hydroworks water quality unit prior to connecting to the at grade infiltration basin on site. Maintenance will be performed per the manufacturer's recommendations; however basic maintenance will consist of monthly inspections and after each major storm event during the first year of installation to accurately establish the required maintenance schedule. The structures will be cleaned out twice per year or upon the stored volume reaching 15% of the particle separator's capacity, or immediately in the event of a spill.

Below Grade Infiltration Basin

Once constructed, infiltration basin will be inspected at a minimum after several storm events for the first year and annually thereafter to confirm drainage system functions as designed. Problems will be addressed immediately. System shall be cleaned as required per the manufacturer's recommendations.

Phosphorus Removal

The 60% phosphorus removal requirement has been achieved through the use of stormwater BMP's that are documented within Volume 2 of the Massachusetts Stormwater Handbook. The proposed water quality unit has been sized to treat the 1" Water Quality Volume, and the at grade infiltration basin has been sized to provided greater than the 1" WQV.

CONCLUSION

The proposed stormwater management plan for the project addresses both water quantity and quality issues and conforms to the standards outlined in the revised MADEP Stormwater Management Policy.

Figures

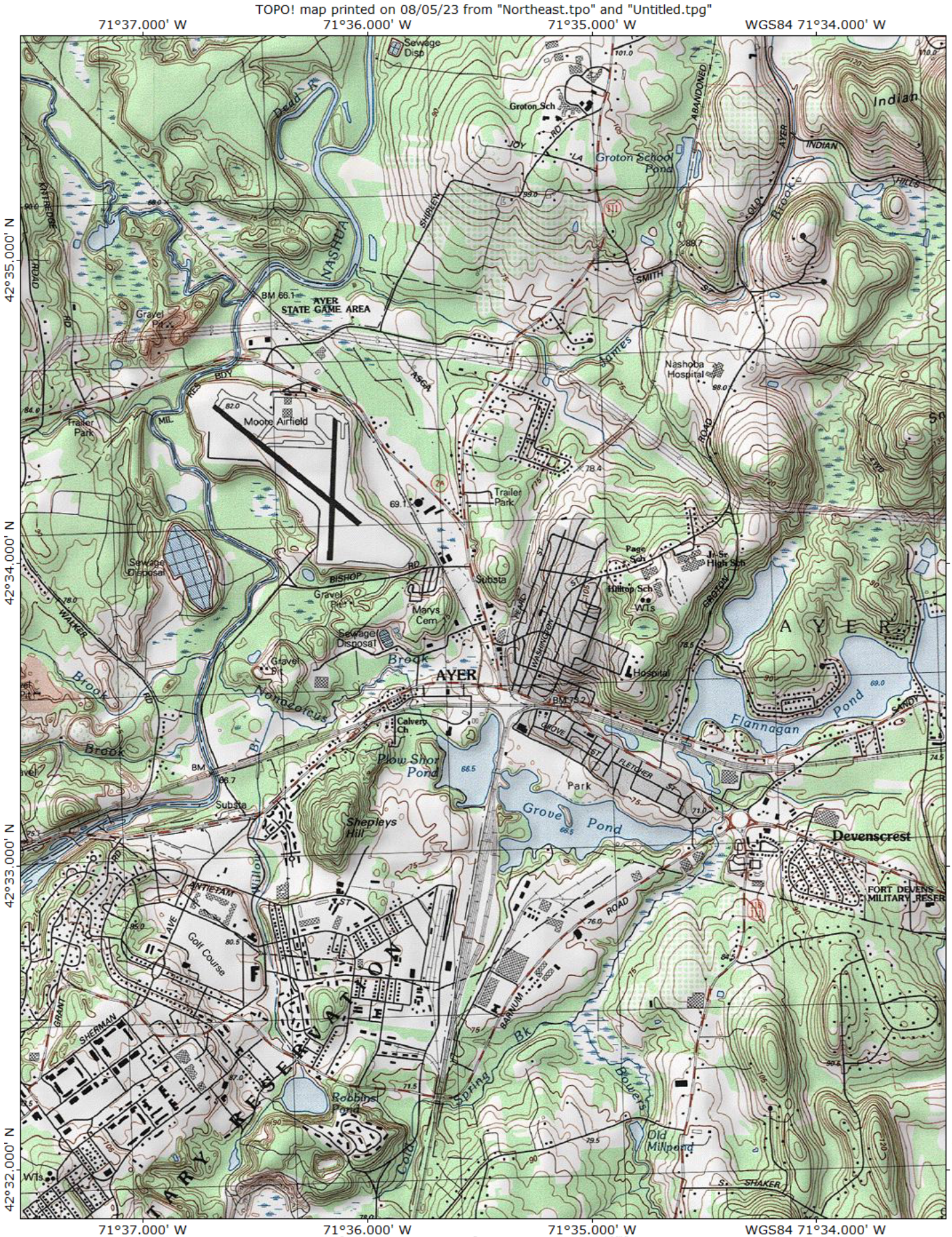

Figure 1
Site Locus

A.P. 26-15
N/F
MANNONE
BK. 65321 PG. 496

SEE PLAN NO. 935 OF 2005

BOSTON & MAINE RAILROAD
(FITCHBURG DIVISION - GREENVILLE BRANCH)

1R

SEWER EASEMENT
BK. 14336 PG. 138

20' SETBACK LINE

25' SETBACK LINE

30' SETBACK LINE

EOP

SMH
R=216.30
I=212.88

6" S

20" DEAD

12" MAPLE X3

18" MAPLE X3

10" MAPLE

8" MAPLE

8" MAPLE

#44

EXISTING DWELLING
FFE=224.59
#42

TR

W

OHW

GC

ASPHALT DRIVEWAY

ACCESS

PARK STREET (RTE 2A & 111)
(PUBLIC - 1898 TOWN LAYOUT 50' WIDE)

SB/DH (F)

RIGHT-OF-WAY LIMIT

SITE BENCHMARK
MAG NAIL
ELEV.=224.53

BIT. CONC. WALK

GRAVEL WALL W/ 4' CLR.

AREA 1
TOTAL=22,063 SF
ROOFTOP "A"=1,515 SF
PVMNT "A"=3,365 SF
GRASS "A"=14,861 SF
WOODS "A"=2,322 SF

A.P. 26-18
N/F
NATIONAL RETAIL PROPERTIES LP
BK. 64363 PG. 575

No.	Date	Revision

Drawn By: JLL
Designed By: JLL
Checked By:

McCarty Engineering, Inc.
Civil Engineers
42 Tucker Drive, Leominster, MA 01453
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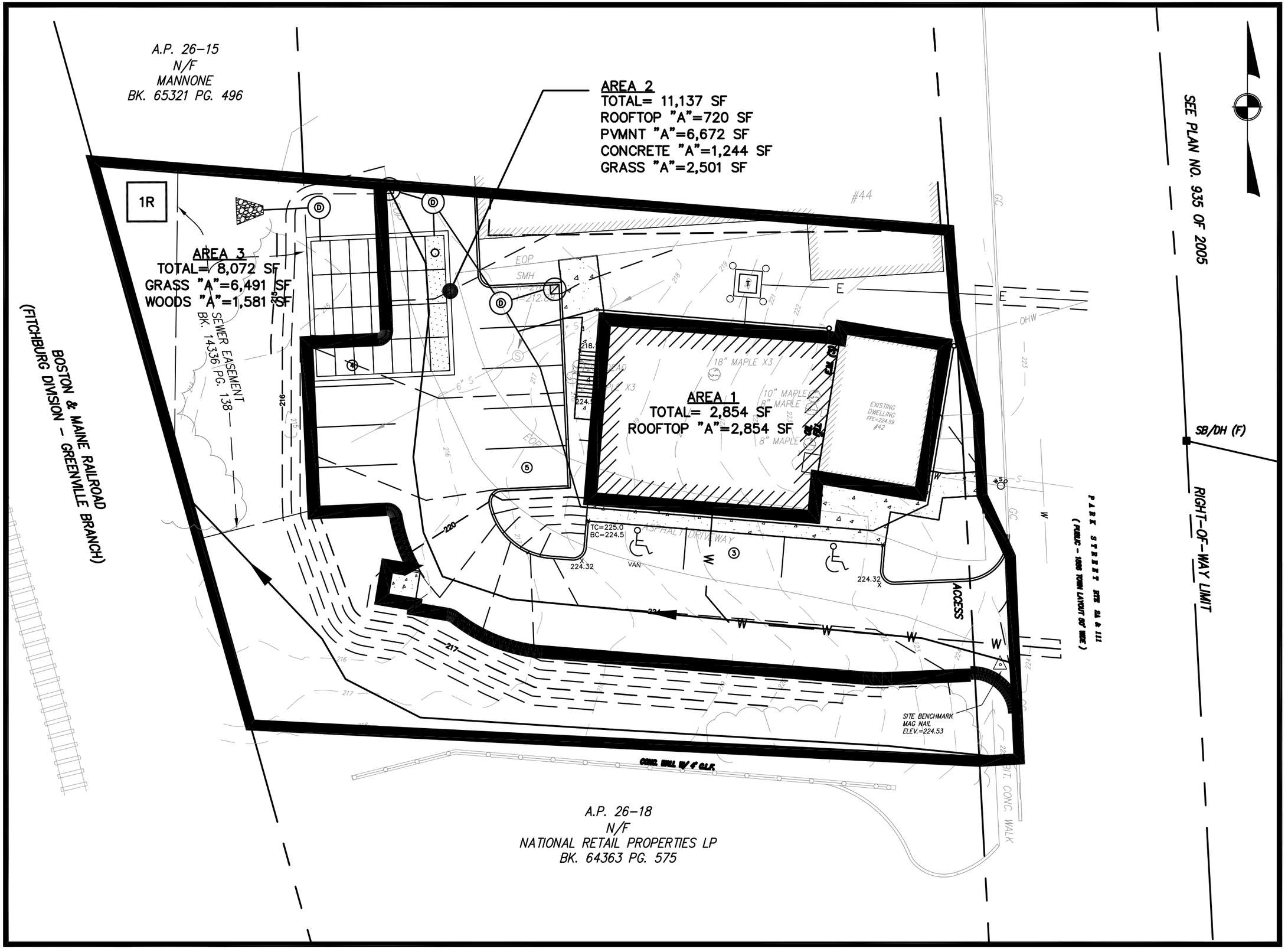
Project Name
Proposed Mixed-Use Development
42 Park Street
Ayer, MA 01432

Sheet Title
Existing Watershed Plan

Job No: Park Street
File Name: Existing Drainage
Date: 9/1/2023
Scale: 1"=20'

Sheet No.
2



No.	Date	Revision

Drawn By: JLL | Designed By: JLL | Checked By:

McCarty Engineering, Inc.
Civil Engineers
42 Tucker Drive, Leominster, MA 01453
phone:(978) 534-1318 fax: (978) 840-6907

Project Name

Proposed Mixed-Use Development
42 Park Street
Ayer, MA 01432

Sheet Title

Proposed Watershed Plan

Job No: Park Street
File Name: Proposed Drainage
Date: 9/1/2023
Scale: 1"=20'

Sheet No. 3

Appendix A

NRCS Soil Survey

Map Scale: 1:666 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 30 60 120 180

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil 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 1:25,000.

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: Middlesex County, Massachusetts
Survey Area Data: Version 22, Sep 9, 2022

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
602	Urban land		0.7	57.4%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	0.5	42.6%
Totals for Area of Interest			**1.2**	**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

Soil Logs

Commonwealth of Massachusetts
City/Town of ATER

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

A. Facility Information

M/F FRANCIS MANNONE
Owner Name

44 PARK STREET
Street Address

19-26-17
Map/Lot #

ATER
City

MA
State

01432
Zip Code

B. Site Information

1. (Check one) ☑ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☐ Yes ☐ No If yes: MASS SOIL SURVEY
Source

602
626 B
Soil Map Unit

MERRIMAC
Soil Name

Soil Limitations

SAND
Soil Parent material

OUTLASH TERRACE
Landform

3. Surficial Geological Report Available? ☑ Yes ☐ No If yes:
Year Published/Source

Map Unit

ATER GRANITE - DEVENS LOWER POND FACIES
Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☑ No

5. Within a velocity zone? ☐ Yes ☑ No

6. Within a Mapped Wetland Area? ☐ Yes ☑ No If yes, MassGIS Wetland Data Layer:
Wetland Type

7. Current Water Resource Conditions (USGS):
Month/Day/ Year
Range: ☐ Above Normal ☑ Normal ☐ Below Normal

8. Other references reviewed: WEST GROTON - 1981

Commonwealth of Massachusetts
City/Town of ACTON

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

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: 1123-01 (Hole #) | 11-3-23 (Date) | AM (Time) | SUNNY 30° (Weather) | 42.563 (Latitude) | -71.591 (Longitude:)

1. Land Use GRAVEL PARKING (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2-5% (Slope (%))

Description of Location:

2. Soil Parent Material: SAND | OUTWASH TERRACE (Landform) | BACK SLOPE (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Wetlands _____ feet | Property Line _____ feet | Drinking Water Well _____ feet | Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-12"	FILL										
12"-20"	Bw	SANDY LOAM	10YR 5/4								
20"-68"	C	MED. SAND	2.5Y 5/4	38"	7.5YR 5/8	5%					NO STONES

Additional Notes:
GROUNDWATER AT 52"

Commonwealth of Massachusetts
City/Town of ATEIR

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

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: 1123-02 (Hole #) 11-3-23 (Date) AM (Time) SUNNY 30° (Weather) 42.563 (Latitude) -71.591 (Longitude:)

1. Land Use: GRAVEL PARKING (e.g., woodland, agricultural field, vacant lot, etc.) N/A (Vegetation) N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.) 2-5% (Slope (%)

Description of Location:

2. Soil Parent Material: SAND OUTWASH TERRACE (Landform) BACK SLOPE (Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet; Drainage Way _____ feet; Wetlands _____ feet; Property Line _____ feet; Drinking Water Well _____ feet; Other _____ feet

4. Unsuitable Materials Present: ☐ Yes ☑ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☑ Yes ☐ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-13"	FILL										
13-22"	B/C	SANDY LOAM	10YR5/6								
22"-67"	C	MED. SAND	2.5Y5/4	38"	7.5YR5/8						NO STONES

Additional Notes:
GROUNDWATER AT 52"

Commonwealth of Massachusetts
City/Town of ATEK

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

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole #_____	Obs. Hole #_____
☑ Depth observed standing water in observation hole	_____ inches	_____ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☑ Depth to soil redoximorphic features (mottles)	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: _____ inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☐ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: UNKNOWN inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of ATER

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

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

L.C.G.

Signature of Soil Evaluator

11-3-23

Date

LAWRENCE C. GREENE #2688

Typed or Printed Name of Soil Evaluator / License #

6-30-25

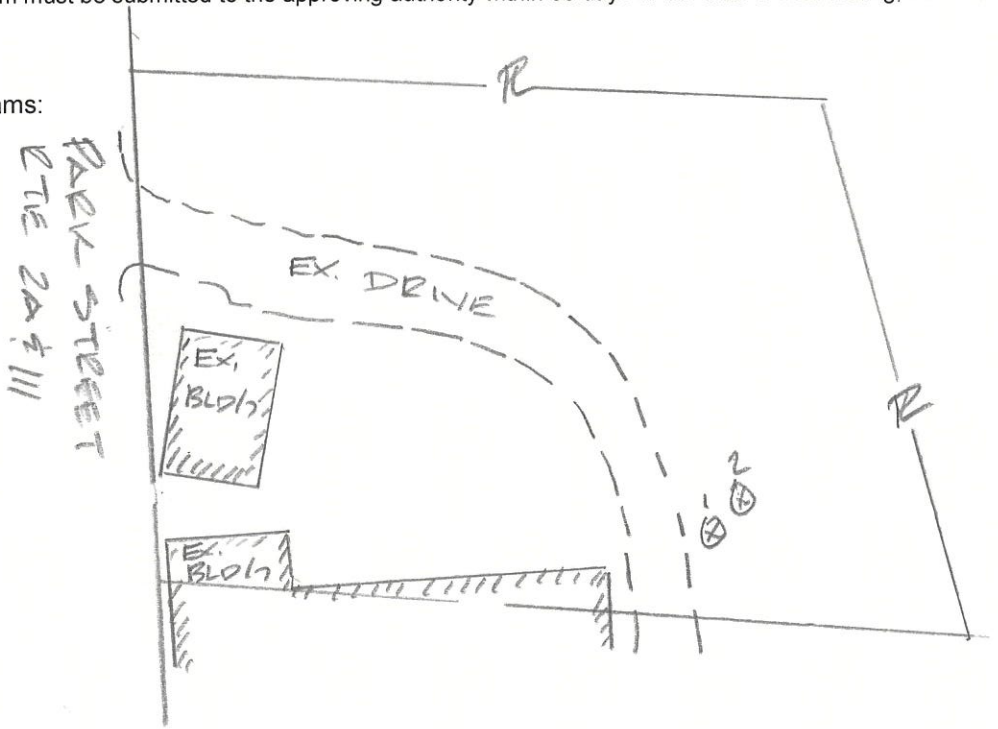
Expiration Date of License

Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:



Recharge Calculations

McCarty Engineering, INC. Project: 42 Park Street
Stormwater Recharge

Date: 11/6/23
Comp: JLL
City: Ayer Check : BRM
State: MA

Recharge Required

Hydrologic Soil Goup	Volume to Recharge (in)
A	**0.6**

Required Recharge Volume

Soil group	Impervious Area (ac)	Required Volume (ac-ft)
A	0.26	0.013
	Total	0.013

Recharge Provided

***Total Recharge Provided in Infiltration Basin during the 2-year storm= 0.049 AC-FT**

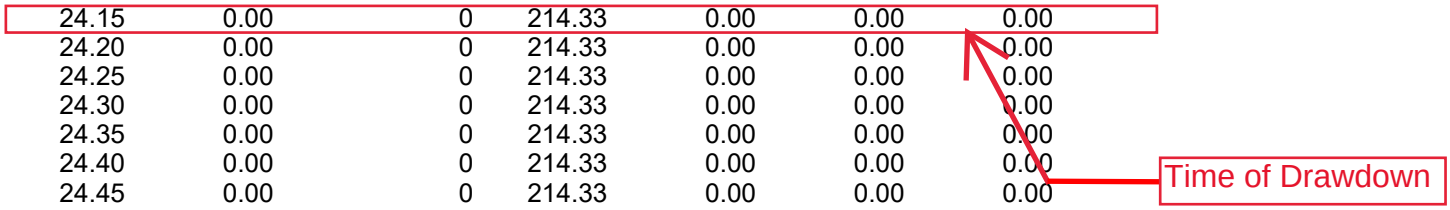
**All recharge is taking place through the bottom of the infiltration basins. Refer to the Proposed Conditions HydroCAD Model for the Recharge Volume for all storm events.*

Drawdown Analysis

Drawdown Analysis-Infiltration Basin

Hydrograph for Pond 1P: 310 Underground System (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
23.85	0.02	1	214.33	0.02	0.02	0.00
23.90	0.02	1	214.33	0.02	0.02	0.00
23.95	0.02	1	214.33	0.02	0.02	0.00
24.00	0.02	1	214.33	0.02	0.02	0.00
24.05	0.02	1	214.33	0.02	0.02	0.00
24.10	0.00	0	214.33	0.01	0.01	0.00
24.15	0.00	0	214.33	0.00	0.00	0.00
24.20	0.00	0	214.33	0.00	0.00	0.00
24.25	0.00	0	214.33	0.00	0.00	0.00
24.30	0.00	0	214.33	0.00	0.00	0.00
24.35	0.00	0	214.33	0.00	0.00	0.00
24.40	0.00	0	214.33	0.00	0.00	0.00
24.45	0.00	0	214.33	0.00	0.00	0.00
24.50	0.00	0	214.33	0.00	0.00	0.00
24.55	0.00	0	214.33	0.00	0.00	0.00
24.60	0.00	0	214.33	0.00	0.00	0.00
24.65	0.00	0	214.33	0.00	0.00	0.00
24.70	0.00	0	214.33	0.00	0.00	0.00
24.75	0.00	0	214.33	0.00	0.00	0.00
24.80	0.00	0	214.33	0.00	0.00	0.00
24.85	0.00	0	214.33	0.00	0.00	0.00
24.90	0.00	0	214.33	0.00	0.00	0.00
24.95	0.00	0	214.33	0.00	0.00	0.00
25.00	0.00	0	214.33	0.00	0.00	0.00



Water Quality Volume & Flow Rate Calculations

Water Quality Volume Calculation-Infiltration Basin

Stage-Area-Storage for Pond 1P: 310 Underground System (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
215.39	1,222	757	215.92	1,222	1,162
215.40	1,222	765	215.93	1,222	1,168
215.41	1,222	774	215.94	1,222	1,174
215.42	1,222	783	215.95	1,222	1,180
215.43	1,222	791	215.96	1,222	1,186
215.44	1,222	800	215.97	1,222	1,192
215.45	1,222	808	215.98	1,222	1,198
215.46	1,222	816	215.99	1,222	1,203
215.47	1,222	825	216.00	1,222	1,209
215.48	1,222	833	216.01	1,222	1,214
215.49	1,222	841	216.02	1,222	1,220
215.50	1,222	850	216.03	1,222	1,225
215.51	1,222	858	216.04	1,222	1,231
215.52	1,222	866	216.05	1,222	1,236
215.53	1,222	875	216.06	1,222	1,241
215.54	1,222	883	216.07	1,222	1,247
215.55	1,222	891	216.08	1,222	1,252
215.56	1,222	899	216.09	1,222	1,257
215.57	1,222	907	216.10	1,222	1,262
215.58	1,222	915	216.11	1,222	1,268
215.59	1,222	923	216.12	1,222	1,273
215.60	1,222	931	216.13	1,222	1,278
215.61	1,222	939	216.14	1,222	1,283
215.62	1,222	947	216.15	1,222	1,288
215.63	1,222	955	216.16	1,222	1,293
215.64	1,222	963	216.17	1,222	1,298
215.65	1,222	971	216.18	1,222	1,302
215.66	1,222	978	216.19	1,222	1,307
215.67	1,222	986	216.20	1,222	1,312
215.68	1,222	994	216.21	1,222	1,317
215.69	1,222	1,001	216.22	1,222	1,322
215.70	1,222	1,009	216.23	1,222	1,327
215.71	1,222	1,016	216.24	1,222	1,332
215.72	1,222	1,024	216.25	1,222	1,337
215.73	1,222	1,031	216.26	1,222	1,342
215.74	1,222	1,039	216.27	1,222	1,346
215.75	1,222	1,046	216.28	1,222	1,351
215.76	1,222	1,054	216.29	1,222	1,356
215.77	1,222	1,061	216.30	1,222	1,361
215.78	1,222	1,068	216.31	1,222	1,366
215.79	1,222	[illegible]	[illegible]32	1,222	1,371
215.80	1,222	[illegible]	216.33	1,222	1,376
215.81	1,222	1,089	216.34	1,222	1,381
215.82	1,222	1,096	216.35	1,222	1,386
215.83	1,222	1,103	216.36	1,222	1,390
215.84	1,222	1,110	216.37	1,222	1,395
215.85	1,222	1,117	216.38	1,222	1,400
215.86	1,222	1,124	216.39	1,222	1,405
215.87	1,222	1,130	216.40	1,222	1,410
215.88	1,222	1,137	216.41	1,222	1,415
215.89	1,222	1,143	216.42	1,222	1,420
215.90	1,222	1,150	216.43	1,222	1,425
215.91	1,222	1,156	216.44	1,222	1,430

Outlet Invert =

WQv Provided

WQv Required=1.0in x Area Inp. sf x 1ft/12in
WQv Required=1.0in x 10,961 sf x 1ft/12in =913.4 cf

1,484cf > 913.4 cf

McCarty Engineering, INC.	Project:	42 Park Street	Proj. No:	
			Date:	9/1/23
	City:	Ayer	Comp:	JLL
	State:	MA	Check :	BRM

Converting WQv to Fow Rate for Sizing Proprietary Stormwater Treatemnnt Practices

Required WQv = 1.0 inch

$Q_{0.5}$=(qu)(A)(WQv)

qu = Unit Peak Discharge in csm/in - This Variable derived from MADEP Flow rate table, Figure 2 (atta
A = Impervious Area in square miles (sm) - 1 ac = 0.0015625 sm
WQv= Water Quality Volume in watershed inches (1.0 in)

Structure

WQU 1 (DMH 1)

Tc= 5 minutes = 0.083 hours
qu= 795 csm/in
A= 0.15 ac = 0.00024sm
WQv= 1.0 in

Flow Rate= (795 csm/in)x(0.00024sm)x(1.0 in)
Flow Rate= 0.19

McCarty Engineering, INC.	Project:	42 Park Street	Proj. No:	
			Date:	9/1/23
	City:	Ayer	Comp:	JLL
	State:	MA	Check :	BRM

Converting WQv to Fow Rate for Sizing Proprietary Stormwater Treatemnnt Practices

Required WQv = 1.0 inch

$Q_{0.5}$=(qu)(A)(WQv)

qu = Unit Peak Discharge in csm/in - This Variable derived from MADEP Flow rate table, Figure 2 (atta
A = Impervious Area in square miles (sm) - 1 ac = 0.0015625 sm
WQv= Water Quality Volume in watershed inches (1.0 in)

Structure

WQU 1 (DMH 1)

Tc= 5 minutes = 0.083 hours
qu= 795 csm/in
A= 0.05 ac = 0.00007sm
WQv= 1.0 in

Flow Rate= (795 csm/in)x(0.00007sm)x(1.0 in)
Flow Rate= 0.06

TSS Removal Worksheets

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: WQU to Infiltration Basin

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Water Quality Unit	**0.99**	**1.00**	**0.99**	**0.01**
Infiltration Basin	**0.80**	**0.01**	**0.008**	**0.002**
	0.00	**0.002**	**0.00**	**0.002**
	0.00	**0.002**	**0.00**	**0.002**
	0.00	**0.002**	**0.00**	**0.002**

Total TSS Removal = **99.8%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: **42 Park Street**
Prepared By: **JLL**
Date: **9/1/2023**

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Infiltration Basin Pre-Treatment

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Water Quality Unit	0.99	1.00	0.99	0.01
	0.00	0.01	0.00	0.01
	0.00	0.01	0.00	0.01
	0.00	0.01	0.00	0.20
	0.00	0.01	0.00	0.01

Total TSS Removal = 99%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 42 Park Street
Prepared By: JLL
Date: 9/1/2023

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Hydroworks Sizing Summary

42 Park St CB-1

Ayer, Ma

08-21-2023

Recommended Size: HydroDome HD 4i

A HydroDome HD 4i is recommended to provide 99 % annual TSS removal based on a drainage area of .17 (ac) with an imperviousness of 91.4 % and Sterling 2 Nnw, Massachusetts rainfall for the Hydroworks standard particle size distribution.

The recommended HydroDome HD 4i treats 100 % of the annual runoff and provides 99 % annual TSS removal for the Sterling 2 Nnw rainfall records and Hydroworks standard particle size distribution.

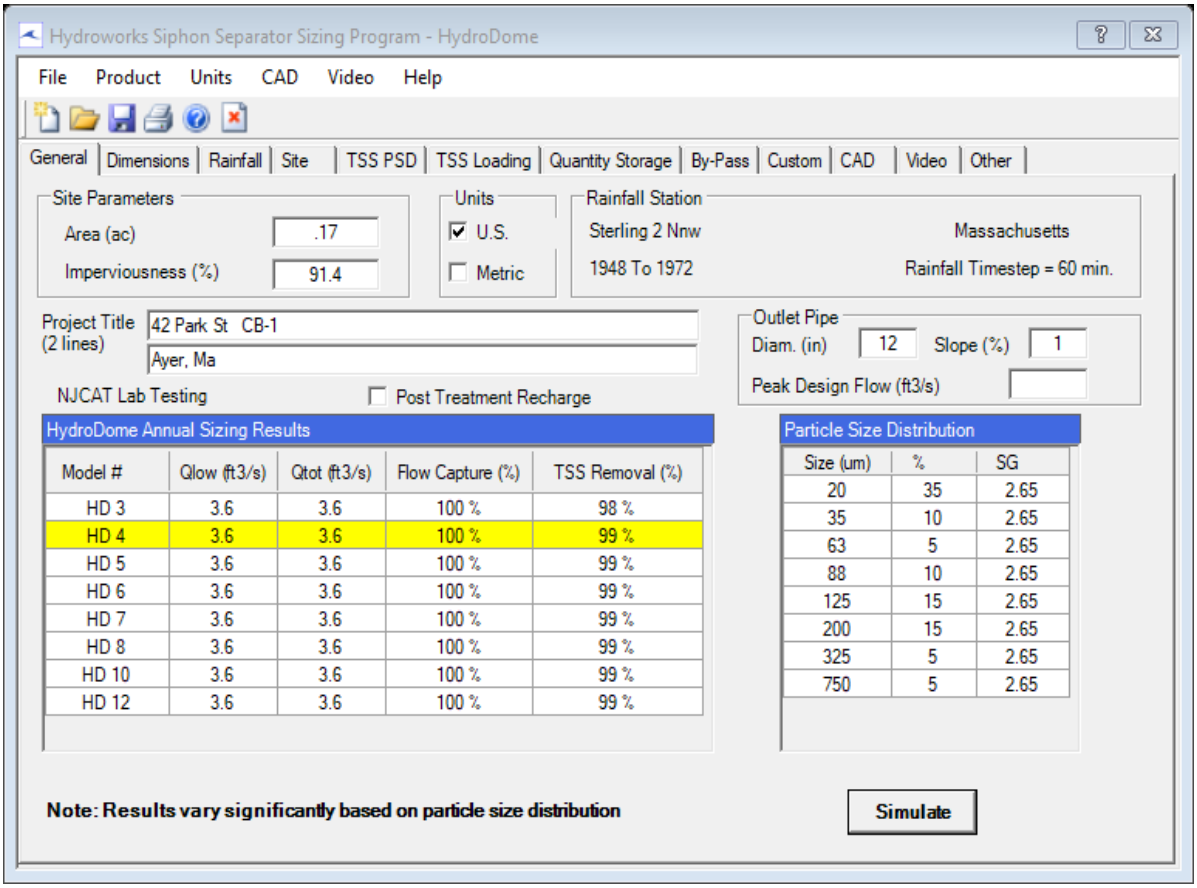
The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of 3.56 (ft3/s) for the given 12 (in) pipe diameter at 1% slope. The headloss was calculated to be 12 (in) above the crown of the 12 (in) outlet pipe.

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

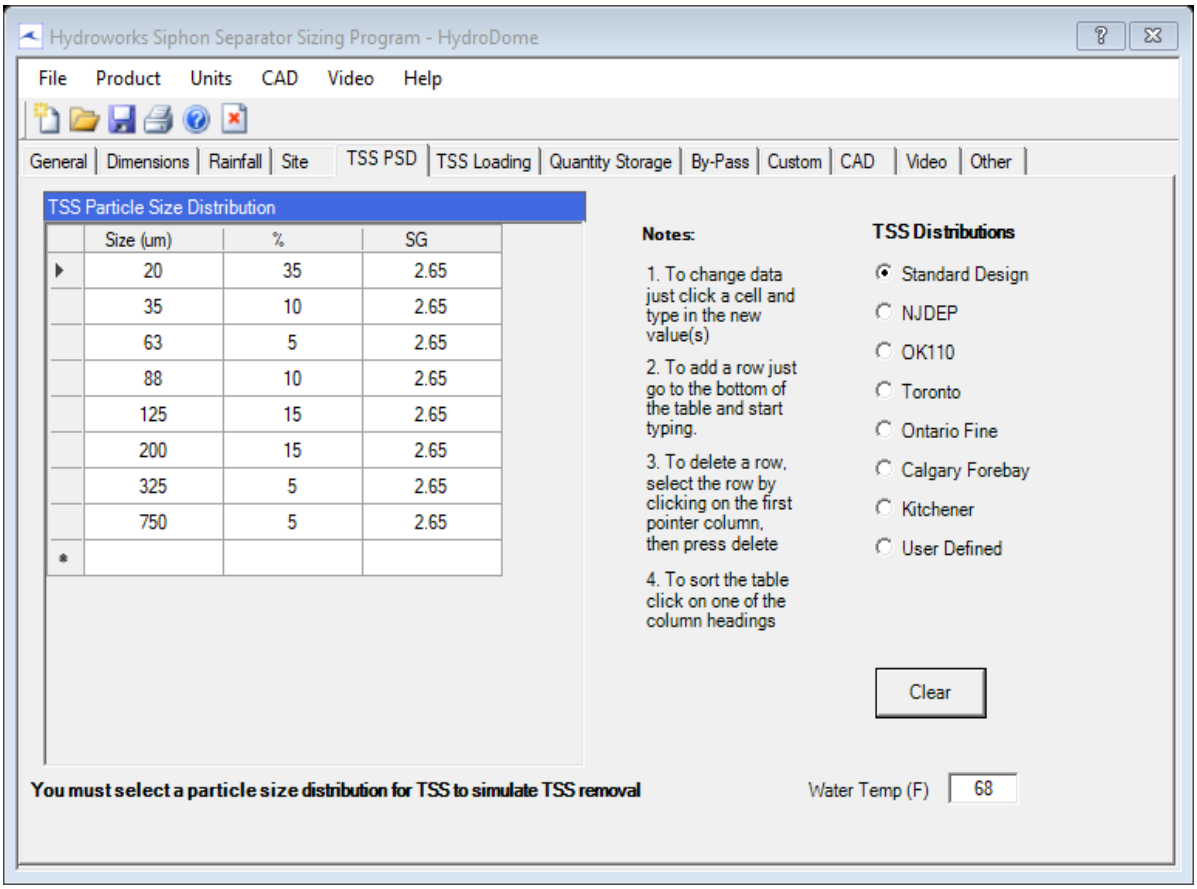
If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

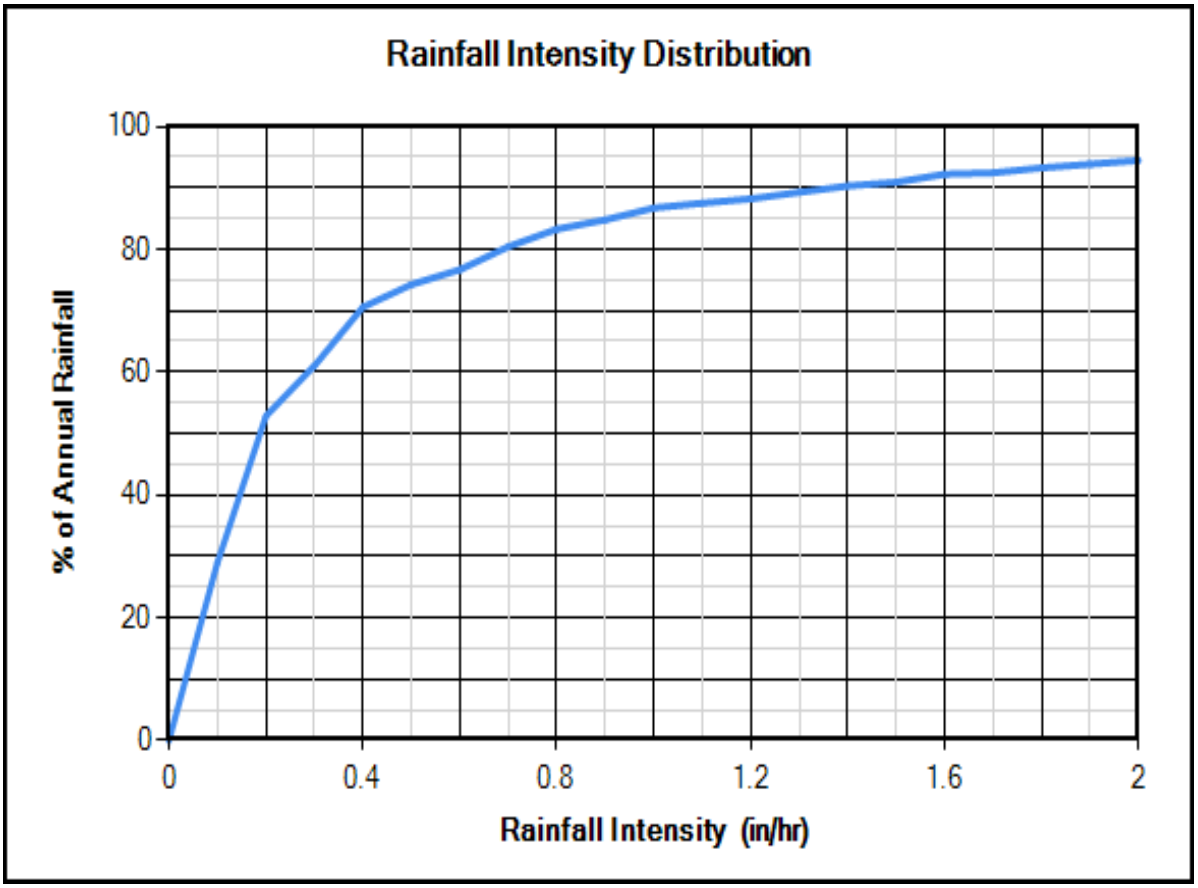
TSS Removal Sizing Summary



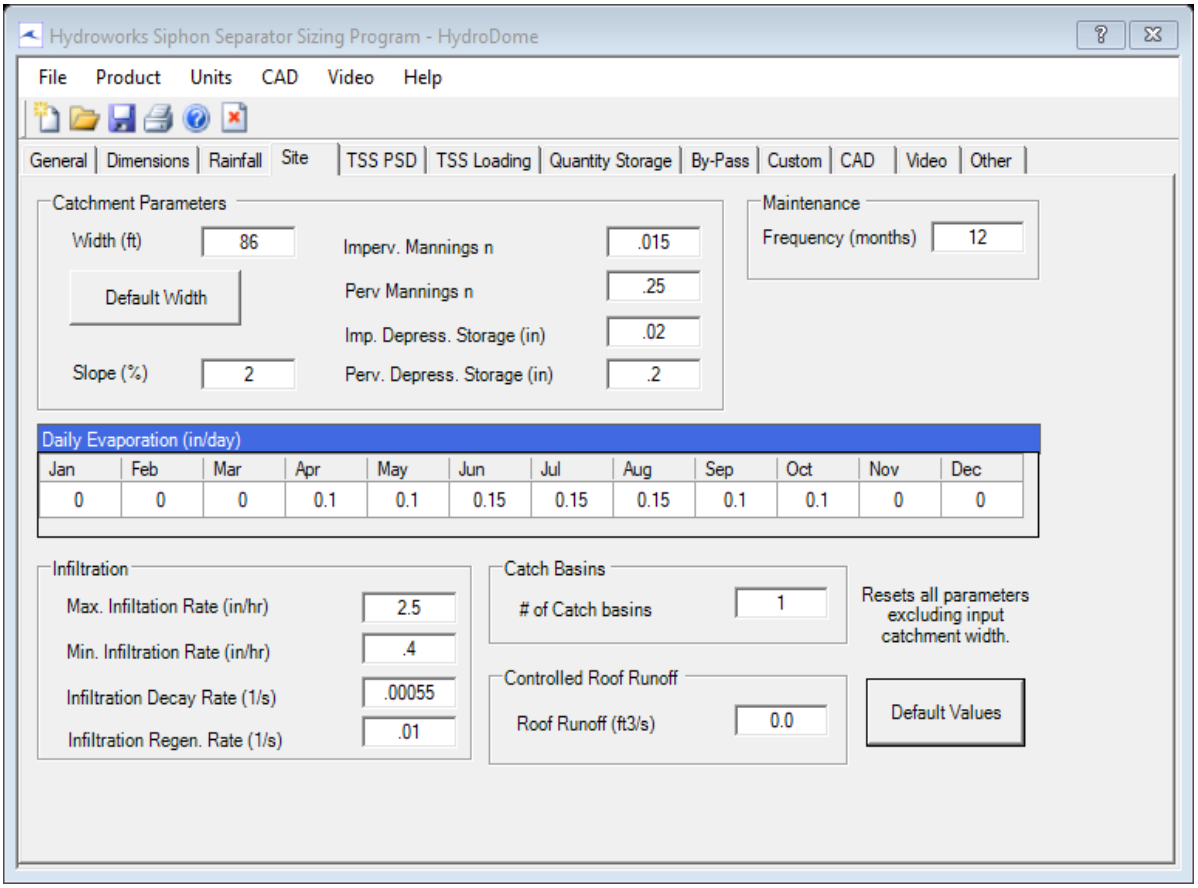
TSS Particle Size Distribution



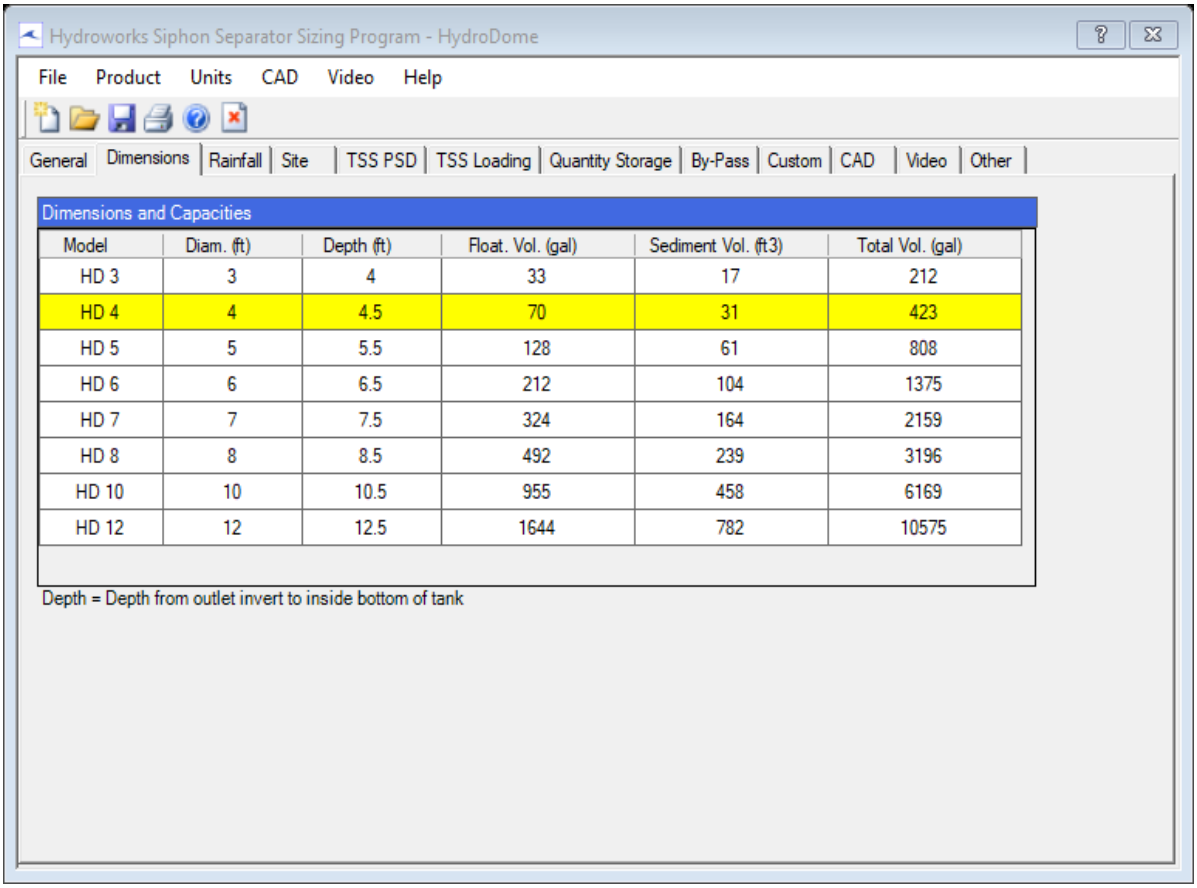
Rainfall Station - Sterling 2 Nnw, Massachusetts(1948 To 1972)



Site Physical Characteristics



Dimensions And Capacities

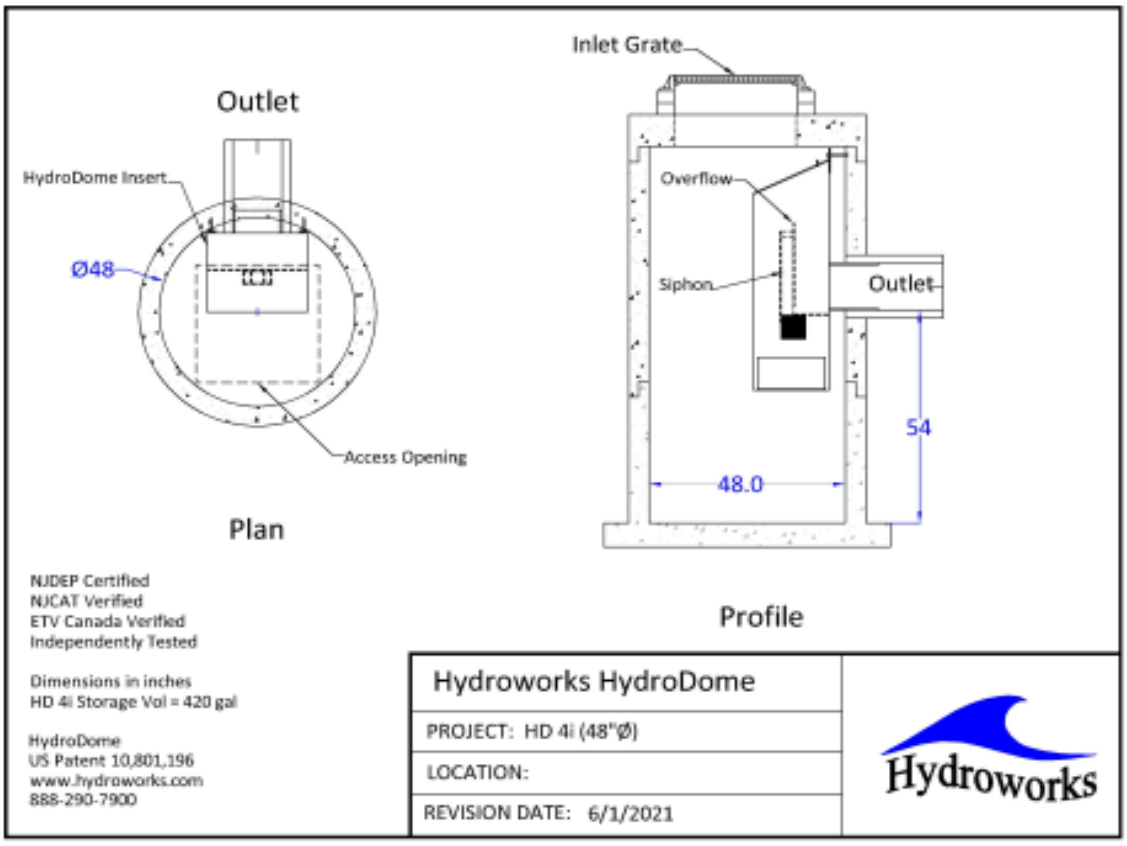


Dimensions and Capacities

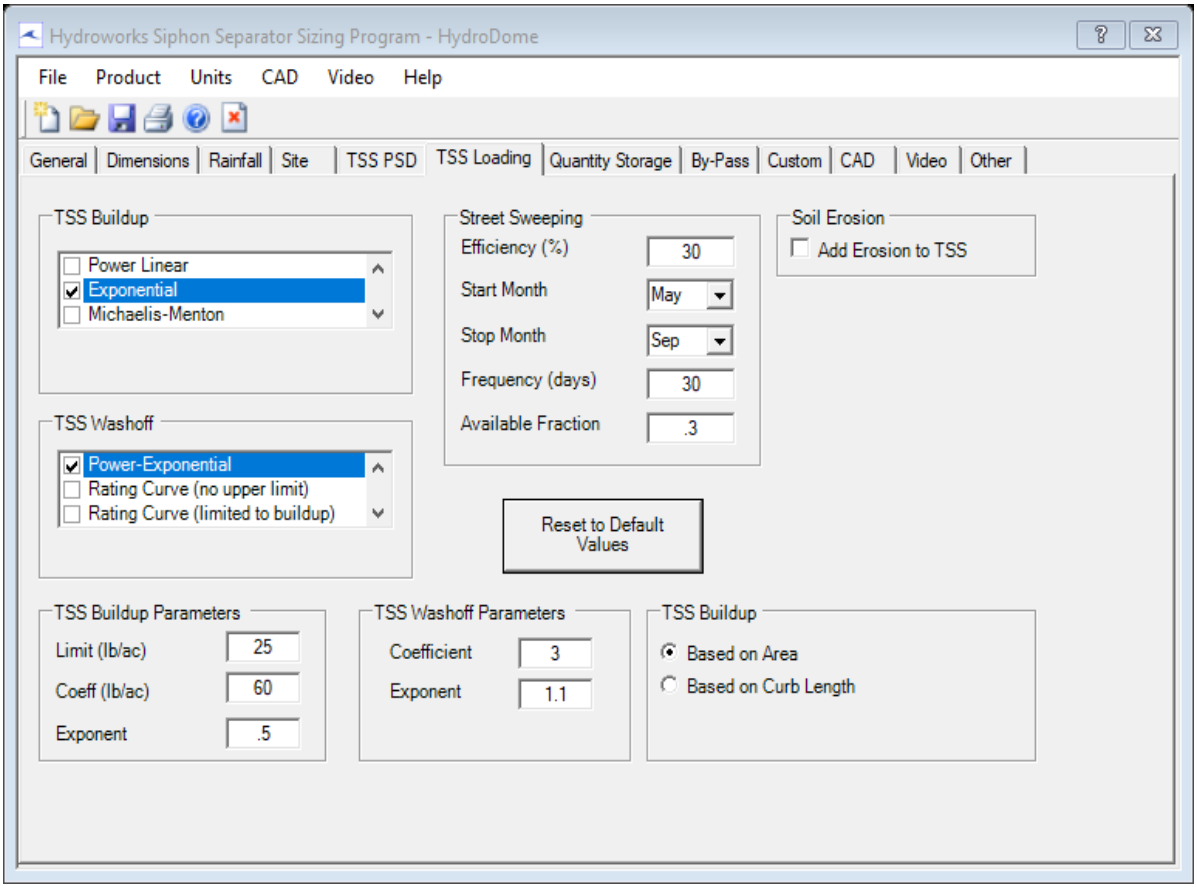
Model	Diam. (ft)	Depth (ft)	Float. Vol. (gal)	Sediment Vol. (ft3)	Total Vol. (gal)
HD 3	3	4	33	17	212
HD 4	4	4.5	70	31	423
HD 5	5	5.5	128	61	808
HD 6	6	6.5	212	104	1375
HD 7	7	7.5	324	164	2159
HD 8	8	8.5	492	239	3196
HD 10	10	10.5	955	458	6169
HD 12	12	12.5	1644	782	10575

Depth = Depth from outlet invert to inside bottom of tank

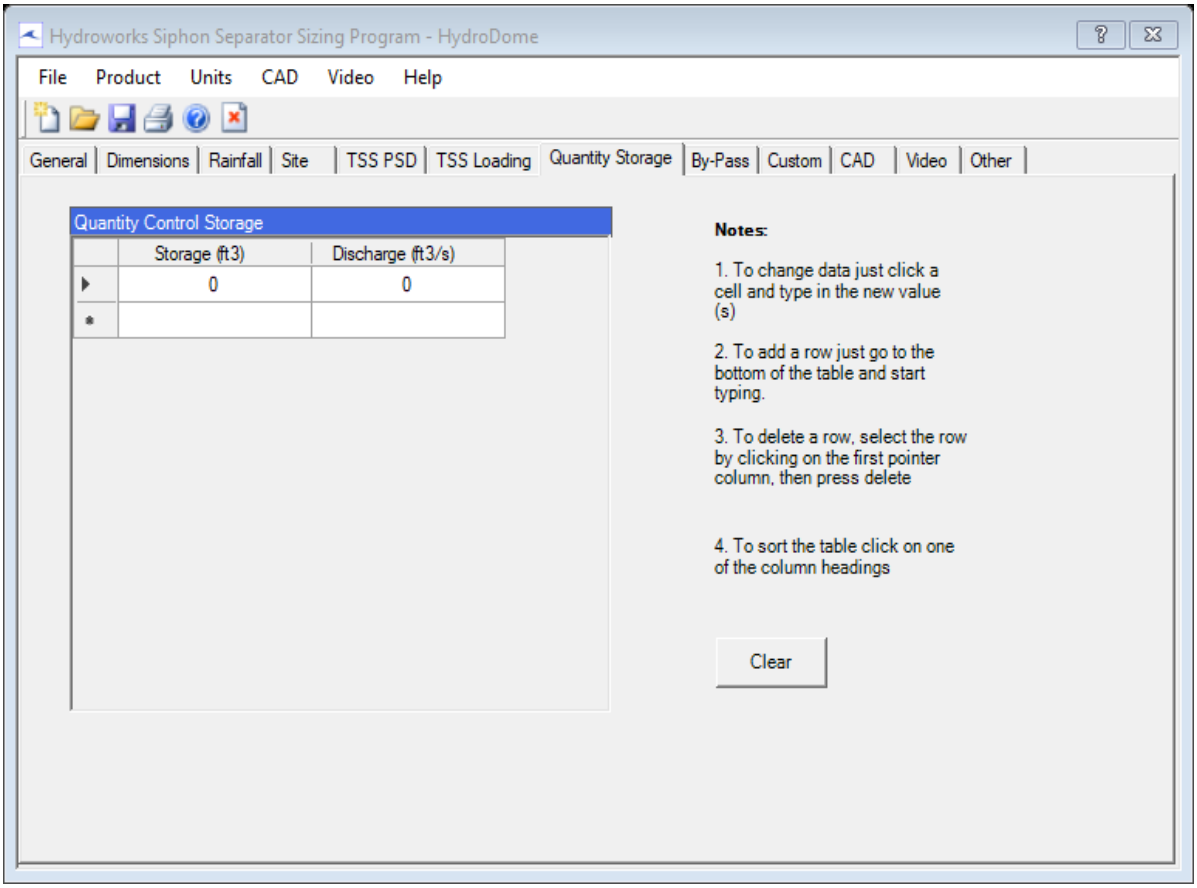
Generic HD 4i CAD Drawing



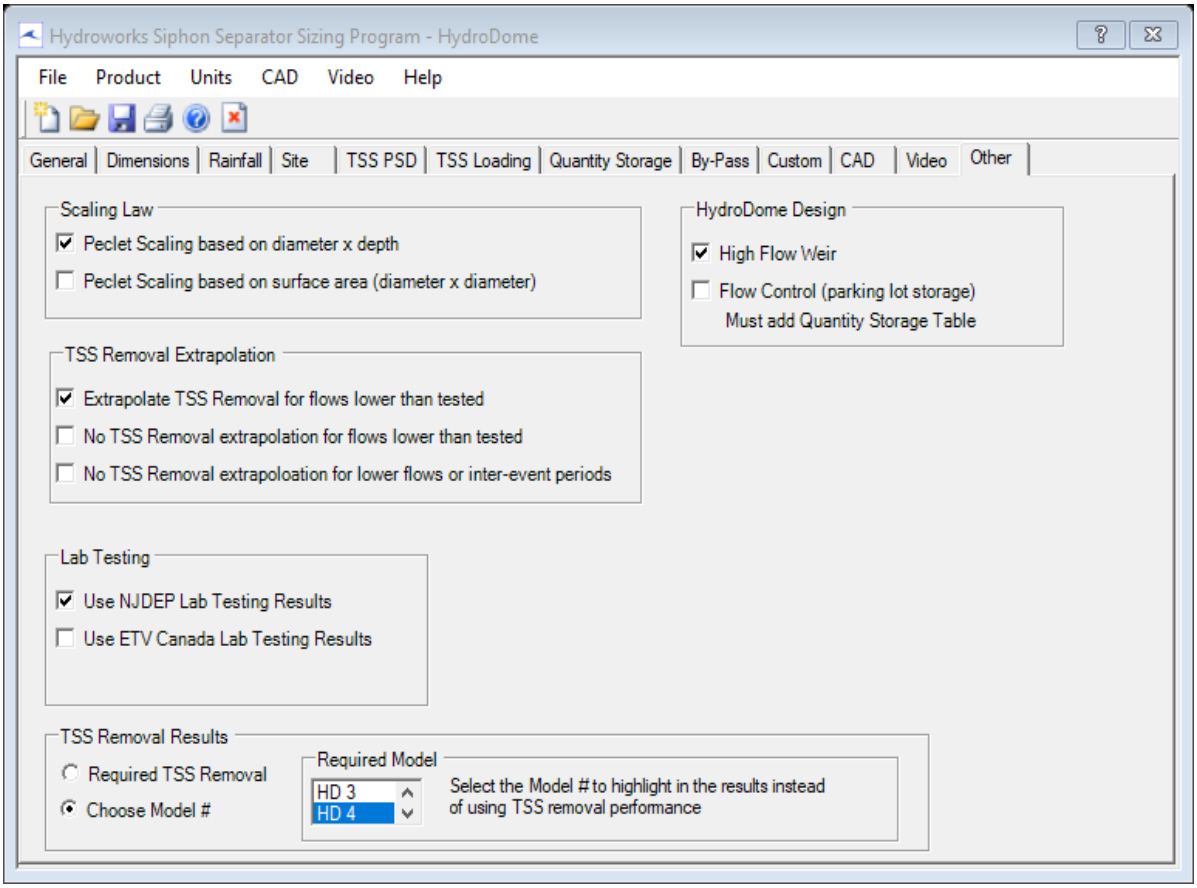
TSS Buildup And Washoff



Upstream Quantity Storage



Other Parameters



Flagged Issues

If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.6

1-800-290-7900
www.hydroworks.com

Hydroworks Sizing Summary

42 Park St CB-2

Ayer, Ma

08-21-2023

Recommended Size: HydroDome HD 4i

A HydroDome HD 4i is recommended to provide 99 % annual TSS removal based on a drainage area of .12 (ac) with an imperviousness of 39 % and Sterling 2 Nnw, Massachusetts rainfall for the Hydroworks standard particle size distribution.

The recommended HydroDome HD 4i treats 100 % of the annual runoff and provides 99 % annual TSS removal for the Sterling 2 Nnw rainfall records and Hydroworks standard particle size distribution.

The HydroDome has a siphon which creates a discontinuity in headloss. Since a peak flow was not specified, headloss was calculated using the full pipe flow of 3.56 (ft3/s) for the given 12 (in) pipe diameter at 1% slope. The headloss was calculated to be 12 (in) above the crown of the 12 (in) outlet pipe.

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

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The sizing program is for sizing purposes only and does not address any site specific parameters such as hydraulic gradeline, tailwater submergence, groundwater, soils bearing capacity, etc. Headloss calculations are not a hydraulic gradeline calculation since this requires a starting water level and an analysis of the entire system downstream of the HydroDome .

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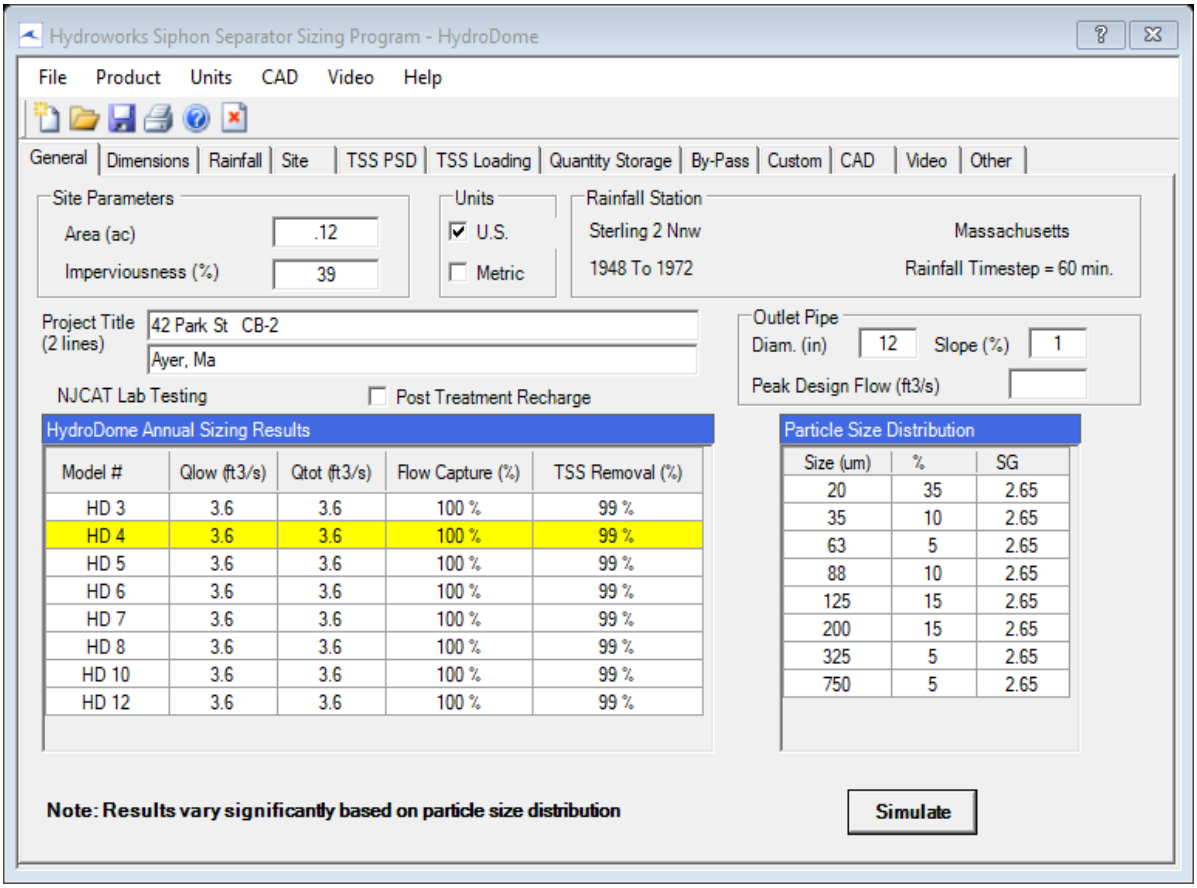

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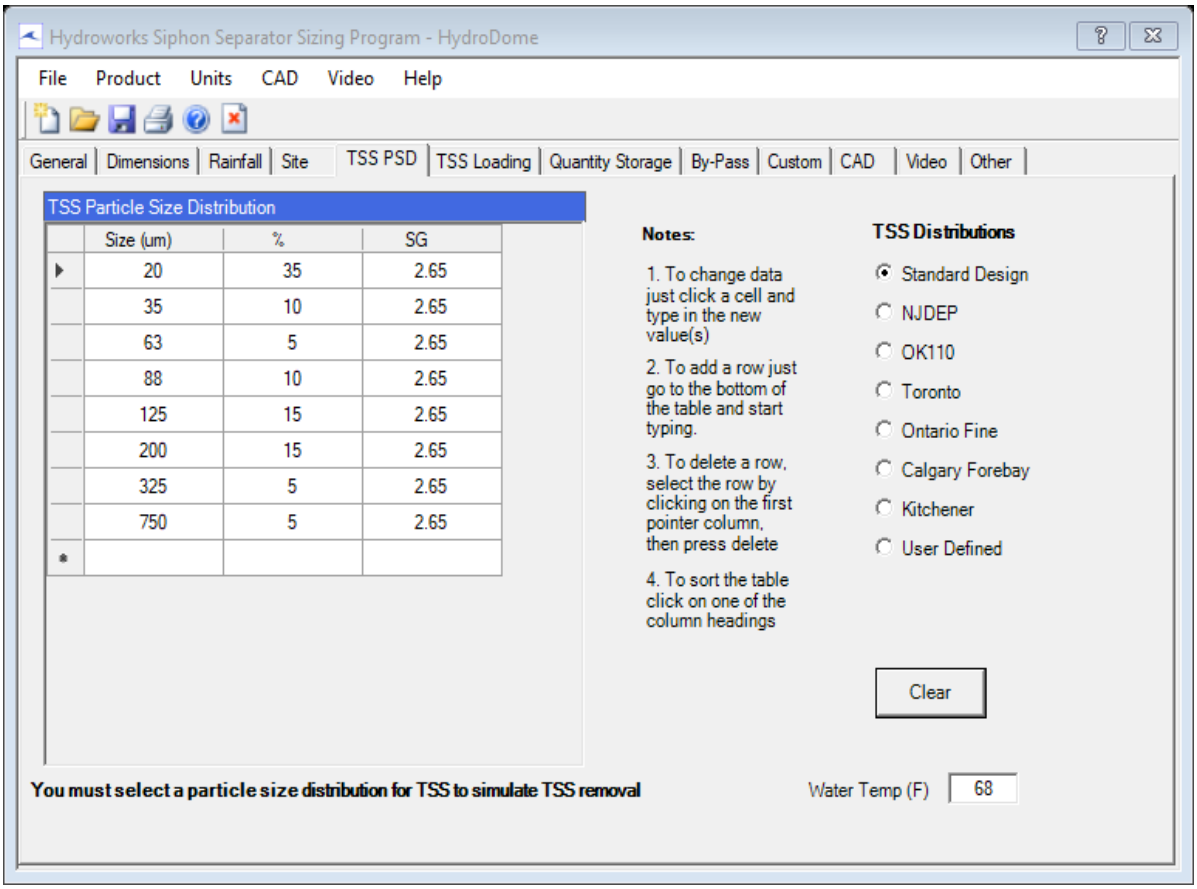

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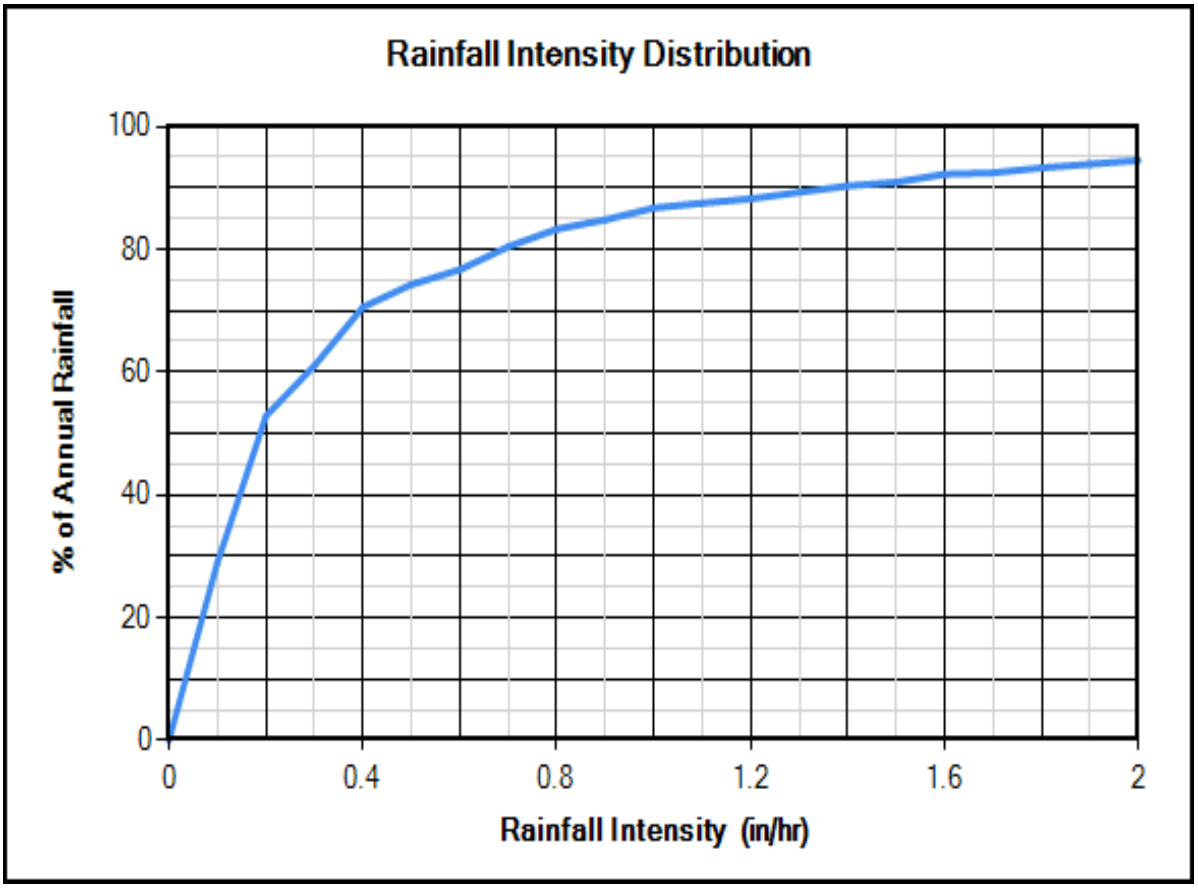

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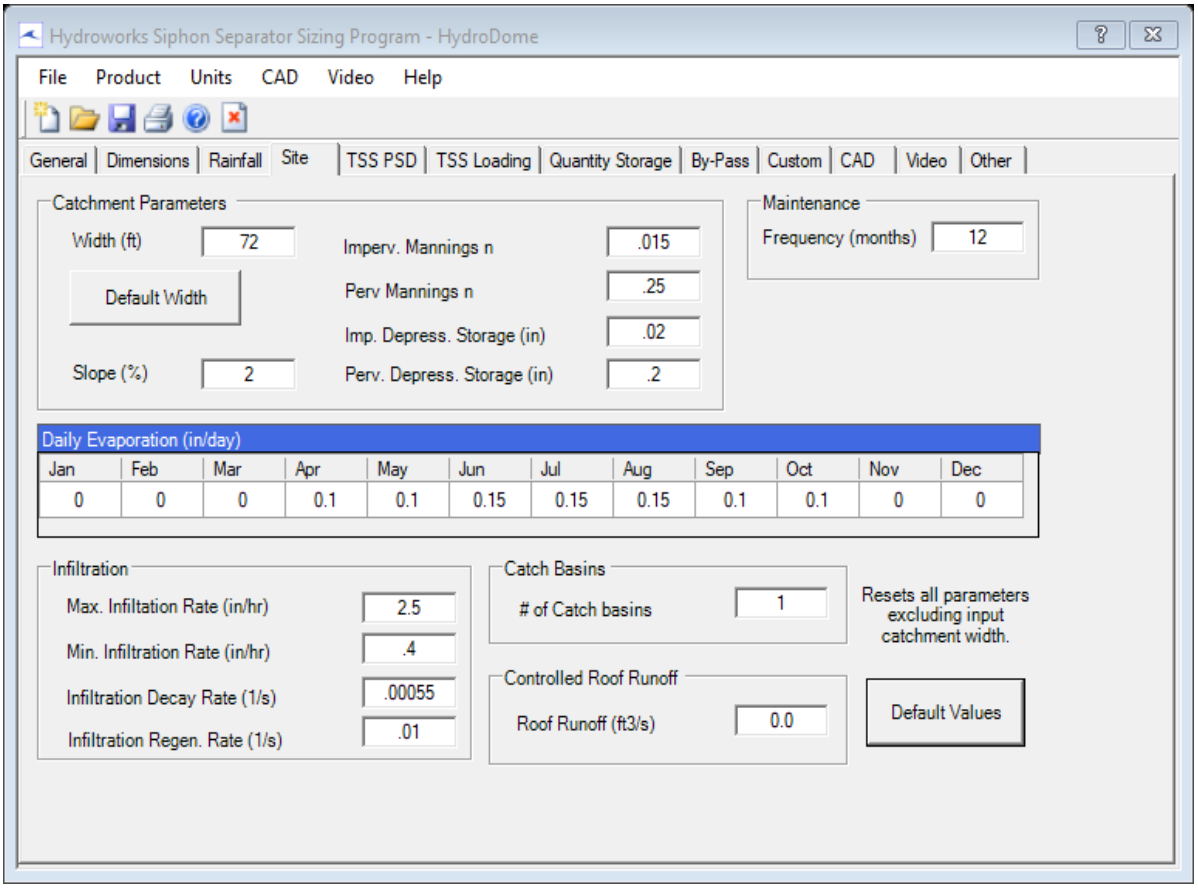
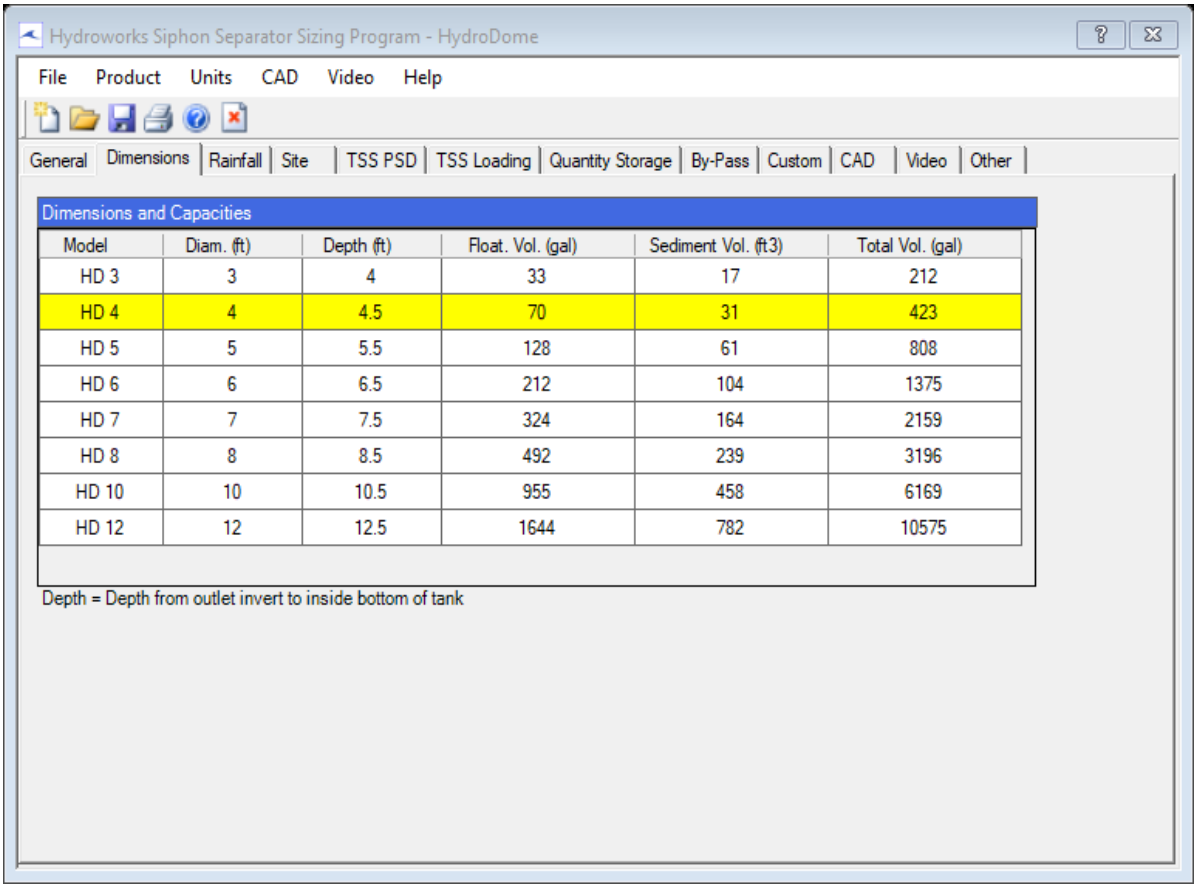


Dimensions And Capacities



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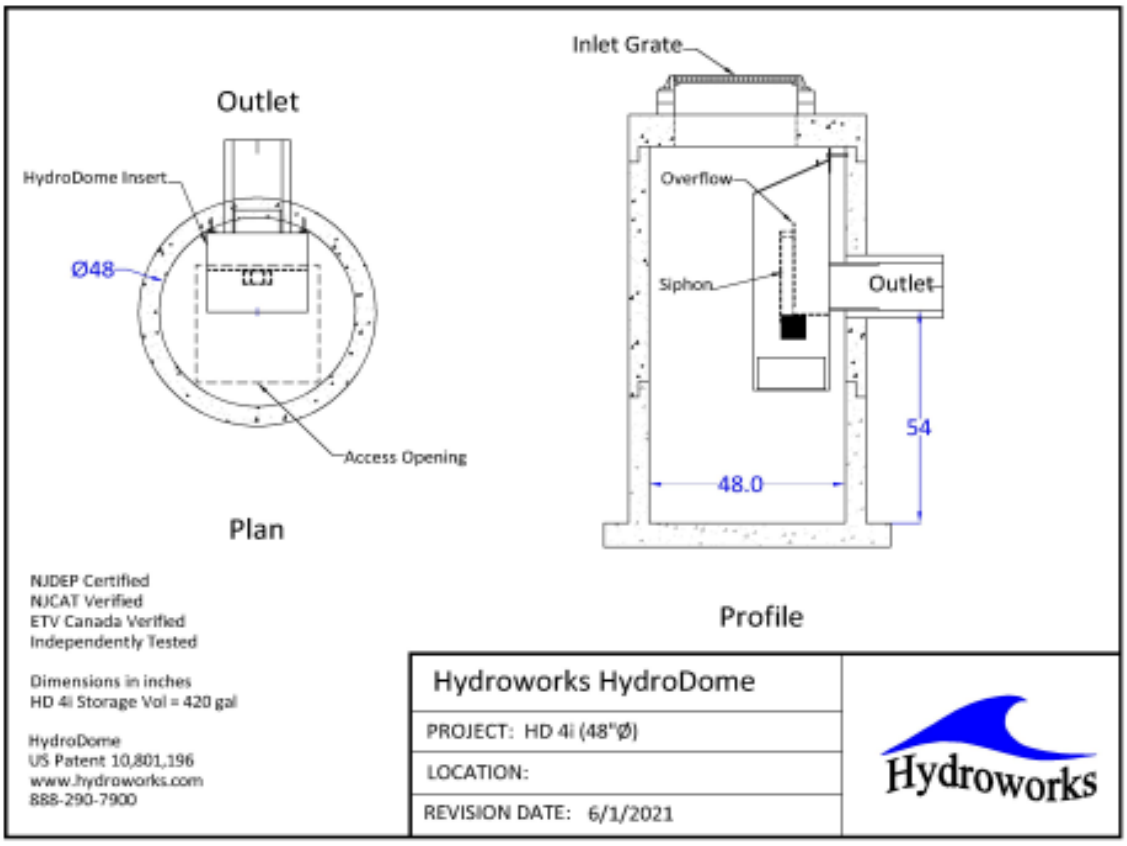
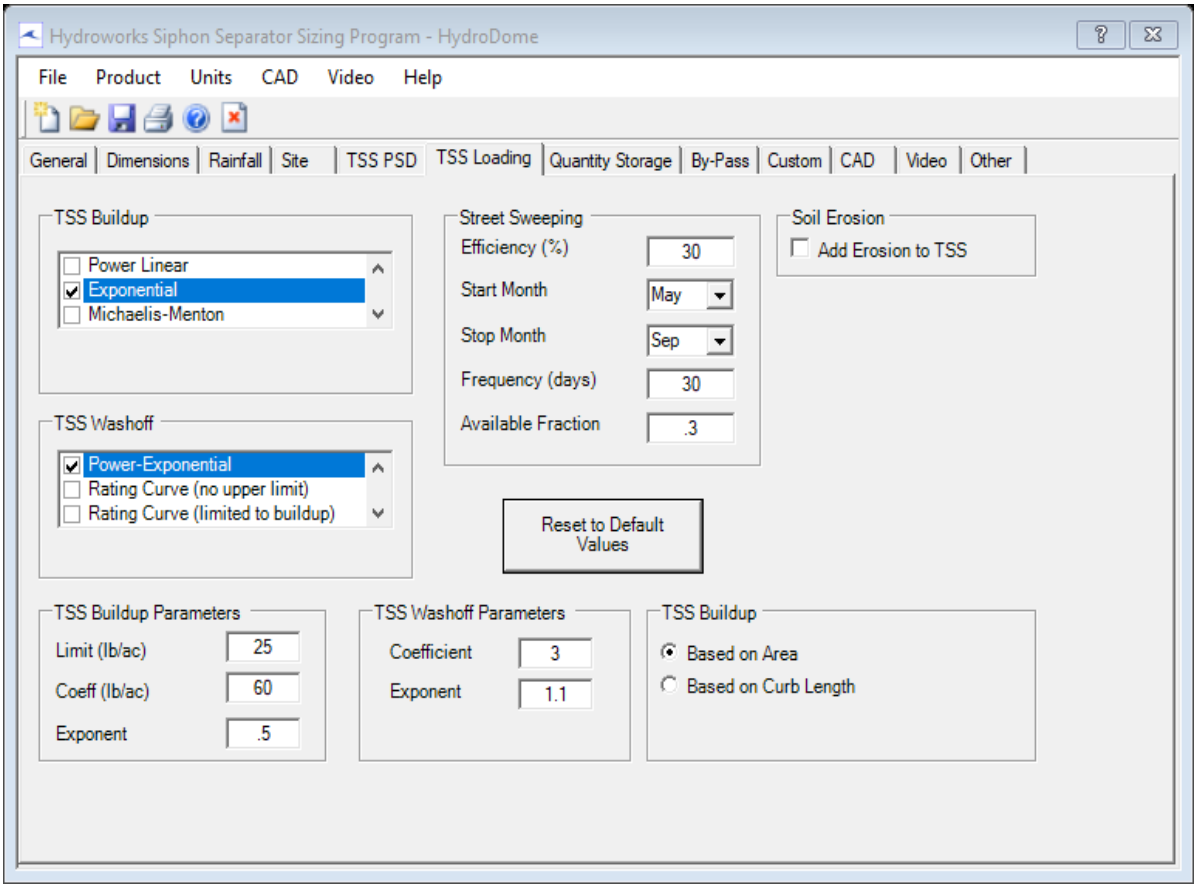
Depth = Depth from outlet invert to inside bottom of tank

Generic HD 4i CAD Drawing



TSS Buildup And Washoff



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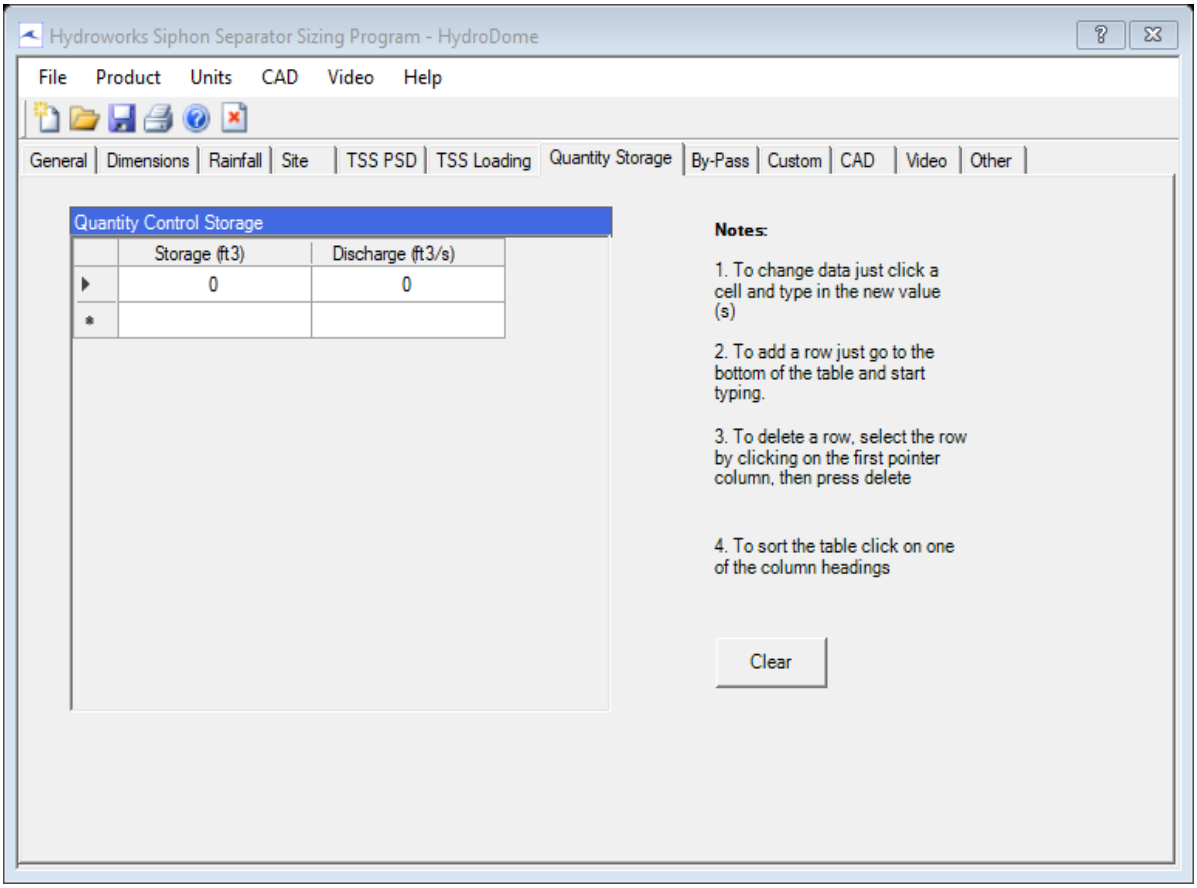
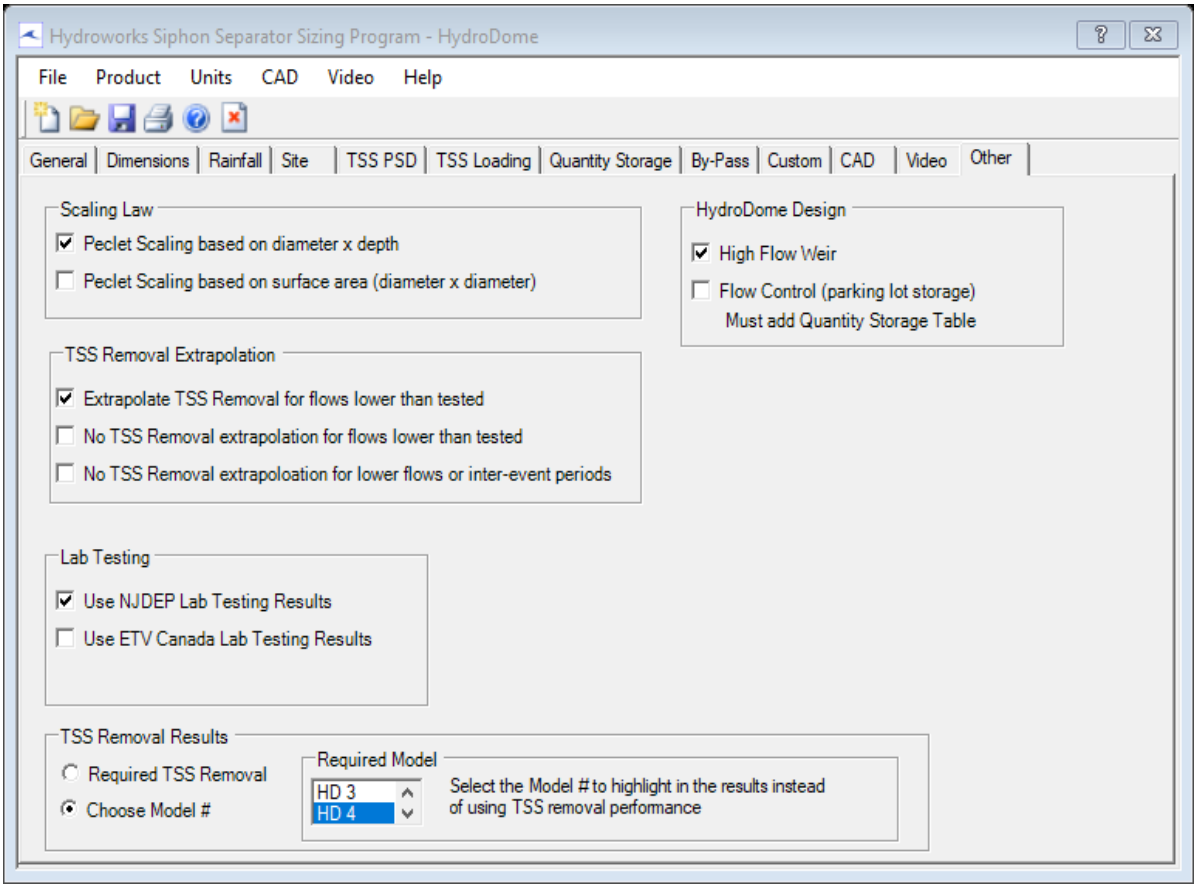


Other Parameters



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If there is underground detention storage upstream of the HydroDome please contact Hydroworks to ensure it has been modeled correctly.

Hydroworks Sizing Program - Version 5.6

1-800-290-7900
www.hydroworks.com

Operation and Maintenance Plan

42 Park Street
Ayer, Massachusetts
Operation and Maintenance Plan

The site contractor will be responsible for the operation and maintenance of the stormwater collection system including deep sump catch basins and at grade infiltration basin during construction. After construction, the Property Owner is responsible for the operation and maintenance of the proposed stormwater collection system. The following Operation and Maintenance Plan for the project is proposed in accordance with DEP Stormwater Management Standard No. 9 to ensure that the stormwater collection and treatment system operates in accordance with the MADEP Stormwater Management Policy.

Schedule for Inspection and Maintenance after Construction:

Stormwater Management System Owner/Operator

- The property owner will be the owner and operator of the proposed stormwater collection system on site.
- If the property is sold, a copy of this Operation and Maintenance Plan will be transferred to the new property owners.

Below Grade Infiltration Basin

- Once constructed, basins will be inspected at a minimum after several storm events for the first year and annually thereafter to confirm drainage system functions as designed. Problems will be addressed immediately.
- System shall be cleaned as required per the manufacturer's recommendations.

Water Quality Units

- Structure cover should be inspected monthly for evidence of repair. Verify that inverts are secure and free flowing. Measure depth of sediment below water line.
- Unit shall be cleaned a minimum of twice per year. One of these cleanings to occur before April 15th of each year and one shall occur before September 15th of each year. Unite must be cleaned with a vacuum pump.

- All liquid, sediment, and hydrocarbons shall be pumped from the sump at least twice per year at intervals corresponding with the unit cleaning.
- All sediment, water and hydrocarbons should be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.
- Refer to water quality unit manufacturers specifications for additional maintenance recommendations.

The routine and non-routine maintenance tasks to be undertaken after construction and a schedule for implementing those tasks.

- A site maintenance log will be kept. This log will record the dates when maintenance tasks were completed, the person who completed the task, and any observations of malfunctions in components of the stormwater management system. A sample maintenance log form is attached.

Estimated Operations and Maintenance Budget

- Operation and maintenance costs for the project are expected to be approximately $5,000/year

42 Park Street
Ayer, Massachusetts
Operation and Maintenance Plan

Operation and Maintenance Schedule

BMP	Frequency	Date Performed	Comments	Cleaning/ Repair Needed? Yes/No	Date of Cleaning/ Repair	Performed By
Below Grade Infiltration Basins	Inspection after each major storm event for the first year Cleaning as needed					
Water Quality Units	Monthly Inspections Biannual Cleaning					

Site Maintenance Supervisor:_____ Date:_____

Long Term Pollution Prevention Plan

42 Park Street
Ayer, Massachusetts
Long Term Pollution Prevention Plan

A long term pollution prevention plan is an important element of the routine operation and maintenance of an industrial facility that is designed to reduce or eliminate the creation of pollutants at the source. In addition to the obvious environmental benefits of protecting the natural resources downstream of the facility, maintaining a long term pollution prevention plan will provide for a healthier and safer living and work environment. The following long term pollution prevention practices will be employed at the property.

- Good housekeeping practices:
  Maintaining a clean property will prevent or reduce the amount of pollutants in the stormwater runoff discharging from the site. This will be achieved through periodic parking lot sweeping, at the owners discretion, and through catch basin and infiltration basin cleaning as detailed within the sites Stormwater Operation and Maintenance Plan.

- Provisions for storing materials and waste products inside or under cover:
  Materials will be stored in their appropriate containers and shall be stored under cover or in a secure enclosure to reduce the risk of spills. Waste products will be placed in proper bins until emptied by a licensed solid waste management company.

- Vehicle washing controls:
  Vehicle washing may be conducted within the driveways of the residential units. All wash water will be collected in the proposed stormwater infrastructure on site.

- Requirements for routine inspections and maintenance of stormwater BMPs:
  Refer to the maintenance schedule provided in the Stormwater Operation and Maintenance Plan.

- Spill prevention and response plans:
  Materials shall be stored in their proper original container in a secure location. No mixing of materials shall occur unless recommended by the manufacturer. The manufacturer's recommendations for proper use and disposal should be strictly adhered to. In the case of a spill the manufacturer's method for cleanup shall be followed. The area shall be kept ventilated and personnel handling the cleanup shall wear proper protective clothing. Spills of toxic or hazardous material shall be reported to the appropriate State and/or local authority in accordance with local and/or State regulations.

- Provisions for maintenance of lawns, gardens, and other landscaped areas:
  Owner will maintain surrounding landscaped area as needed.

- Requirements for storage and use of fertilizers, herbicides, and pesticides:
  Fertilizers, herbicides and pesticides shall be stored in their appropriate containers in a secure location as described above. Protective clothing shall be used when handled, and quantities shall be applied according to manufacturer's recommendations. Typically, the handling of these items will be the responsibility of a landscape contractor and will be stored off site.

- Pet waste management provisions:
  Pet waste management will be the responsibility of the individual pet owners. Trash receptacles will be located at various locations throughout the site for pet waste disposal.

- Provisions for operation and management of septic systems:
  Septic Systems are not applicable at this site.

- Provisions for solid waste management:
  Solid waste material shall be placed in outdoor secure containers until emptied by licensed waste management company.

- Snow disposal and plowing plans relative to Wetland Resource Areas:
  Snow shall be placed on upland areas only where sand and debris will remain after snowmelt for later removal. Snow shall be plowed in accordance with standard operating procedures and stored in designated areas as detailed on the site plan approval documents. Any sand and debris remaining after snow piles have melted will be removed by the facility owners or maintenance contractors.

- Winter Road Salt/or Sand Use and Storage restriction:
  The use of environmentally friendly alternatives to road salt will be considered.

- Street sweeping schedules
  Street sweeping will occur only as needed at the discretion of the owner.

- Provisions for prevention of illicit discharges to the stormwater management system:
  The Stormwater Management System associated with the development has been designed such that prior to storm water runoff discharging from the site, it is treated through a series of best management practices. To the Engineer's knowledge, there are no known or designed non-storm water discharges that are or will be connected to the storm water collection system that would convey pollutants directly to groundwater or surface waters.

- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to a near critical areas or from LUHPPL:
  All catch basins shall be equipped with hoods to prevent oils and floatables from discharging to the underground infiltration basins.

- Training for staff or personnel involved with the implementing Long Term Pollution Prevention Plan:
  Facilities staff will be responsible for implementing the Long Term Pollution Prevention Plan and staff will be trained in accordance with company policy.

- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:
  Ali Goldinak
  50 Mountain Ave,
  Fitchburg, AM 01420
  (973) 202-6333

MADEP Stormwater Checklist

Pipe Sizing (Culvert) Calculations

McCarty Engineering, Inc. Project: 42 Park Street Proj. No: 42 Park

Culvert Flows Date: 9/1/23

City: Ayer Comp: JLL

State: MA Check : BRM

*Shaded columns indicate input values

	Paved		Unpaved						
Culvert ID	AREA (sq. ft)	C FACTOR	AREA (sq. ft)	C FACTOR	COMPOSITE C	TOTAL AREA (sq. ft)	TOTAL AREA (acres)	Q	Double Grate
CB 1	1413	0.9	2105	0.3	0.54	3518	0.08	0.3	NO
CB 2	6486	0.9	421	0.3	0.86	6907	0.16	0.8	NO
RL 1	1427	0.9	0	0.3	0.90	1427	0.03	0.2	NO
RL 2	1427	0.9	0	0.3	0.90	1427	0.03	0.2	NO

Pipe Design Worksheet

Project # /Name: 42 Park Street

Calculated By: JLL **Date:** 9/1/2023
Checked By: BRM **Date:** 9/1/2023

**Flows form the 25-year storm event from HydroCAD were u*

n= 0.01 **HDPE Pipe**

Culvert	Q	Qsum	Length	Slope	Dia.	Full-Flow Velocity	Full-Flow Capacity[2]	
(ID, Lot #)	(cfs)	(cfs)	(ft.)	(ft./ft.)	(in.)	(fps)	(cfs)	
CB 1 to DMH 1	0.30		7.5	0.01	12	5.91	4.64	O.K
RL 1 to RL 2	0.20		161.4	0.02	8	6.38	2.23	O.K
RL 2 to DMH 1	0.40	0.40	70.0	0.01	8	4.51	1.58	O.K
DMH 1 to DMH 2	0.70	0.70	14.6	0.01	12	5.91	4.64	O.K
CB 2 to DMH 2	0.40		5.3	0.01	12	5.91	4.64	O.K
OCS 1 to FES 1*	0.19		10.0	0.01	8	4.51	1.58	O.K

[1] $V=1.49/n \times R^{2/3} \times S^{1/2}$

[2] $Q=VA$

Illicit Discharge Compliance Statement

42 Park Street
Ayer, Massachusetts

Illicit Discharge Compliance Statement

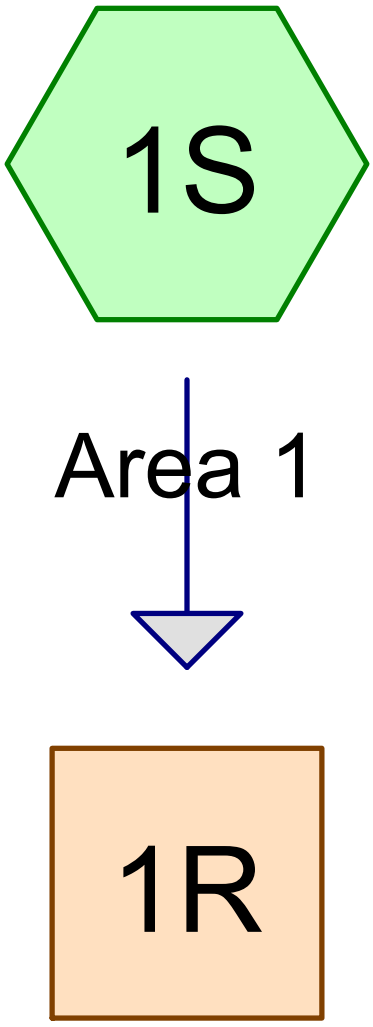
The Stormwater Management System associated with the development of 42 Park Street has been designed such that prior to storm water runoff discharging from the site, it is treated through a series of best management practices. To the Engineer's knowledge, there are no known or designed non-storm water discharges that are or will be connected to the storm water collection system that would convey pollutants directly to groundwater or surface waters.

Name: Brian Marchetti, P.E. Title: Vice President

Signature:  Date: 9/1/2023

Appendix B

Existing Conditions HydroCAD Model



Rail Road

Subcat Reach Pond Link

Routing Diagram for 2023-08-14 Existing Drainage
Prepared by McCarty Engineering, Printed 9/2/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.341	39	>75% Grass cover, Good, HSG A (1S)
0.077	98	Paved parking, HSG A (1S)
0.035	98	Roofs, HSG A (1S)
0.053	30	Woods, Good, HSG A (1S)
0.506	**51**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.506	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.506		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.341	0.000	0.000	0.000	0.000	0.341	>75% Grass cover, Good	1S
0.077	0.000	0.000	0.000	0.000	0.077	Paved parking	1S
0.035	0.000	0.000	0.000	0.000	0.035	Roofs	1S
0.053	0.000	0.000	0.000	0.000	0.053	Woods, Good	1S
0.506	**0.000**	**0.000**	**0.000**	**0.000**	**0.506**	**TOTAL AREA**	

Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Area 1 Runoff Area=22,063 sf 22.12% Impervious Runoff Depth=0.11"
Flow Length=197' Tc=8.5 min CN=51 Runoff=0.01 cfs 0.005 af

Reach 1R: Rail Road Inflow=0.01 cfs 0.005 af
Outflow=0.01 cfs 0.005 af

Total Runoff Area = 0.506 ac Runoff Volume = 0.005 af Average Runoff Depth = 0.11"
77.88% Pervious = 0.394 ac 22.12% Impervious = 0.112 ac

Summary for Subcatchment 1S: Area 1

Runoff = 0.01 cfs @ 12.53 hrs, Volume= 0.005 af, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.02"

Area (sf)	CN	Description
1,515	98	Roofs, HSG A
3,365	98	Paved parking, HSG A
14,861	39	>75% Grass cover, Good, HSG A
2,322	30	Woods, Good, HSG A
22,063	51	Weighted Average
17,183		77.88% Pervious Area
4,880		22.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	129	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	18	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.5	197	Total			

Summary for Reach 1R: Rail Road

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

Inflow Area = 0.506 ac, 22.12% Impervious, Inflow Depth = 0.11" for 2-Year event
Inflow = 0.01 cfs @ 12.53 hrs, Volume= 0.005 af
Outflow = 0.01 cfs @ 12.53 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Area 1 Runoff Area=22,063 sf 22.12% Impervious Runoff Depth=0.54"
Flow Length=197' Tc=8.5 min CN=51 Runoff=0.16 cfs 0.023 af

Reach 1R: Rail Road Inflow=0.16 cfs 0.023 af
Outflow=0.16 cfs 0.023 af

Total Runoff Area = 0.506 ac Runoff Volume = 0.023 af Average Runoff Depth = 0.54"
77.88% Pervious = 0.394 ac 22.12% Impervious = 0.112 ac

Summary for Subcatchment 1S: Area 1

Runoff = 0.16 cfs @ 12.18 hrs, Volume= 0.023 af, Depth= 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.48"

Area (sf)	CN	Description
1,515	98	Roofs, HSG A
3,365	98	Paved parking, HSG A
14,861	39	>75% Grass cover, Good, HSG A
2,322	30	Woods, Good, HSG A
22,063	51	Weighted Average
17,183		77.88% Pervious Area
4,880		22.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	129	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	18	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.5	197	Total			

Summary for Reach 1R: Rail Road

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

Inflow Area = 0.506 ac, 22.12% Impervious, Inflow Depth = 0.54" for 10-Year event
Inflow = 0.16 cfs @ 12.18 hrs, Volume= 0.023 af
Outflow = 0.16 cfs @ 12.18 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Area 1 Runoff Area=22,063 sf 22.12% Impervious Runoff Depth=1.02"
Flow Length=197' Tc=8.5 min CN=51 Runoff=0.42 cfs 0.043 af

Reach 1R: Rail Road Inflow=0.42 cfs 0.043 af
Outflow=0.42 cfs 0.043 af

Total Runoff Area = 0.506 ac Runoff Volume = 0.043 af Average Runoff Depth = 1.02"
77.88% Pervious = 0.394 ac 22.12% Impervious = 0.112 ac

Summary for Subcatchment 1S: Area 1

Runoff = 0.42 cfs @ 12.15 hrs, Volume= 0.043 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.61"

Area (sf)	CN	Description
1,515	98	Roofs, HSG A
3,365	98	Paved parking, HSG A
14,861	39	>75% Grass cover, Good, HSG A
2,322	30	Woods, Good, HSG A
22,063	51	Weighted Average
17,183		77.88% Pervious Area
4,880		22.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	129	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	18	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.5	197	Total			

Summary for Reach 1R: Rail Road

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

Inflow Area = 0.506 ac, 22.12% Impervious, Inflow Depth = 1.02" for 25-Year event
Inflow = 0.42 cfs @ 12.15 hrs, Volume= 0.043 af
Outflow = 0.42 cfs @ 12.15 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Area 1 Runoff Area=22,063 sf 22.12% Impervious Runoff Depth=2.29"
Flow Length=197' Tc=8.5 min CN=51 Runoff=1.15 cfs 0.097 af

Reach 1R: Rail Road Inflow=1.15 cfs 0.097 af
Outflow=1.15 cfs 0.097 af

Total Runoff Area = 0.506 ac Runoff Volume = 0.097 af Average Runoff Depth = 2.29"
77.88% Pervious = 0.394 ac 22.12% Impervious = 0.112 ac

Summary for Subcatchment 1S: Area 1

Runoff = 1.15 cfs @ 12.13 hrs, Volume= 0.097 af, Depth= 2.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.89"

Area (sf)	CN	Description
1,515	98	Roofs, HSG A
3,365	98	Paved parking, HSG A
14,861	39	>75% Grass cover, Good, HSG A
2,322	30	Woods, Good, HSG A
22,063	51	Weighted Average
17,183		77.88% Pervious Area
4,880		22.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	129	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.4	18	0.0200	0.71		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.5	197	Total			

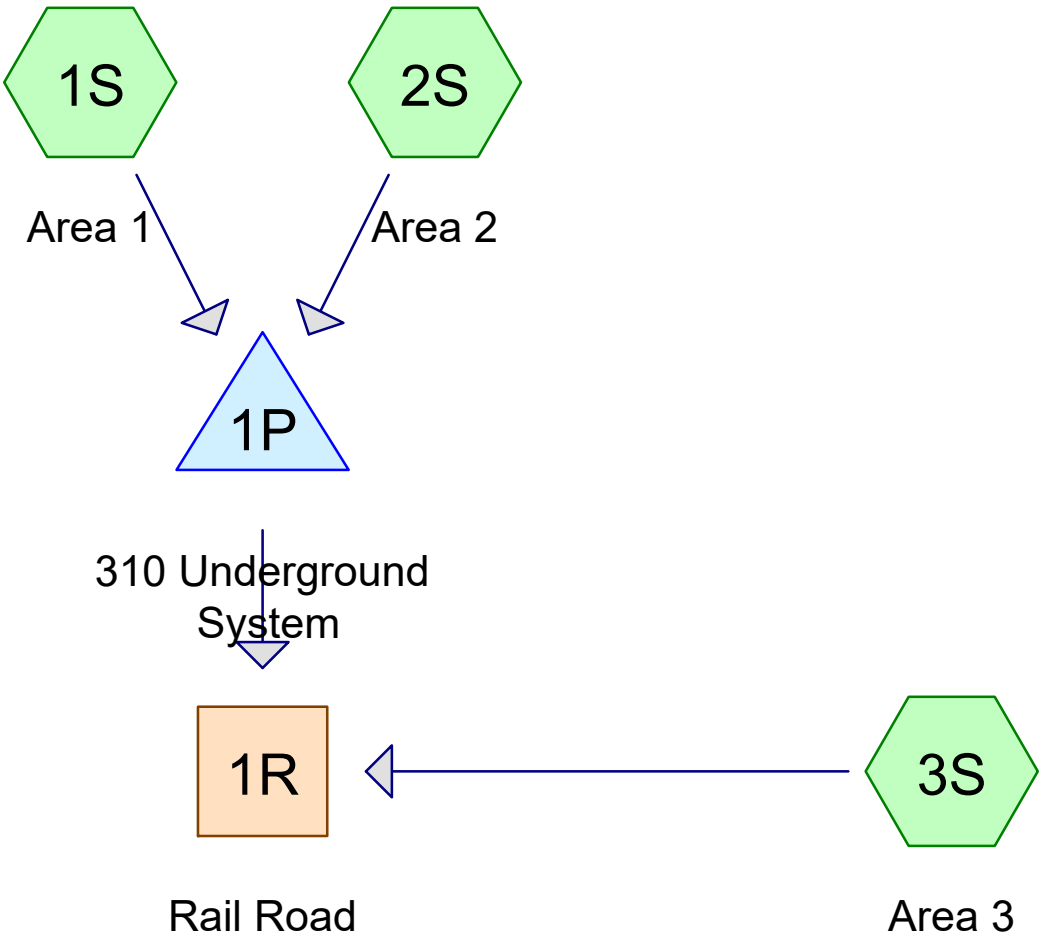
Summary for Reach 1R: Rail Road

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

Inflow Area = 0.506 ac, 22.12% Impervious, Inflow Depth = 2.29" for 100-Year event
Inflow = 1.15 cfs @ 12.13 hrs, Volume= 0.097 af
Outflow = 1.15 cfs @ 12.13 hrs, Volume= 0.097 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Proposed Conditions HydroCAD Model



Subcat Reach Pond Link

Routing Diagram for 2023-11-03 Revised Drainage
Prepared by McCarty Engineering, Printed 11/6/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.206	39	>75% Grass cover, Good, HSG A (2S, 3S)
0.029	98	Concrete, HSG A (2S)
0.153	98	Paved parking, HSG A (2S)
0.082	98	Roofs, HSG A (1S, 2S)
0.036	30	Woods, Good, HSG A (3S)
0.506	**69**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.506	HSG A	1S, 2S, 3S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.506		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.206	0.000	0.000	0.000	0.000	0.206	>75% Grass cover, Good	2S, 3S
0.029	0.000	0.000	0.000	0.000	0.029	Concrete	2S
0.153	0.000	0.000	0.000	0.000	0.153	Paved parking	2S
0.082	0.000	0.000	0.000	0.000	0.082	Roofs	1S, 2S
0.036	0.000	0.000	0.000	0.000	0.036	Woods, Good	3S
0.506	**0.000**	**0.000**	**0.000**	**0.000**	**0.506**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	215.75	215.65	10.0	0.0100	0.012	6.0	0.0	0.0

Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Area 1 Runoff Area=2,854 sf 100.00% Impervious Runoff Depth=2.79"
Tc=5.0 min CN=98 Runoff=0.20 cfs 0.015 af

Subcatchment 2S: Area 2 Runoff Area=11,137 sf 77.54% Impervious Runoff Depth=1.61"
Tc=5.0 min CN=85 Runoff=0.50 cfs 0.034 af

Subcatchment 3S: Area 3 Runoff Area=8,072 sf 0.00% Impervious Runoff Depth=0.00"
Tc=5.0 min CN=37 Runoff=0.00 cfs 0.000 af

Reach 1R: Rail Road Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 1P: 310 Underground System Peak Elev=214.84' Storage=252 cf Inflow=0.70 cfs 0.049 af
Discarded=0.29 cfs 0.049 af Primary=0.00 cfs 0.000 af Outflow=0.29 cfs 0.049 af

Total Runoff Area = 0.506 ac Runoff Volume = 0.049 af Average Runoff Depth = 1.17"
47.92% Pervious = 0.243 ac 52.08% Impervious = 0.264 ac

Summary for Subcatchment 1S: Area 1

Runoff = 0.20 cfs @ 12.07 hrs, Volume= 0.015 af, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.02"

Area (sf)	CN	Description
2,854	98	Roofs, HSG A
2,854		100.00% Impervious Area

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

Summary for Subcatchment 2S: Area 2

Runoff = 0.50 cfs @ 12.08 hrs, Volume= 0.034 af, Depth= 1.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.02"

	Area (sf)	CN	Description
	720	98	Roofs, HSG A
	6,672	98	Paved parking, HSG A
*	1,244	98	Concrete, HSG A
	2,501	39	>75% Grass cover, Good, HSG A
	11,137	85	Weighted Average
	2,501		22.46% Pervious Area
	8,636		77.54% Impervious Area

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

Summary for Subcatchment 3S: Area 3

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.02"

Area (sf)	CN	Description
6,491	39	>75% Grass cover, Good, HSG A
1,581	30	Woods, Good, HSG A
8,072	37	Weighted Average
8,072		100.00% Pervious Area

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

Summary for Reach 1R: Rail Road

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

Inflow Area = 0.506 ac, 52.08% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 310 Underground System

Inflow Area = 0.321 ac, 82.12% Impervious, Inflow Depth = 1.85" for 2-Year event
Inflow = 0.70 cfs @ 12.07 hrs, Volume= 0.049 af
Outflow = 0.29 cfs @ 12.27 hrs, Volume= 0.049 af, Atten= 58%, Lag= 12.0 min
Discarded = 0.29 cfs @ 12.27 hrs, Volume= 0.049 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Peak Elev= 214.84' @ 12.27 hrs Surf.Area= 1,222 sf Storage= 252 cf

Plug-Flow detention time= 4.3 min calculated for 0.049 af (100% of inflow)
Center-of-Mass det. time= 4.3 min (810.2 - 805.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	214.33'	875 cf	**31.50'W x 38.80'L x 2.33'H Field A** 2,852 cf Overall - 663 cf Embedded = 2,188 cf x 40.0% Voids
#2A	214.83'	663 cf	**ADS_StormTech SC-310 +Cap** x 45 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 45 Chambers in 9 Rows
		1,539 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	214.33'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 212.33'
#2	Primary	215.75'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 215.75' / 215.65' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.29 cfs @ 12.27 hrs HW=214.84' (Free Discharge)
↑**1=Exfiltration** (Controls 0.29 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=214.33' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Pond 1P: 310 Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

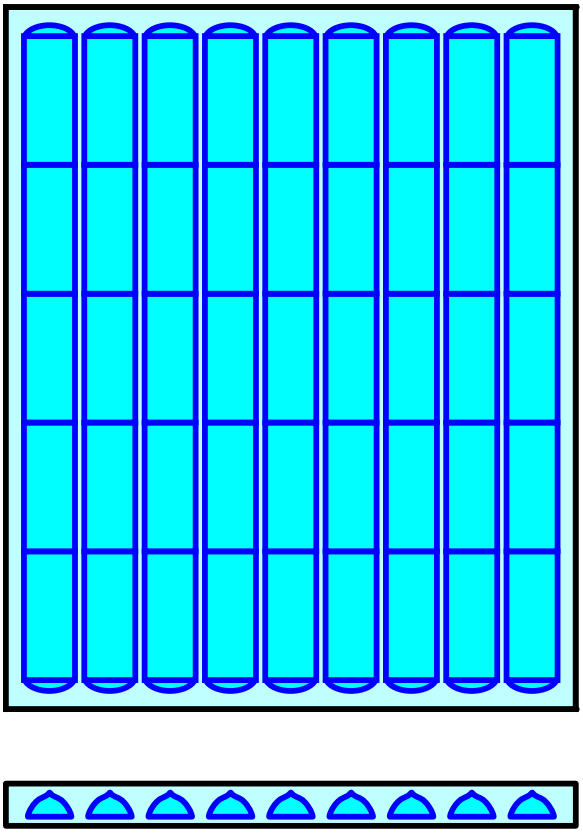
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +12.0" End Stone x 2 = 38.80' Base Length
9 Rows x 34.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 31.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

45 Chambers x 14.7 cf = 663.4 cf Chamber Storage

2,851.8 cf Field - 663.4 cf Chambers = 2,188.4 cf Stone x 40.0% Voids = 875.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,538.8 cf = 0.035 af
Overall Storage Efficiency = 54.0%
Overall System Size = 38.80' x 31.50' x 2.33'

45 Chambers
105.6 cy Field
81.1 cy Stone



Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Area 1 Runoff Area=2,854 sf 100.00% Impervious Runoff Depth=4.24"
Tc=5.0 min CN=98 Runoff=0.30 cfs 0.023 af

Subcatchment 2S: Area 2 Runoff Area=11,137 sf 77.54% Impervious Runoff Depth=2.89"
Tc=5.0 min CN=85 Runoff=0.89 cfs 0.062 af

Subcatchment 3S: Area 3 Runoff Area=8,072 sf 0.00% Impervious Runoff Depth=0.06"
Tc=5.0 min CN=37 Runoff=0.00 cfs 0.001 af

Reach 1R: Rail Road Inflow=0.00 cfs 0.001 af
Outflow=0.00 cfs 0.001 af

Pond 1P: 310 Underground System Peak Elev=215.34' Storage=714 cf Inflow=1.19 cfs 0.085 af
Discarded=0.35 cfs 0.085 af Primary=0.00 cfs 0.000 af Outflow=0.35 cfs 0.085 af

Total Runoff Area = 0.506 ac Runoff Volume = 0.086 af Average Runoff Depth = 2.03"
47.92% Pervious = 0.243 ac 52.08% Impervious = 0.264 ac

Summary for Subcatchment 1S: Area 1

Runoff = 0.30 cfs @ 12.07 hrs, Volume= 0.023 af, Depth= 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.48"

Area (sf)	CN	Description
2,854	98	Roofs, HSG A
2,854		100.00% Impervious Area

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

Summary for Subcatchment 2S: Area 2

Runoff = 0.89 cfs @ 12.07 hrs, Volume= 0.062 af, Depth= 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.48"

	Area (sf)	CN	Description
	720	98	Roofs, HSG A
	6,672	98	Paved parking, HSG A
*	1,244	98	Concrete, HSG A
	2,501	39	>75% Grass cover, Good, HSG A
	11,137	85	Weighted Average
	2,501		22.46% Pervious Area
	8,636		77.54% Impervious Area

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

Summary for Subcatchment 3S: Area 3

Runoff = 0.00 cfs @ 15.29 hrs, Volume= 0.001 af, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.48"

Area (sf)	CN	Description
6,491	39	>75% Grass cover, Good, HSG A
1,581	30	Woods, Good, HSG A
8,072	37	Weighted Average
8,072		100.00% Pervious Area

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

Summary for Reach 1R: Rail Road

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

Inflow Area = 0.506 ac, 52.08% Impervious, Inflow Depth = 0.02" for 10-Year event
Inflow = 0.00 cfs @ 15.29 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 15.29 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 310 Underground System

Inflow Area = 0.321 ac, 82.12% Impervious, Inflow Depth = 3.17" for 10-Year event
Inflow = 1.19 cfs @ 12.07 hrs, Volume= 0.085 af
Outflow = 0.35 cfs @ 12.40 hrs, Volume= 0.085 af, Atten= 70%, Lag= 19.4 min
Discarded = 0.35 cfs @ 12.40 hrs, Volume= 0.085 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Peak Elev= 215.34' @ 12.40 hrs Surf.Area= 1,222 sf Storage= 714 cf

Plug-Flow detention time= 11.2 min calculated for 0.085 af (100% of inflow)
Center-of-Mass det. time= 11.2 min (805.2 - 794.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	214.33'	875 cf	**31.50'W x 38.80'L x 2.33'H Field A** 2,852 cf Overall - 663 cf Embedded = 2,188 cf x 40.0% Voids
#2A	214.83'	663 cf	**ADS_StormTech SC-310 +Cap** x 45 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 45 Chambers in 9 Rows
		1,539 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	214.33'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 212.33'
#2	Primary	215.75'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 215.75' / 215.65' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.35 cfs @ 12.40 hrs HW=215.34' (Free Discharge)
↑**1=Exfiltration** (Controls 0.35 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=214.33' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Pond 1P: 310 Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

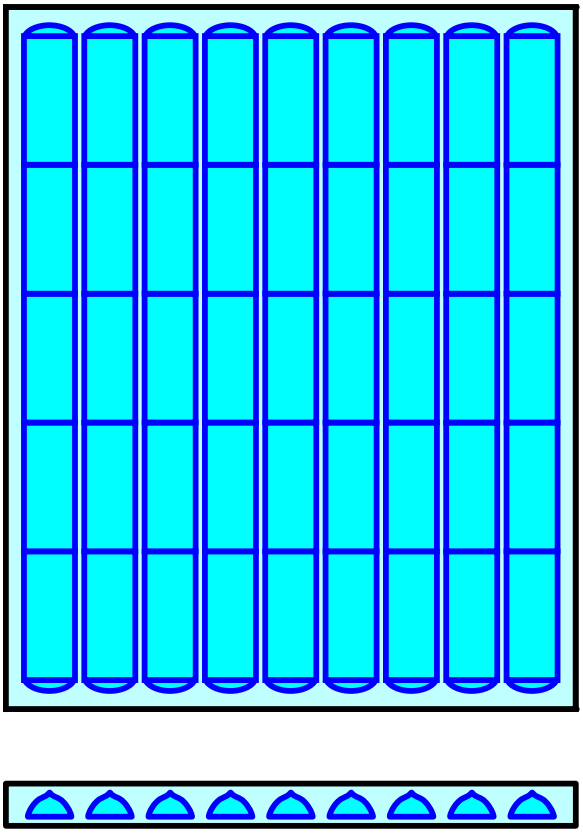
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +12.0" End Stone x 2 = 38.80' Base Length
9 Rows x 34.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 31.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

45 Chambers x 14.7 cf = 663.4 cf Chamber Storage

2,851.8 cf Field - 663.4 cf Chambers = 2,188.4 cf Stone x 40.0% Voids = 875.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,538.8 cf = 0.035 af
Overall Storage Efficiency = 54.0%
Overall System Size = 38.80' x 31.50' x 2.33'

45 Chambers
105.6 cy Field
81.1 cy Stone



Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Area 1 Runoff Area=2,854 sf 100.00% Impervious Runoff Depth=5.37"
Tc=5.0 min CN=98 Runoff=0.37 cfs 0.029 af

Subcatchment 2S: Area 2 Runoff Area=11,137 sf 77.54% Impervious Runoff Depth=3.94"
Tc=5.0 min CN=85 Runoff=1.20 cfs 0.084 af

Subcatchment 3S: Area 3 Runoff Area=8,072 sf 0.00% Impervious Runoff Depth=0.25"
Tc=5.0 min CN=37 Runoff=0.01 cfs 0.004 af

Reach 1R: Rail Road Inflow=0.03 cfs 0.004 af
Outflow=0.03 cfs 0.004 af

Pond 1P: 310 Underground System Peak Elev=215.84' Storage=1,112 cf Inflow=1.58 cfs 0.113 af
Discarded=0.41 cfs 0.113 af Primary=0.02 cfs 0.000 af Outflow=0.43 cfs 0.113 af

Total Runoff Area = 0.506 ac Runoff Volume = 0.117 af Average Runoff Depth = 2.77"
47.92% Pervious = 0.243 ac 52.08% Impervious = 0.264 ac

Summary for Subcatchment 1S: Area 1

Runoff = 0.37 cfs @ 12.07 hrs, Volume= 0.029 af, Depth= 5.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.61"

Area (sf)	CN	Description
2,854	98	Roofs, HSG A
2,854		100.00% Impervious Area

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

Summary for Subcatchment 2S: Area 2

Runoff = 1.20 cfs @ 12.07 hrs, Volume= 0.084 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.61"

	Area (sf)	CN	Description
	720	98	Roofs, HSG A
	6,672	98	Paved parking, HSG A
*	1,244	98	Concrete, HSG A
	2,501	39	>75% Grass cover, Good, HSG A
	11,137	85	Weighted Average
	2,501		22.46% Pervious Area
	8,636		77.54% Impervious Area

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

Summary for Subcatchment 3S: Area 3

Runoff = 0.01 cfs @ 12.43 hrs, Volume= 0.004 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.61"

Area (sf)	CN	Description
6,491	39	>75% Grass cover, Good, HSG A
1,581	30	Woods, Good, HSG A
8,072	37	Weighted Average
8,072		100.00% Pervious Area

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

Summary for Reach 1R: Rail Road

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

Inflow Area = 0.506 ac, 52.08% Impervious, Inflow Depth = 0.10" for 25-Year event
Inflow = 0.03 cfs @ 12.42 hrs, Volume= 0.004 af
Outflow = 0.03 cfs @ 12.42 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 310 Underground System

Inflow Area = 0.321 ac, 82.12% Impervious, Inflow Depth = 4.23" for 25-Year event
Inflow = 1.58 cfs @ 12.07 hrs, Volume= 0.113 af
Outflow = 0.43 cfs @ 12.41 hrs, Volume= 0.113 af, Atten= 73%, Lag= 20.6 min
Discarded = 0.41 cfs @ 12.41 hrs, Volume= 0.113 af
Primary = 0.02 cfs @ 12.41 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Peak Elev= 215.84' @ 12.41 hrs Surf.Area= 1,222 sf Storage= 1,112 cf

Plug-Flow detention time= 16.4 min calculated for 0.113 af (100% of inflow)
Center-of-Mass det. time= 16.4 min (803.9 - 787.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	214.33'	875 cf	**31.50'W x 38.80'L x 2.33'H Field A** 2,852 cf Overall - 663 cf Embedded = 2,188 cf x 40.0% Voids
#2A	214.83'	663 cf	**ADS_StormTech SC-310 +Cap** x 45 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 45 Chambers in 9 Rows
		1,539 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	214.33'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 212.33'
#2	Primary	215.75'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 215.75' / 215.65' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.41 cfs @ 12.41 hrs HW=215.84' (Free Discharge)
↑**1=Exfiltration** (Controls 0.41 cfs)

Primary OutFlow Max=0.02 cfs @ 12.41 hrs HW=215.84' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.02 cfs @ 0.82 fps)

Pond 1P: 310 Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

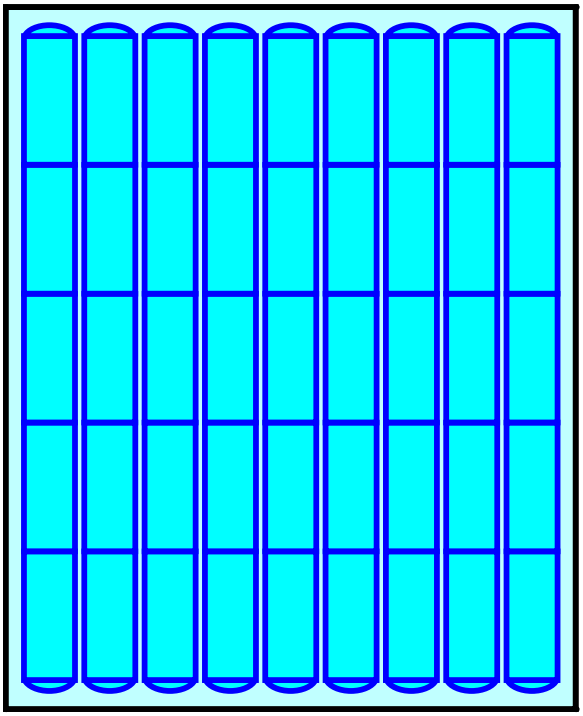
5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +12.0" End Stone x 2 = 38.80' Base Length
9 Rows x 34.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 31.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

45 Chambers x 14.7 cf = 663.4 cf Chamber Storage

2,851.8 cf Field - 663.4 cf Chambers = 2,188.4 cf Stone x 40.0% Voids = 875.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,538.8 cf = 0.035 af
Overall Storage Efficiency = 54.0%
Overall System Size = 38.80' x 31.50' x 2.33'

45 Chambers
105.6 cy Field
81.1 cy Stone



Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Area 1 Runoff Area=2,854 sf 100.00% Impervious Runoff Depth=7.65"
Tc=5.0 min CN=98 Runoff=0.53 cfs 0.042 af

Subcatchment 2S: Area 2 Runoff Area=11,137 sf 77.54% Impervious Runoff Depth=6.11"
Tc=5.0 min CN=85 Runoff=1.83 cfs 0.130 af

Subcatchment 3S: Area 3 Runoff Area=8,072 sf 0.00% Impervious Runoff Depth=0.93"
Tc=5.0 min CN=37 Runoff=0.11 cfs 0.014 af

Reach 1R: Rail Road Inflow=0.67 cfs 0.033 af
Outflow=0.67 cfs 0.033 af

Pond 1P: 310 Underground System Peak Elev=216.60' Storage=1,508 cf Inflow=2.36 cfs 0.172 af
Discarded=0.50 cfs 0.153 af Primary=0.58 cfs 0.019 af Outflow=1.08 cfs 0.172 af

Total Runoff Area = 0.506 ac Runoff Volume = 0.186 af Average Runoff Depth = 4.41"
47.92% Pervious = 0.243 ac 52.08% Impervious = 0.264 ac

Summary for Subcatchment 1S: Area 1

Runoff = 0.53 cfs @ 12.07 hrs, Volume= 0.042 af, Depth= 7.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.89"

Area (sf)	CN	Description
2,854	98	Roofs, HSG A
2,854		100.00% Impervious Area

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

Summary for Subcatchment 2S: Area 2

Runoff = 1.83 cfs @ 12.07 hrs, Volume= 0.130 af, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.89"

	Area (sf)	CN	Description
	720	98	Roofs, HSG A
	6,672	98	Paved parking, HSG A
*	1,244	98	Concrete, HSG A
	2,501	39	>75% Grass cover, Good, HSG A
	11,137	85	Weighted Average
	2,501		22.46% Pervious Area
	8,636		77.54% Impervious Area

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

Summary for Subcatchment 3S: Area 3

Runoff = 0.11 cfs @ 12.12 hrs, Volume= 0.014 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.89"

Area (sf)	CN	Description
6,491	39	>75% Grass cover, Good, HSG A
1,581	30	Woods, Good, HSG A
8,072	37	Weighted Average
8,072		100.00% Pervious Area

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

Summary for Reach 1R: Rail Road

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

Inflow Area = 0.506 ac, 52.08% Impervious, Inflow Depth = 0.78" for 100-Year event
Inflow = 0.67 cfs @ 12.22 hrs, Volume= 0.033 af
Outflow = 0.67 cfs @ 12.22 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: 310 Underground System

Inflow Area = 0.321 ac, 82.12% Impervious, Inflow Depth = 6.42" for 100-Year event
Inflow = 2.36 cfs @ 12.07 hrs, Volume= 0.172 af
Outflow = 1.08 cfs @ 12.22 hrs, Volume= 0.172 af, Atten= 54%, Lag= 9.1 min
Discarded = 0.50 cfs @ 12.22 hrs, Volume= 0.153 af
Primary = 0.58 cfs @ 12.22 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
Peak Elev= 216.60' @ 12.22 hrs Surf.Area= 1,222 sf Storage= 1,508 cf

Plug-Flow detention time= 16.1 min calculated for 0.172 af (100% of inflow)
Center-of-Mass det. time= 16.1 min (794.1 - 778.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	214.33'	875 cf	**31.50'W x 38.80'L x 2.33'H Field A** 2,852 cf Overall - 663 cf Embedded = 2,188 cf x 40.0% Voids
#2A	214.83'	663 cf	**ADS_StormTech SC-310 +Cap** x 45 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 45 Chambers in 9 Rows
		1,539 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	214.33'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 212.33'
#2	Primary	215.75'	**6.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 215.75' / 215.65' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.50 cfs @ 12.22 hrs HW=216.60' (Free Discharge)
1=Exfiltration (Controls 0.50 cfs)

Primary OutFlow Max=0.58 cfs @ 12.22 hrs HW=216.60' (Free Discharge)
2=Culvert (Inlet Controls 0.58 cfs @ 2.95 fps)

Pond 1P: 310 Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

5 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 36.80' Row Length +12.0" End Stone x 2 = 38.80' Base Length
9 Rows x 34.0" Wide + 6.0" Spacing x 8 + 12.0" Side Stone x 2 = 31.50' Base Width
6.0" Base + 16.0" Chamber Height + 6.0" Cover = 2.33' Field Height

45 Chambers x 14.7 cf = 663.4 cf Chamber Storage

2,851.8 cf Field - 663.4 cf Chambers = 2,188.4 cf Stone x 40.0% Voids = 875.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,538.8 cf = 0.035 af
Overall Storage Efficiency = 54.0%
Overall System Size = 38.80' x 31.50' x 2.33'

45 Chambers
105.6 cy Field
81.1 cy Stone