Stormwater Management Report

Ground-Mount Solar PV Development

40 Sizer Drive
Wales, MA 01081

Project # 3652200259

Prepared for:

Sunpin Solar Development LLC

3 Corporate Park, Suite 168, Irvine, CA 92606

January 2021,
Revised September 2021

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January 2021, Revised September 2021

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1.0 Existing Conditions

The project Site, approximately 100 acres, is located at the southern end of Sizer Drive in Wales, Massachusetts in the R1 residential zoning district. Under existing conditions, the site is primarily undeveloped and consists of woods. A residential dwelling exists on site with a detached garage, both situated near the end Sizer Drive. It should be noted that the site property includes approximately 150 feet of the Sizer Drive roadway that is not included within the Town right-of-way.

Figure 1 – Site Location

1.1 Groundwater and Soils

Based on Natural Resources Conservation Service (NRCS) Web Soil Survey mapping, soils within the development areas of the Site are as follows:

Table 1: Soils Summary

Map Symbol	Soil Type	Hydrologic Soil Group	Depth to Water
307D	Paxton fine sandy loam, 15-25% slopes, extremely stony	C	±26"
100E	Brookfield-Brimfield-Rock outcrop complex, steep	-	>6.56'

Wood conducted test holes within the footprints of the proposed stormwater best management practices (BMPs) in order to confirm site soil type(s) and depths to groundwater. Fine sandy loam with cobbles was encountered in all test holes and consistent with NRCS mapping for Hydrologic C soils. Groundwater was found at depths ranging from 16 to 29 inches. See Appendix A.1 for the NRCS soil maps and see appendix A.5 for the Test Hole Location Plan and MA Form 11 Soil Suitability forms.

1.2 FEMA Flood Zone

According to FEMA flood insurance rate map (FIRM) number 25013C0479E effective July 16, 2013, the Site lies within zone X. This zone is designated as areas with minimal flood hazard. Furthermore, the Project is not anticipated to impact the floodplain. See Appendix A.3 for the FEMA flood map.

1.3 Wetlands/Waterbodies

Wood verified a previous wetland delineation in the field in October of 2020. Wetlands exist along the eastern and western sides of the Site. Also present on the site is an unnamed stream listed as intermittent according to the Census 2000 Rivers and Streams data layer on the Massachusetts GIS online mapping tool. The stream is also listed as a cold-water fishery according to the Department of Fish and Wildlife Cold-water Fisheries Resources data layer. The stream runs southwest to northeast in the northern portion of the site and is tributary to Wales Brook, also a cold-water fishery.

1.4 Environmental Resource Areas

According to Massachusetts GIS online mapping tool, the Site is not within any wellhead protection areas, areas of critical environmental concern (ACEC), NHESP estimated habitats of rare wildlife, priority habitats of rare species, or potential/certified vernal pools. The Site does fall within a prime 2 and prime 3 forest land zone. As previously mentioned, the site is tributary to a cold-water fishery. See Appendix A.4 for an environmental resource map.

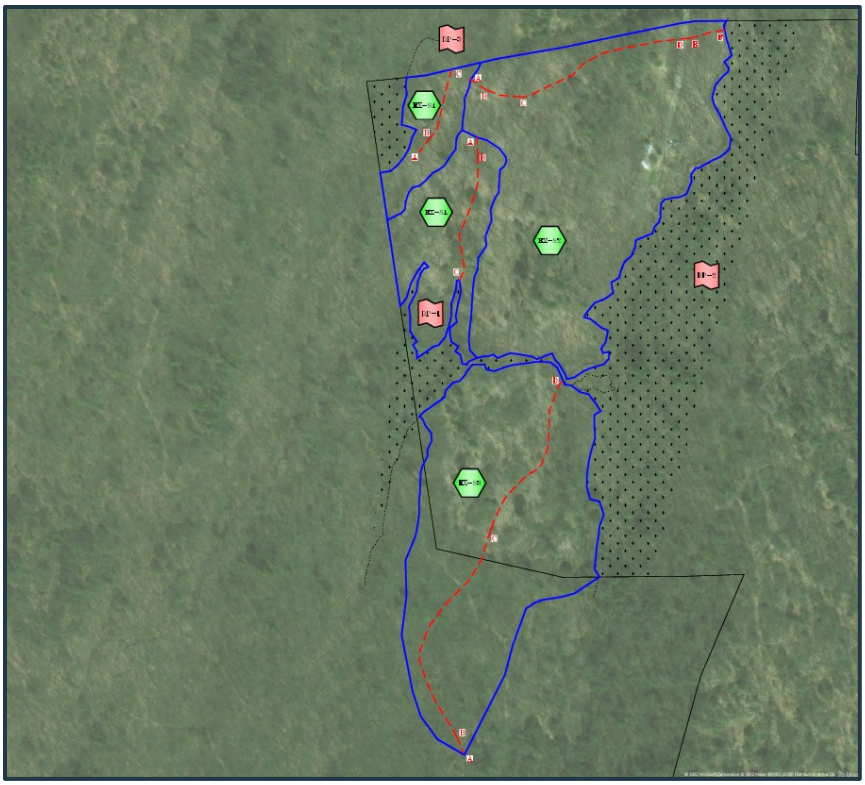
1.5 Pre-development Analysis

Grades on the site are moderately steep. Topography of the Site shows that runoff flows generally from west to east to the wetland complex along the eastern side of the Site before reaching the intermittent stream running offsite to the north. Smaller portions of the Site discharge runoff to the west and north. Runoff that is initially directed to the western wetlands complex eventually flows east via the stream before reaching the eastern wetland area.

Under pre-development conditions, the Site was analyzed as five sub-watersheds (total study area of 1,049,036 square feet or 24.08± acres) contributing to the following Design Points:

- Design Point "DP-1" is the flagged wetland to the west of the Site.
- Design Point "DP-2" is the flagged wetland area along the eastern side of the Site.
- Design Point "DP-3" is the flagged wetland area to the northwest of the project property.

See Appendix B.1 for Existing HydroCAD Calculations and Appendix D for an Existing Watershed Map.



- Sub-watershed "EX-S1" represents the western portion of the Site. It is 2.72± acres (118,364 sq.ft.). and consists entirely of woods in good condition. Runoff from EX-S1 flows overland generally from northeast to southwest to the existing western wetland area (Design Point DP-1).
- Sub-watershed "EX-S2" represents the central/eastern portion of the Site. It is 10.82± acres (471,424 sq.ft.) and is comprised mostly of woods in good condition with smaller areas of impervious driveway and roof. Runoff from EX-S2 flows overland generally from west to east to the existing wetlands along the eastern side of the Site (Design Point DP-2).
- Sub-watershed "EX-S3" represents the southern portion of the Site as well as offsite area to the south. It is 9.32± acres (406,052 sq.ft.) and consists entirely of woods in good condition. Runoff from EX-S3 flows overland generally from southwest to northeast to the existing wetlands along the eastern side of the Site (Design Point DP-2).
- Sub-watershed "EX-S4" represents the northwestern portion of the Site. It is 1.22± acres (53,196 sq.ft.) and consists entirely of woods in good condition. Runoff from EX-S4 flows overland generally from south to north before travelling offsite to Design Point DP-3.

2.0 Proposed Conditions

The stormwater runoff pattern for the solar Project Site will remain largely unchanged. The proposed development consists of a ground-mounted solar PV array and associated site access drive from the end of Sizer Drive in Wales, Massachusetts. The existing garage on Site will be razed, however, the adjacent residential structure will remain. Proposed development impacts have been minimized to the maximum extent practicable by implementing bioretention best management practices (BMPs) and a crushed stone access drive.

There will be approximately 12.7 acres of tree clearing to reduce shading and maximize the energy output of the solar development. With the exception of the stream crossing area, there will be no tree clearing within the 50-ft wetland buffer zone. Following tree clearing, the proposed access road will be graded in order to ensure slopes are not too steep for maintenance and emergency vehicles. The proposed 20-foot wide access road will start at the intersection of the Site's property line with Sizer Drive and follow the path of the existing access drive before extending to the southern portion of the Site. The access road will cross the existing stream via an open-bottom (three-sided) concrete box culvert. In order to minimize disturbance of the streambed and wetland resource area, the culvert will span the bank-full width and resource area width. There will be no permanent disturbance to the streambed or wetland resource area as a result of this development. Additionally, the proposed access road will be constructed with clean angular crushed stone to maintain infiltration capacity. The access road will be seldomly utilized except for occasional maintenance needs. The runoff curve number for the access road was calculated as follows utilizing the equation for potential maximum retention from TR-55 and HydroCAD guidance for CN modeling:

$$S = \frac{1000}{CN} - 10 \quad or \quad CN = \frac{1000}{S+10}$$

S = available voids in inches = 33% void ratio x 12-inch section = 3.96 inches

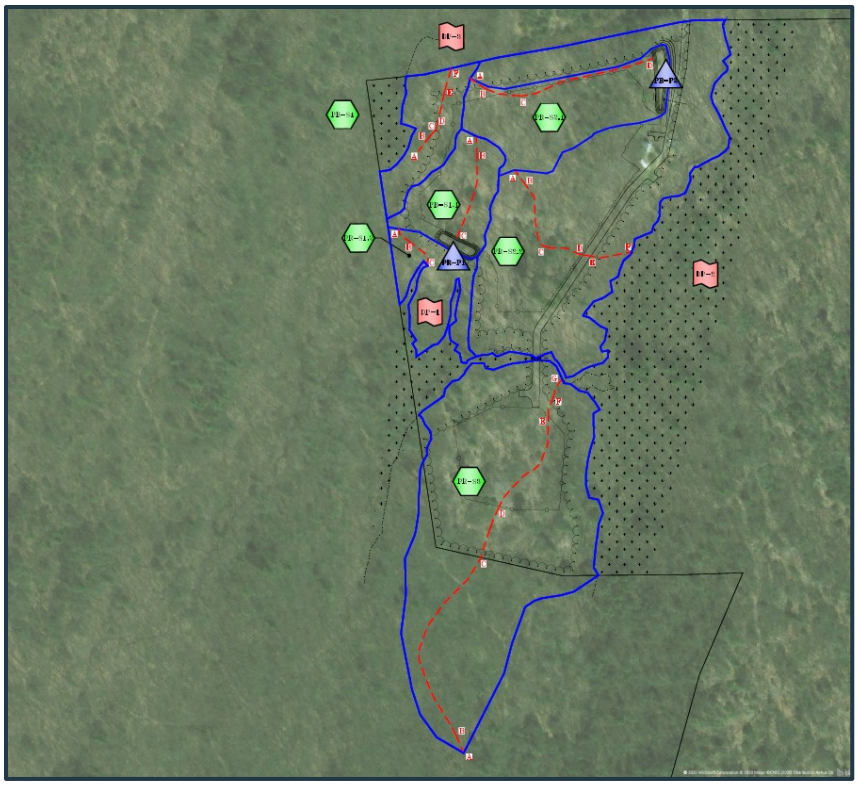
$$CN = \frac{1000}{3.96 + 10} = 72$$

Apart from the portions of the access drive and bioretention basins, the existing ground surface will not be regraded; however, it will be revegetated. Only the stumps within the fenced area will be removed (approximately 7.8 acres). Outside the fenced area but within the tree clearing limits, stumps will remain, but groundcover will be re-established through seeding. These areas will not be regularly maintained and are therefore anticipated to re-establish as brush. All surfaces within the proposed fenceline, except for the concrete equipment pads and the crushed stone access road, will be revegetated to meadow conditions.

In aggregate, the project has been designed to provide required controls for post-development peak rates at or below pre-development rates for the modeled storm events.

2.1 Post-development Analysis

Under post-development conditions, the Site was divided into six sub-watersheds (total study area of 1,049,036 square feet or 24.08± acres) contributing to the previously described Design Points DP-1 through DP-3, where peak discharge rates were evaluated. See Appendix B.2 for Proposed HydroCAD calculations and Appendix D for a Proposed Drainage Figure.



- Sub-watershed "PR-S1.1" represents the western portion of the Site directed to Bioretention Basin 1. It is 1.24± acres (53,826 sq.ft.) and is comprised mostly of meadow and brush (solar panel area) with smaller areas of woods and brush in good condition. Runoff from PR-S1.1 flows overland generally from northeast to southwest to Detention Basin 1 before being discharged to Design Point DP-1.
- Sub-watershed "PR-S1.2" represents the western portion of the Site not directed to a stormwater best management practice (BMP). It is 1.48± acres (64,538 sq.ft.) and is comprised mostly of woods in good condition with a small area of brush. Runoff from PR-S1.2 flows overland generally from northwest to southeast to Design Point DP-1.
- Sub-watershed "PR-S2.1" represents the northern portion of the Site directed to Bioretention Basin 2. It is 2.55± acres (110,956 sq.ft.) and is comprised of meadow and brush with a smaller area of woods in good condition. Runoff from PR-S2.1 flows overland generally from west to east to Detention Basin 2 before being discharged to Design Point DP-2.
- Sub-watershed "PR-S2.2" is 8.28± acres (360,469 sq.ft.) and consists of meadow and brush (solar panel area) as well as woods in good condition. It represents the central and eastern portion of the Site including the proposed crushed stone access road. While this roadway is not modeled as a conventional BMP, it is situated downgradient of the solar area and parallel to existing contours. Runoff from frequent smaller storms that reaches the roadway will be encouraged to infiltrate through the crushed stone while larger storms will continue towards Design Point DP-2.
- Sub-watershed "PR-S3" represents the southern portion of the Site as well as offsite area to the south. It is 9.32± acres (406,051 sq.ft.) and is comprised mostly of woods and brush in good condition and meadow solar panel area. Runoff from PR-S3 flows overland generally from southwest to northeast before reaching Design Point DP-2.

- Sub-watershed "PR-S4" represents the northwestern portion of the Site. It is 1.22± acres (53,196 sq.ft.) and is comprised of woods and brush in good condition and meadow. Runoff from PR-S4 flows overland generally from south to north offsite to Design Point DP-3.

3.0 Hydrologic Analysis

The hydrologic analysis was performed using HydroCAD software for a 24-hour, Type III rainfall event. The documented rainfall was taken from NOAA Atlas 14, Volume 10, Version 3, which estimates rainfall amounts for the 2, 10, 25, and 100-year storm events of 3.21, 5.05, 6.20, and 7.96-inches, respectively. See Appendix A.2 for the NOAA Rainfall Data.

Table 2 provides a summary of this analysis, which shows that post-development peak discharge rates will be equal to or less than pre-development peak discharge rates for all calculated storms.

Table 2: Hydrologic Analysis Summary

Design Point	Description	Design Storm	Peak Flow (cfs)	
			EX	PR
DP-1	Western Wetlands	2-yr	1.46	1.16
		10-yr	4.00	3.27
		25-yr	5.80	4.78
		100-yr	8.71	8.69
DP-2	Eastern Wetlands	2-yr	12.78	11.53
		10-yr	35.38	34.90
		25-yr	51.36	50.59
		100-yr	77.26	75.99
DP-3	Northwestern Wetlands	2-yr	0.95	0.88
		10-yr	2.59	2.48
		25-yr	3.75	3.63
		100-yr	5.63	5.49

4.0 Conclusion – Massachusetts Stormwater Management Standards

This project has been designed in accordance with the latest edition of the *Massachusetts Stormwater Handbook,* Chapter 1 Stormwater Management Standards, as summarized below and provided in other submission documents.

1. Standard 1: No New Untreated Discharges

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

   Standard Met
   The proposed development includes a negligible new impervious surface (concrete transformer pads) on the property. Impervious area is also being removed as a result of razing the existing garage. The runoff from each solar panel will flow overland underneath any downhill panels and eventually to a discharge point. The proposed access road will be constructed of angular crushed stone to maintain infiltration capacity. Because there are insignificant proposed impervious surfaces, there is no associated water quality volume requiring stormwater treatment.

2. Standard 2: Peak Rate Attenuation

   "Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04."

   Standard Met
   Utilizing two bioretention basin BMPs, the stormwater management system has been designed to attenuate the post-development peak discharge rates to pre-development levels for the 2-, 10-, 25-, and 100-year storm events in accordance with the requirements of Standard 2. (See Table 2 for the Hydrology Analysis Summary).

3. Standard 3: Recharge

   "Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook."

   Standard Not Applicable
   The proposed design includes an insignificant impervious area (concrete transformer pads), so the required groundwater recharge volume will be zero. Groundwater recharge on Site is not expected to change. Therefore, Standard 3 is not applicable.

4. Standard 4: Water Quality

   "Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

   a. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;

   b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and

c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook."

Standard Not Applicable
In accordance with Volume 1 Chapter 1 of the Massachusetts Stormwater Handbook under Standard 4, the proposed development only adds a negligible impervious area to the Site. Therefore, the required water quality volume is zero, and Standard 4 is not applicable.

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

"For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00."

Standard Not Applicable
In accordance with the *MassDEP* definition, the project is not considered a "land use with higher potential pollutant loads" therefore Standard 8 is not applicable to this project.

6. Standard 6: Critical Areas

"Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply."

Standard Met
This project discharges to a stream classified by the Department of Fish and Wildlife as a cold-water fishery. The proposed stormwater best management practices for the site include only bioretention basins which are recommended for use near cold-water fisheries in Volume 2 Chapter 2 of the Massachusetts Stormwater Handbook. Additionally, there will be no salting or sanding for de-icing, limited fertilizing to establish vegetation, and upon completion of construction there will be extremely limited access to the site (quarterly inspections and mowing).

7. Standard 7: Redevelopments and Other Projects Subject to the Standards Only to the Maximum Extent Practicable

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

comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions."

Standard Not Applicable
This project is not considered a redevelopment or infill project; therefore, Standard 7 is not applicable to this project.

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

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

   Standard Met
   Pollution prevention is addressed in the Stormwater Pollution Prevention Plan (SWPPP) provided under separate cover, which confirms the requirements of Standard 8 have been met.

9. Standard 9: Operation and Maintenance Plan

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

   Standard Met
   Operation and maintenance are addressed in the Operation and Maintenance Plan and Long-Term Pollution Prevention Plan provided under separate cover, which confirms the requirements of standard 9 have been met.

10. Standard 10: Prohibition of Illicit Discharges

    "All illicit discharges to the stormwater management system are prohibited."

    Standard Met
    There are no existing or proposed illicit discharges from the Site; therefore, Standard 10 has been met.

Appendix A:

Background Information

Appendix A.1:

NRCS Soils Information

Hydrologic Soil Group—Hampden and Hampshire Counties, Massachusetts, Eastern Part
(PL)

Map Scale: 1:5,600 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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: Hampden and Hampshire Counties, Massachusetts, Eastern Part
Survey Area Data: Version 15, Jun 10, 2020

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

Date(s) aerial images were photographed: Apr 9, 2011—May 12, 2011

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
100E	Brookfield-Brimfield-Rock outcrop complex, steep		81.9	81.6%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	C	18.5	18.4%
Totals for Area of Interest			**100.3**	**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

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Some minor components, however, have properties and behavior characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Hampden and Hampshire Counties, Massachusetts, Eastern Part

100E—Brookfield-Brimfield-Rock outcrop complex, steep

Map Unit Setting

National map unit symbol: vhr4

Elevation: 330 to 1,260 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Brookfield and similar soils: 35 percent
Brimfield and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brookfield

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over friable coarse-loamy basal till derived from mica schist; granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 65 inches: fine sandy loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Brimfield

Setting

Landform: Hills

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till derived from mica schist over mica schist

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 15 inches: gravelly fine sandy loam
H3 - 15 to 19 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Parent material: Granite and gneiss

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Hollis

Percent of map unit: 10 percent
Hydric soil rating: No

Charlton

Percent of map unit: 5 percent
Hydric soil rating: No

Paxton

Percent of map unit: 5 percent
Hydric soil rating: No

307D—Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w67l
Elevation: 0 to 1,570 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Paxton, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton, Extremely Stony

Setting

Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Charlton, extremely stony

Percent of map unit: 9 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge, extremely stony

Percent of map unit: 5 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 1 percent
Landform: Drainageways, drumlins, depressions, hills, ground moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Hampden and Hampshire Counties, Massachusetts, Eastern Part
Survey Area Data: Version 15, Jun 10, 2020

Appendix A.2:

NOAA Rainfall Data

NOAA Atlas 14, Volume 10, Version 3
Location name: Wales, Massachusetts, USA*
Latitude: 42.0681°, Longitude: -72.2057°
Elevation: 854.21 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	**0.344** (0.266-0.445)	**0.408** (0.314-0.528)	**0.512** (0.393-0.665)	**0.598** (0.457-0.782)	**0.717** (0.531-0.978)	**0.807** (0.585-1.13)	**0.900** (0.634-1.30)	**1.00** (0.671-1.49)	**1.14** (0.737-1.76)	**1.25** (0.789-1.97)
10-min	**0.488** (0.376-0.631)	**0.578** (0.446-0.748)	**0.725** (0.557-0.942)	**0.848** (0.648-1.11)	**1.02** (0.752-1.39)	**1.14** (0.829-1.59)	**1.27** (0.898-1.84)	**1.42** (0.951-2.11)	**1.61** (1.04-2.49)	**1.77** (1.12-2.79)
15-min	**0.574** (0.443-0.742)	**0.680** (0.524-0.880)	**0.853** (0.655-1.11)	**0.997** (0.762-1.30)	**1.20** (0.884-1.63)	**1.35** (0.975-1.87)	**1.50** (1.06-2.17)	**1.67** (1.12-2.48)	**1.90** (1.23-2.93)	**2.08** (1.32-3.28)
30-min	**0.765** (0.590-0.989)	**0.907** (0.699-1.17)	**1.14** (0.875-1.48)	**1.33** (1.02-1.74)	**1.60** (1.18-2.18)	**1.80** (1.30-2.50)	**2.00** (1.41-2.89)	**2.23** (1.50-3.31)	**2.53** (1.64-3.91)	**2.78** (1.76-4.38)
60-min	**0.956** (0.738-1.24)	**1.13** (0.874-1.47)	**1.42** (1.09-1.85)	**1.66** (1.27-2.17)	**2.00** (1.48-2.72)	**2.25** (1.63-3.13)	**2.51** (1.76-3.62)	**2.78** (1.87-4.14)	**3.17** (2.05-4.89)	**3.47** (2.20-5.48)
2-hr	**1.21** (0.942-1.56)	**1.43** (1.11-1.84)	**1.79** (1.38-2.31)	**2.09** (1.61-2.71)	**2.50** (1.86-3.40)	**2.81** (2.05-3.91)	**3.13** (2.23-4.53)	**3.50** (2.36-5.19)	**4.04** (2.63-6.22)	**4.49** (2.85-7.06)
3-hr	**1.39** (1.08-1.78)	**1.65** (1.28-2.11)	**2.06** (1.60-2.65)	**2.41** (1.86-3.11)	**2.89** (2.16-3.92)	**3.24** (2.38-4.51)	**3.62** (2.59-5.25)	**4.07** (2.75-6.01)	**4.75** (3.09-7.28)	**5.32** (3.38-8.33)
6-hr	**1.75** (1.37-2.22)	**2.09** (1.64-2.66)	**2.66** (2.07-3.40)	**3.13** (2.42-4.02)	**3.77** (2.85-5.11)	**4.25** (3.15-5.90)	**4.77** (3.46-6.94)	**5.41** (3.67-7.97)	**6.41** (4.18-9.79)	**7.28** (4.64-11.3)
12-hr	**2.17** (1.71-2.74)	**2.65** (2.08-3.34)	**3.43** (2.69-4.35)	**4.08** (3.18-5.20)	**4.97** (3.77-6.70)	**5.62** (4.20-7.79)	**6.35** (4.63-9.22)	**7.26** (4.93-10.6)	**8.70** (5.69-13.2)	**9.95** (6.37-15.4)
24-hr	**2.59** (2.06-3.25)	**3.21** (2.54-4.03)	**4.21** (3.32-5.31)	**5.05** (3.96-6.40)	**6.20** (4.73-8.31)	**7.04** (5.28-9.70)	**7.96** (5.85-11.5)	**9.15** (6.24-13.3)	**11.0** (7.23-16.7)	**12.7** (8.12-19.5)
2-day	**2.99** (2.38-3.72)	**3.71** (2.96-4.63)	**4.90** (3.88-6.13)	**5.88** (4.63-7.40)	**7.23** (5.55-9.64)	**8.21** (6.19-11.3)	**9.31** (6.87-13.4)	**10.7** (7.32-15.5)	**12.9** (8.49-19.4)	**14.8** (9.55-22.8)
3-day	**3.26** (2.61-4.04)	**4.04** (3.23-5.02)	**5.32** (4.24-6.64)	**6.39** (5.05-8.01)	**7.85** (6.04-10.4)	**8.92** (6.75-12.2)	**10.1** (7.48-14.5)	**11.6** (7.97-16.8)	**14.0** (9.25-21.0)	**16.1** (10.4-24.7)
4-day	**3.49** (2.80-4.32)	**4.32** (3.46-5.35)	**5.68** (4.54-7.06)	**6.81** (5.40-8.52)	**8.36** (6.45-11.1)	**9.50** (7.20-12.9)	**10.8** (7.98-15.4)	**12.4** (8.49-17.8)	**14.9** (9.86-22.3)	**17.2** (11.1-26.2)
7-day	**4.14** (3.34-5.09)	**5.08** (4.09-6.25)	**6.61** (5.30-8.17)	**7.89** (6.28-9.81)	**9.64** (7.46-12.7)	**10.9** (8.31-14.8)	**12.3** (9.17-17.6)	**14.1** (9.75-20.3)	**17.0** (11.3-25.3)	**19.5** (12.6-29.7)
10-day	**4.81** (3.88-5.89)	**5.80** (4.68-7.12)	**7.44** (5.98-9.16)	**8.79** (7.03-10.9)	**10.7** (8.27-14.0)	**12.0** (9.15-16.2)	**13.5** (10.1-19.1)	**15.4** (10.7-22.0)	**18.4** (12.2-27.3)	**20.9** (13.6-31.7)
20-day	**6.93** (5.63-8.43)	**7.99** (6.49-9.74)	**9.74** (7.88-11.9)	**11.2** (9.00-13.8)	**13.2** (10.3-17.0)	**14.7** (11.2-19.4)	**16.3** (12.0-22.5)	**18.1** (12.6-25.6)	**20.7** (13.8-30.6)	**22.9** (14.9-34.6)
30-day	**8.71** (7.11-10.6)	**9.81** (7.99-11.9)	**11.6** (9.42-14.1)	**13.1** (10.6-16.0)	**15.1** (11.8-19.4)	**16.7** (12.7-21.9)	**18.3** (13.4-24.9)	**20.0** (13.9-28.2)	**22.3** (14.9-32.7)	**24.1** (15.7-36.3)
45-day	**10.9** (8.95-13.2)	**12.1** (9.86-14.6)	**13.9** (11.3-16.9)	**15.4** (12.5-18.8)	**17.5** (13.7-22.2)	**19.1** (14.6-24.9)	**20.7** (15.2-27.9)	**22.3** (15.6-31.3)	**24.3** (16.3-35.5)	**25.7** (16.8-38.6)
60-day	**12.8** (10.5-15.4)	**13.9** (11.4-16.8)	**15.8** (12.9-19.1)	**17.4** (14.1-21.1)	**19.5** (15.2-24.7)	**21.2** (16.1-27.4)	**22.8** (16.7-30.4)	**24.3** (17.1-34.0)	**26.1** (17.5-38.0)	**27.2** (17.8-40.8)

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

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

Please refer to NOAA Atlas 14 document for more information.

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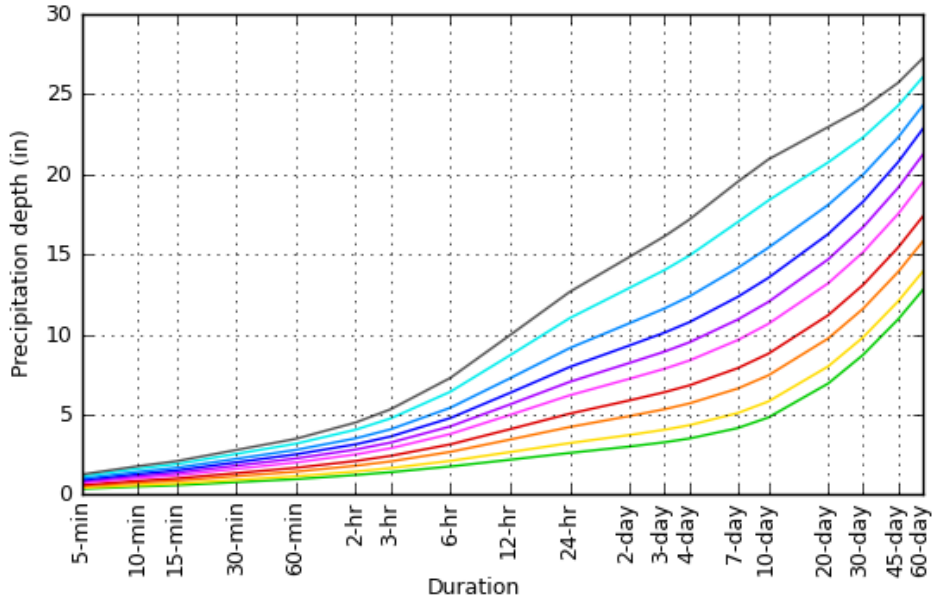
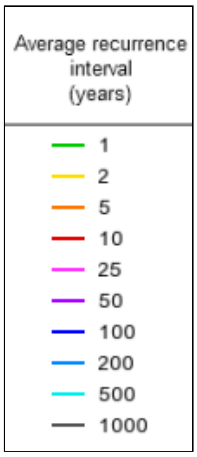
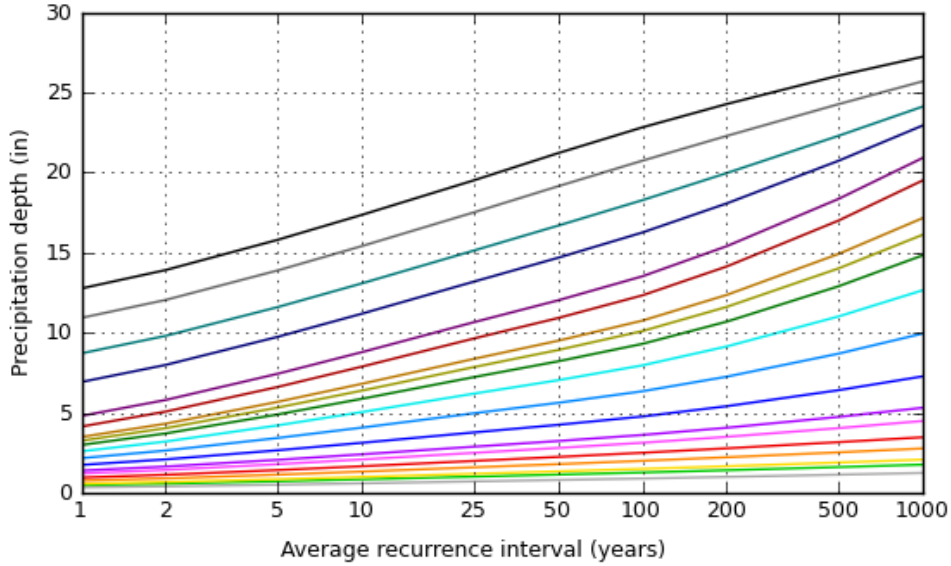
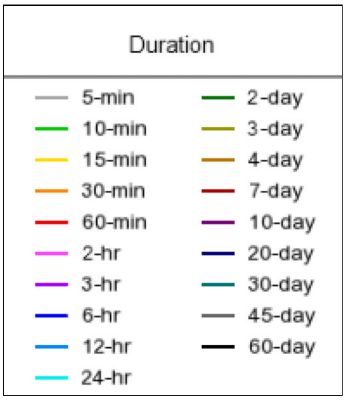
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.0681°, Longitude: -72.2057°









NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Tue Oct 6 17:20:55 2020

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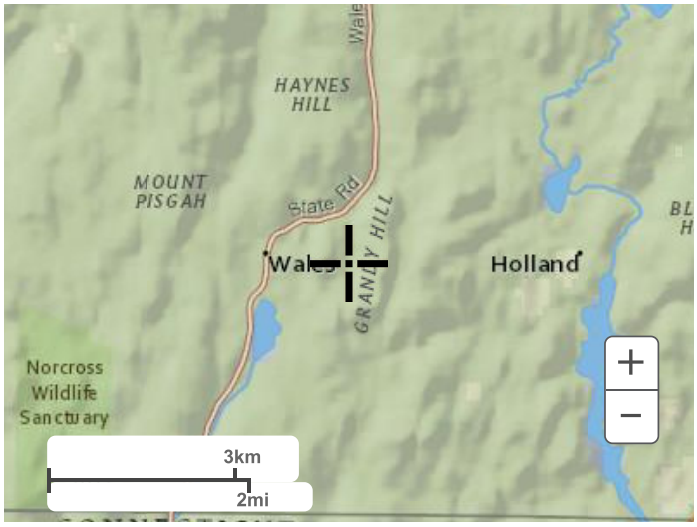
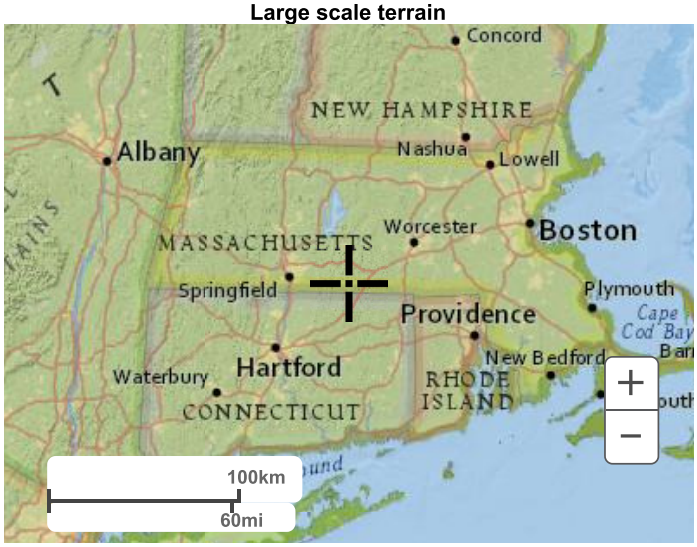
Maps & aerials

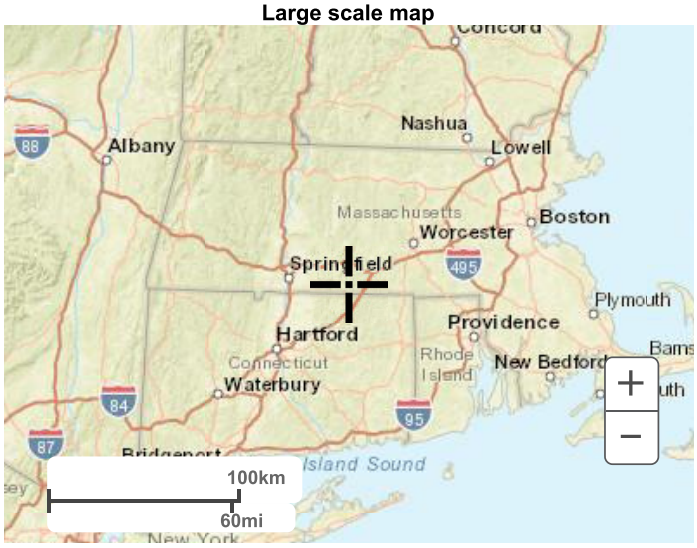
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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

Disclaimer

Appendix A.3:

FEMA Flood Map

National Flood Hazard Layer FIRMette

FEMA

72°12'39"W 42°4'19"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

72°12'2"W 42°3'52"N

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

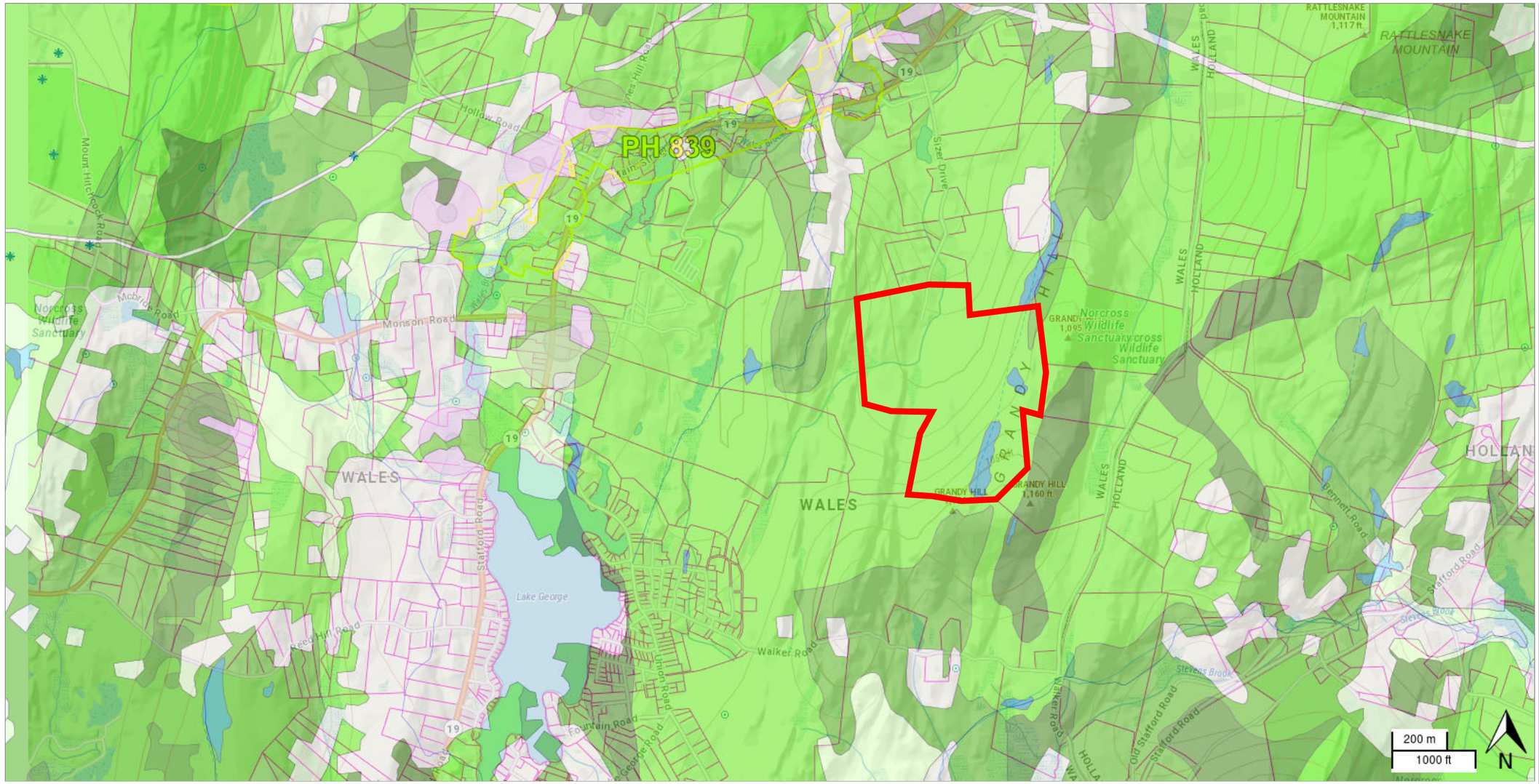
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/7/2020 at 8:28 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by 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.

Appendix A.4:

Environmental Resource Map

Environmental Resource Map



Prime Forest Land
- Prime 1
- Prime 2
- Prime 3
- Statewide Importance
- Local Importance
- Prime 3 Wet
- Statewide Importance Wet
- Local Importance Wet
- Unique Wet
- Non-Forested Land

Zone IIs

Zone Is

NHESP Priority Habitats of Rare Species

NHESP Estimated Habitats of Rare Wildlife

IWPAs

NHESP Certified Vernal Pools

BioMap2 Core Habitat Vernal Pool Core

Potential Vernal Pools

Areas of Critical Environmental Concern ACECs

DFW Coldwater Fisheries Resources

Census 2000 Rivers and Streams
- PERENNIAL
- INTERMITTENT

Tax Parcels for Query

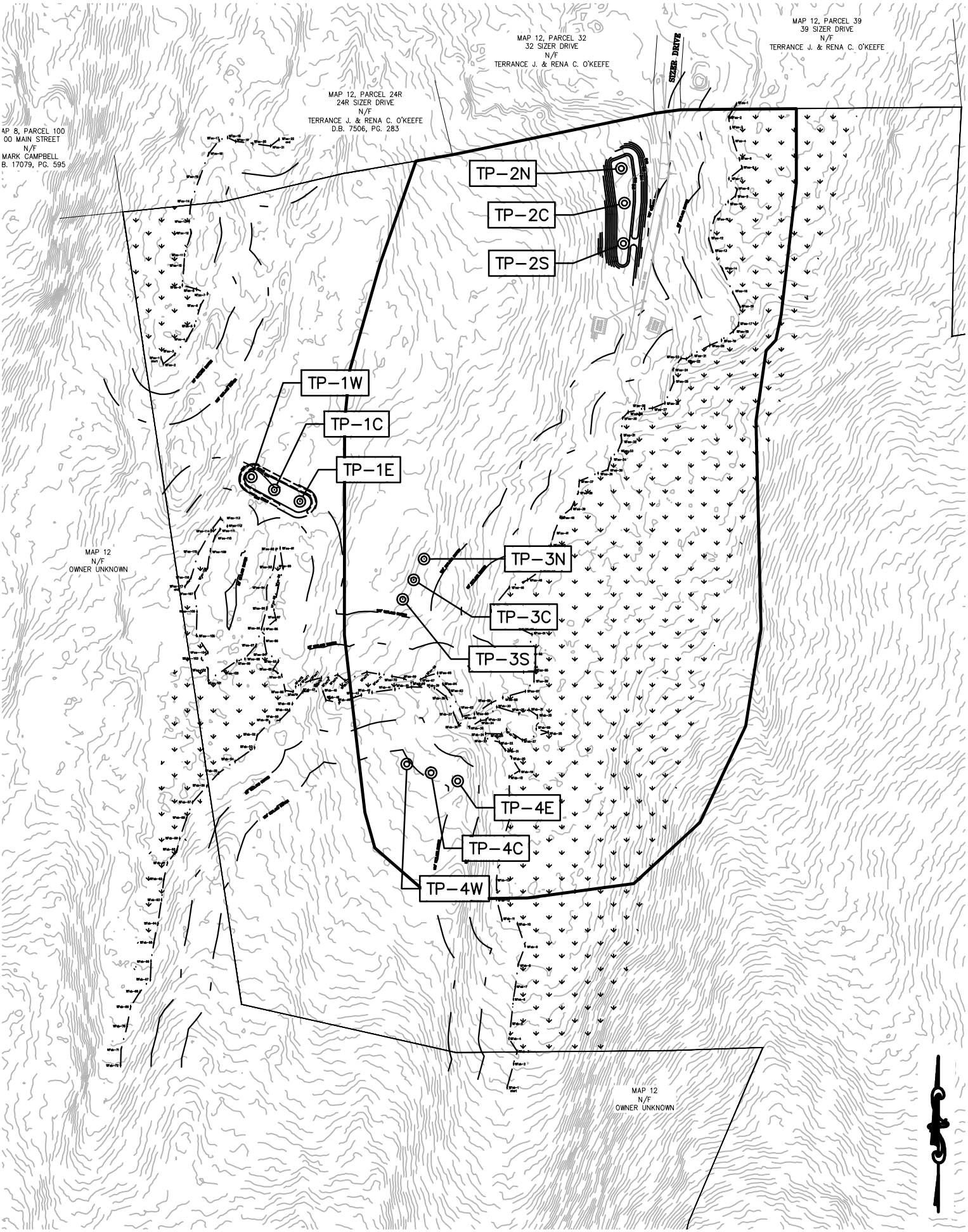
Detailed Features

Tax Parcels for Display

MassGIS Statewide Basemap
MassGIS Topographic Features Basemap

Appendix A.5:

Test Hole Location Plan & Logs



TEST HOLE LOCATION PLAN

1" = 200'

Commonwealth of Massachusetts
City/Town of

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: 1E (Hole #) 1/5/2021 (Date) ____ (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) ____ Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%)

   Description of Location: ____

2. Soil Parent Material: ____ ____ Landform FS 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: 28" 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			
0-1	O	FSL	10YR 2/1	-	-	-	0	0	gran.	-	OM, litter, roots
1-3	A_1	FSL	10YR 3/4	-	-	-	0	0	gran.	-	-
3-5	A_2	FSL	5YR 4/4	-	-	-	0	0	gran.	-	-
5-29	B_w	FSL	7.5YR 4/6	-	-	-	0	0	gran.	-	refusal

Additional Notes:
Sunpin 40 Sizer Dr. Wales MA

Commonwealth of Massachusetts
City/Town of

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: 1C (Hole #) 1/5/2021 (Date) ____ (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) ____ Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%)

Description of Location: ____

2. Soil Parent Material: ____ ____ Landform FS 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: 22" 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			
0-2	O	FSL	10 YR 2/1	-	-	-	0	0	gran.	-	OM, litter, roots
2-20	A	FSL	10 YR 4/3	-	-	-	0	0	gran	-	-
20-36	Bw	FSL	7.5YR 6/6	-	-	-	0	10	gran	-	refusal

Additional Notes:
Sunpin 40 Sizer Dr. Wales MA

Commonwealth of Massachusetts
City/Town of

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: 1W (Hole #) 1/5/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

Description of Location: _____

2. Soil Parent Material: _____ _____ Landform FS 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: 16" 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			
0-2	O	FSL	10 YR 2/1	–	–	–	0	0	granular	–	litter, roots
2-14	A	FSL	10 YR 5/3	–	–	–	0	0	gran.	–	–
14-30	B_w	FSL	10 YR 6/6	–	–	–	0	0	gran.	–	refusal on rock

Additional Notes:
Sunpin 40 Sizer Dr. Wales MA

Commonwealth of Massachusetts
City/Town of

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: 2N (Hole #) 1/5/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ Longitude:

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

Description of Location: _____

2. Soil Parent Material: _____ _____ Landform TS 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			
0-7	A	FSL	7.5 YR 4/4	-	-	-	0	0	gran.	-	-
7-18	Bw	FSL	10 YR 5/8	-	-	-	0	0	gran.	-	refusal on rock

Additional Notes:
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City/Town of

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: 2C (Hole #) 1/5/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

Description of Location: _____

2. Soil Parent Material: _____ _____ Landform TS 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			
0-6	A	FSL	7.5YR 4/3	-	-	-	0	0	gran.	-	-
6-12	Bw_1	FSL	10YR 5/6	-	-	-	0	0	gran.	-	-
12-20	Bw_2	FSL	10YR 5/4	-	-	-	10	0	gran.	-	refusal on rock

Additional Notes:
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City/Town of

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: 23 (Hole #) ____ Date ____ Time ____ Weather ____ Latitude ____ Longitude:

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) ____ Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%)

Description of Location: ____

2. Soil Parent Material: ____ Landform ____ TS 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			
0-7	A	FSL	7.5YR 4/4	-	-	-	-	-	gran.	-	-
7-19	Bw	FSL	10YR 4/4	-	-	-	10	-	gran	-	refusal on rock

Additional Notes:
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City/Town of

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: 3N (Hole #) 1/5/21 (Date) ____ (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) ____ Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%)

Description of Location: ____

2. Soil Parent Material: ____ ____ Landform BS 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			
0-5	A	FSL	7.5YR4/4	-	-	-	0	0	gr.	-	-
5-11	Bw_1	FSL	5YR4/6	-	-	-	0	0	gr	-	-
11-15	Bw_2	FSL	7.5YR4/6	-	-	-	0	0	gr.	-	-
15-36	Bw_3	SL	10YR4/6	-	-	-	0	0	gr.	-	refusal on rock

Additional Notes:
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City/Town of

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: 3C (Hole #) 1/5/2021 (Date) ____ (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) ____ Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%)

   Description of Location: ____

2. Soil Parent Material: ____ ____ Landform BS 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			
0-5	A	FSL	7.5YR 4/4	-	-	-	0	0	gr.	-	-
5-11	Bw_1	FSL	5YR 4/6	-	-	-	0	0	gr.	-	-
11-15	Bw_2	FSL	7.5YR 4/6	-	-	-	0	0	gr.	-	-
15-41	Bw_3	SL	10YR4/6	-	-	-	0	0	gr.	-	refusal on rock

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

Deep Observation Hole Number: 3S (Hole #) 1/5/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

   Description of Location: _____

2. Soil Parent Material: _____ _____ Landform BS 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			
0-5	A	FSL	7.5YR 4/4	-	-	-	0	0	gran.	-	-
5-11	Bw_1	FSL	5YR 4/6	-	-	-	0	0	gr.	-	-
11-14	Bw_2	FSL	7.5YR 4/6	-	-	-	0	0	gr.	-	-
14-40	Bw_3	FSL	10YR 4/6	-	-	-	0	0	gr	-	-
40-45	C	SL	7.5YR 4/4	-	-	-	20	0	gr	-	auger length limit

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

Deep Observation Hole Number: 4E (Hole #) 1/5/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

Description of Location: _____

2. Soil Parent Material: _____ _____ Landform FS 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: 35" 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			
0-1	O										
1-5	A	FSL	10YR 3/2	-	-	-	0	0	gr.	-	-
5-41	Bw	FSL	10YR 4/4	-	-	-	0	0	gr.	-	refusal on rocks

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

Deep Observation Hole Number: 4C (Hole #) 1/5/2021 (Date) _____ (Time) _____ (Weather) _____ (Latitude) _____ (Longitude:)

1. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) _____ Vegetation _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%)

Description of Location: _____

2. Soil Parent Material: _____ _____ Landform FS 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			
0-1	O										
1-5	A	FSL	10YR 3/2	-	-	-	0	0	gr.	-	-
5-31	Bw	FSL	10YR 4/4	-	-	-	0	0	gr.	-	refusal on rocks

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

Deep Observation Hole Number: 4W (Hole #) 1/5/2021 (Date) ____ (Time) ____ (Weather) ____ (Latitude) ____ (Longitude:)

1. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) ____ Vegetation ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%)

Description of Location: ____

2. Soil Parent Material: ____ ____ Landform FS 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			
0-1	O	L									
1-4	A	FSL	10YR3/1	-	-	-	0	0	gr.	-	-
4-19	Bw	FSL	10YR4/4	-	-	-	0	0	gr.	-	refusal on rock

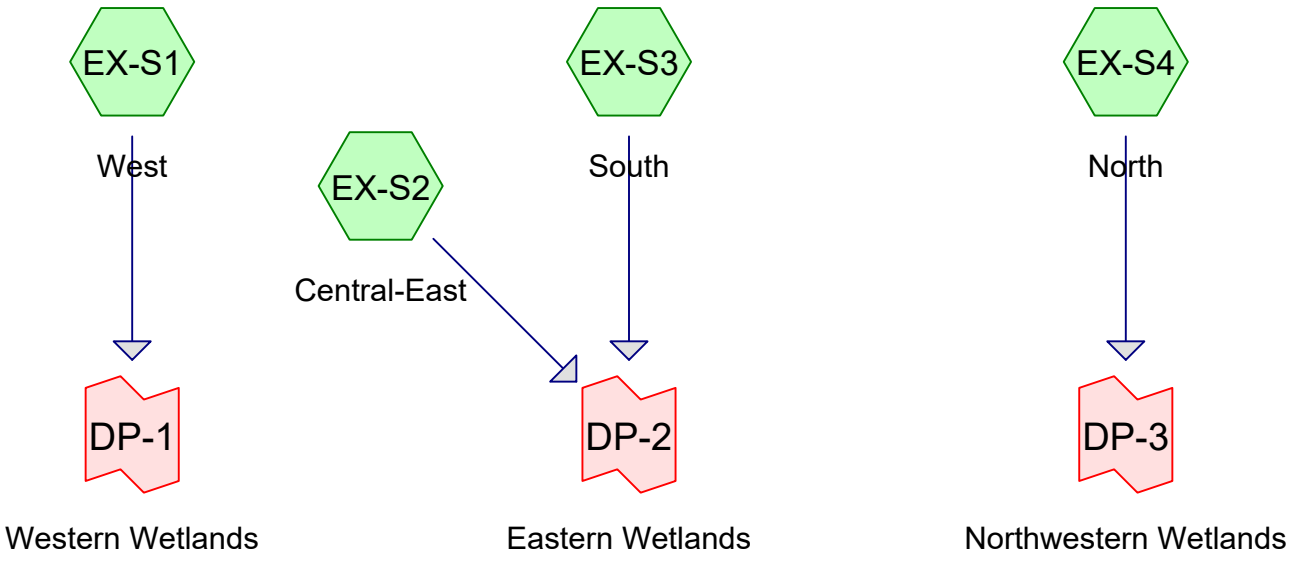
Additional Notes:
Sunpin 40 Sizer Dr. Wales MA

Appendix B:

HydroCAD Analyses

Appendix B.1:

Existing HydroCAD Analysis



Subcat Reach Pond Link

Routing Diagram for EX_2021-03
Prepared by wood., Printed 4/28/2021

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
5,273	98	Paved parking, HSG C (EX-S2)
1,062	98	Unconnected roofs, HSG C (EX-S2)
1,042,701	70	Woods, Good, HSG C (EX-S1, EX-S2, EX-S3, EX-S4)
1,049,036	**70**	**TOTAL AREA**

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 Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-S1: West Runoff Area=118,364 sf 0.00% Impervious Runoff Depth=0.83"
Flow Length=411' Tc=24.5 min CN=70 Runoff=1.46 cfs 8,225 cf

Subcatchment EX-S2: Central-East Runoff Area=471,424 sf 1.34% Impervious Runoff Depth=0.83"
Flow Length=767' Tc=12.9 min CN=70 Runoff=7.46 cfs 32,760 cf

Subcatchment EX-S3: South Runoff Area=406,052 sf 0.00% Impervious Runoff Depth=0.83"
Flow Length=1,199' Tc=17.6 min CN=70 Runoff=5.73 cfs 28,217 cf

Subcatchment EX-S4: North Runoff Area=53,196 sf 0.00% Impervious Runoff Depth=0.83"
Flow Length=256' Tc=8.9 min CN=70 Runoff=0.95 cfs 3,697 cf

Link DP-1: Western Wetlands Inflow=1.46 cfs 8,225 cf
Primary=1.46 cfs 8,225 cf

Link DP-2: Eastern Wetlands Inflow=12.78 cfs 60,978 cf
Primary=12.78 cfs 60,978 cf

Link DP-3: Northwestern Wetlands Inflow=0.95 cfs 3,697 cf
Primary=0.95 cfs 3,697 cf

Total Runoff Area = 1,049,036 sf Runoff Volume = 72,900 cf Average Runoff Depth = 0.83"
99.40% Pervious = 1,042,701 sf 0.60% Impervious = 6,335 sf

Summary for Subcatchment EX-S1: West

Runoff = 1.46 cfs @ 12.39 hrs, Volume= 8,225 cf, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

Area (sf)	CN	Description
118,364	70	Woods, Good, HSG C
118,364		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
8.3	361	0.0208	0.72		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
24.5	411	Total			

Summary for Subcatchment EX-S2: Central-East

Runoff = 7.46 cfs @ 12.20 hrs, Volume= 32,760 cf, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

Area (sf)	CN	Description
465,089	70	Woods, Good, HSG C
5,273	98	Paved parking, HSG C
1,062	98	Unconnected roofs, HSG C
471,424	70	Weighted Average
465,089		98.66% Pervious Area
6,335		1.34% Impervious Area
1,062		16.76% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1400	0.15		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
1.7	107	0.0467	1.08		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
4.5	490	0.1347	1.84		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.0	14	0.0714	5.42		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
1.0	106	0.1226	1.75		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
12.9	767	Total			

Summary for Subcatchment EX-S3: South

Runoff = 5.73 cfs @ 12.27 hrs, Volume= 28,217 cf, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

Area (sf)	CN	Description
406,052	70	Woods, Good, HSG C
406,052		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
6.3	666	0.1230	1.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.9	483	0.0745	1.36		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
17.6	1,199	Total			

Summary for Subcatchment EX-S4: North

Runoff = 0.95 cfs @ 12.15 hrs, Volume= 3,697 cf, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

Area (sf)	CN	Description
53,196	70	Woods, Good, HSG C
53,196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.21"
3.5	206	0.0388	0.98		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
8.9	256	Total			

Summary for Link DP-1: Western Wetlands

Inflow Area = 118,364 sf, 0.00% Impervious, Inflow Depth = 0.83" for 2-YR event
Inflow = 1.46 cfs @ 12.39 hrs, Volume= 8,225 cf
Primary = 1.46 cfs @ 12.39 hrs, Volume= 8,225 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-2: Eastern Wetlands

Inflow Area = 877,476 sf, 0.72% Impervious, Inflow Depth = 0.83" for 2-YR event
Inflow = 12.78 cfs @ 12.23 hrs, Volume= 60,978 cf
Primary = 12.78 cfs @ 12.23 hrs, Volume= 60,978 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-3: Northwestern Wetlands

Inflow Area = 53,196 sf, 0.00% Impervious, Inflow Depth = 0.83" for 2-YR event
Inflow = 0.95 cfs @ 12.15 hrs, Volume= 3,697 cf
Primary = 0.95 cfs @ 12.15 hrs, Volume= 3,697 cf, Atten= 0%, Lag= 0.0 min

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

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 Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-S1: West Runoff Area=118,364 sf 0.00% Impervious Runoff Depth=2.07"
Flow Length=411' Tc=24.5 min CN=70 Runoff=4.00 cfs 20,452 cf

Subcatchment EX-S2: Central-East Runoff Area=471,424 sf 1.34% Impervious Runoff Depth=2.07"
Flow Length=767' Tc=12.9 min CN=70 Runoff=20.42 cfs 81,457 cf

Subcatchment EX-S3: South Runoff Area=406,052 sf 0.00% Impervious Runoff Depth=2.07"
Flow Length=1,199' Tc=17.6 min CN=70 Runoff=15.70 cfs 70,161 cf

Subcatchment EX-S4: North Runoff Area=53,196 sf 0.00% Impervious Runoff Depth=2.07"
Flow Length=256' Tc=8.9 min CN=70 Runoff=2.59 cfs 9,192 cf

Link DP-1: Western Wetlands Inflow=4.00 cfs 20,452 cf
Primary=4.00 cfs 20,452 cf

Link DP-2: Eastern Wetlands Inflow=35.38 cfs 151,618 cf
Primary=35.38 cfs 151,618 cf

Link DP-3: Northwestern Wetlands Inflow=2.59 cfs 9,192 cf
Primary=2.59 cfs 9,192 cf

Total Runoff Area = 1,049,036 sf Runoff Volume = 181,262 cf Average Runoff Depth = 2.07"
99.40% Pervious = 1,042,701 sf 0.60% Impervious = 6,335 sf

Summary for Subcatchment EX-S1: West

Runoff = 4.00 cfs @ 12.36 hrs, Volume= 20,452 cf, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
118,364	70	Woods, Good, HSG C
118,364		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
8.3	361	0.0208	0.72		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
24.5	411	Total			

Summary for Subcatchment EX-S2: Central-East

Runoff = 20.42 cfs @ 12.19 hrs, Volume= 81,457 cf, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
465,089	70	Woods, Good, HSG C
5,273	98	Paved parking, HSG C
1,062	98	Unconnected roofs, HSG C
471,424	70	Weighted Average
465,089		98.66% Pervious Area
6,335		1.34% Impervious Area
1,062		16.76% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1400	0.15		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
1.7	107	0.0467	1.08		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
4.5	490	0.1347	1.84		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.0	14	0.0714	5.42		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
1.0	106	0.1226	1.75		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
12.9	767	Total			

Summary for Subcatchment EX-S3: South

Runoff = 15.70 cfs @ 12.26 hrs, Volume= 70,161 cf, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
406,052	70	Woods, Good, HSG C
406,052		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
6.3	666	0.1230	1.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.9	483	0.0745	1.36		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
17.6	1,199	Total			

Summary for Subcatchment EX-S4: North

Runoff = 2.59 cfs @ 12.13 hrs, Volume= 9,192 cf, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
53,196	70	Woods, Good, HSG C
53,196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.21"
3.5	206	0.0388	0.98		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
8.9	256	Total			

Summary for Link DP-1: Western Wetlands

Inflow Area = 118,364 sf, 0.00% Impervious, Inflow Depth = 2.07" for 10-YR event
Inflow = 4.00 cfs @ 12.36 hrs, Volume= 20,452 cf
Primary = 4.00 cfs @ 12.36 hrs, Volume= 20,452 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-2: Eastern Wetlands

Inflow Area = 877,476 sf, 0.72% Impervious, Inflow Depth = 2.07" for 10-YR event
Inflow = 35.38 cfs @ 12.21 hrs, Volume= 151,618 cf
Primary = 35.38 cfs @ 12.21 hrs, Volume= 151,618 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-3: Northwestern Wetlands

Inflow Area = 53,196 sf, 0.00% Impervious, Inflow Depth = 2.07" for 10-YR event
Inflow = 2.59 cfs @ 12.13 hrs, Volume= 9,192 cf
Primary = 2.59 cfs @ 12.13 hrs, Volume= 9,192 cf, Atten= 0%, Lag= 0.0 min

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

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 Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-S1: West Runoff Area=118,364 sf 0.00% Impervious Runoff Depth=2.96"
Flow Length=411' Tc=24.5 min CN=70 Runoff=5.80 cfs 29,243 cf

Subcatchment EX-S2: Central-East Runoff Area=471,424 sf 1.34% Impervious Runoff Depth=2.96"
Flow Length=767' Tc=12.9 min CN=70 Runoff=29.62 cfs 116,470 cf

Subcatchment EX-S3: South Runoff Area=406,052 sf 0.00% Impervious Runoff Depth=2.96"
Flow Length=1,199' Tc=17.6 min CN=70 Runoff=22.78 cfs 100,320 cf

Subcatchment EX-S4: North Runoff Area=53,196 sf 0.00% Impervious Runoff Depth=2.96"
Flow Length=256' Tc=8.9 min CN=70 Runoff=3.75 cfs 13,143 cf

Link DP-1: Western Wetlands Inflow=5.80 cfs 29,243 cf
Primary=5.80 cfs 29,243 cf

Link DP-2: Eastern Wetlands Inflow=51.36 cfs 216,790 cf
Primary=51.36 cfs 216,790 cf

Link DP-3: Northwestern Wetlands Inflow=3.75 cfs 13,143 cf
Primary=3.75 cfs 13,143 cf

Total Runoff Area = 1,049,036 sf Runoff Volume = 259,176 cf Average Runoff Depth = 2.96"
99.40% Pervious = 1,042,701 sf 0.60% Impervious = 6,335 sf

Summary for Subcatchment EX-S1: West

Runoff = 5.80 cfs @ 12.35 hrs, Volume= 29,243 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

Area (sf)	CN	Description
118,364	70	Woods, Good, HSG C
118,364		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
8.3	361	0.0208	0.72		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
24.5	411	Total			

Summary for Subcatchment EX-S2: Central-East

Runoff = 29.62 cfs @ 12.18 hrs, Volume= 116,470 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

Area (sf)	CN	Description
465,089	70	Woods, Good, HSG C
5,273	98	Paved parking, HSG C
1,062	98	Unconnected roofs, HSG C
471,424	70	Weighted Average
465,089		98.66% Pervious Area
6,335		1.34% Impervious Area
1,062		16.76% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1400	0.15		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
1.7	107	0.0467	1.08		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
4.5	490	0.1347	1.84		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.0	14	0.0714	5.42		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
1.0	106	0.1226	1.75		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
12.9	767	Total			

Summary for Subcatchment EX-S3: South

Runoff = 22.78 cfs @ 12.25 hrs, Volume= 100,320 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

Area (sf)	CN	Description
406,052	70	Woods, Good, HSG C
406,052		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
6.3	666	0.1230	1.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.9	483	0.0745	1.36		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
17.6	1,199	Total			

Summary for Subcatchment EX-S4: North

Runoff = 3.75 cfs @ 12.13 hrs, Volume= 13,143 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

Area (sf)	CN	Description
53,196	70	Woods, Good, HSG C
53,196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.21"
3.5	206	0.0388	0.98		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
8.9	256	Total			

Summary for Link DP-1: Western Wetlands

Inflow Area = 118,364 sf, 0.00% Impervious, Inflow Depth = 2.96" for 25-YR event
Inflow = 5.80 cfs @ 12.35 hrs, Volume= 29,243 cf
Primary = 5.80 cfs @ 12.35 hrs, Volume= 29,243 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-2: Eastern Wetlands

Inflow Area = 877,476 sf, 0.72% Impervious, Inflow Depth = 2.96" for 25-YR event
Inflow = 51.36 cfs @ 12.21 hrs, Volume= 216,790 cf
Primary = 51.36 cfs @ 12.21 hrs, Volume= 216,790 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-3: Northwestern Wetlands

Inflow Area = 53,196 sf, 0.00% Impervious, Inflow Depth = 2.96" for 25-YR event
Inflow = 3.75 cfs @ 12.13 hrs, Volume= 13,143 cf
Primary = 3.75 cfs @ 12.13 hrs, Volume= 13,143 cf, Atten= 0%, Lag= 0.0 min

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

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 Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-S1: West Runoff Area=118,364 sf 0.00% Impervious Runoff Depth=4.43"
Flow Length=411' Tc=24.5 min CN=70 Runoff=8.71 cfs 43,695 cf

Subcatchment EX-S2: Central-East Runoff Area=471,424 sf 1.34% Impervious Runoff Depth=4.43"
Flow Length=767' Tc=12.9 min CN=70 Runoff=44.51 cfs 174,031 cf

Subcatchment EX-S3: South Runoff Area=406,052 sf 0.00% Impervious Runoff Depth=4.43"
Flow Length=1,199' Tc=17.6 min CN=70 Runoff=34.25 cfs 149,899 cf

Subcatchment EX-S4: North Runoff Area=53,196 sf 0.00% Impervious Runoff Depth=4.43"
Flow Length=256' Tc=8.9 min CN=70 Runoff=5.63 cfs 19,638 cf

Link DP-1: Western Wetlands Inflow=8.71 cfs 43,695 cf
Primary=8.71 cfs 43,695 cf

Link DP-2: Eastern Wetlands Inflow=77.26 cfs 323,930 cf
Primary=77.26 cfs 323,930 cf

Link DP-3: Northwestern Wetlands Inflow=5.63 cfs 19,638 cf
Primary=5.63 cfs 19,638 cf

Total Runoff Area = 1,049,036 sf Runoff Volume = 387,263 cf Average Runoff Depth = 4.43"
99.40% Pervious = 1,042,701 sf 0.60% Impervious = 6,335 sf

Summary for Subcatchment EX-S1: West

Runoff = 8.71 cfs @ 12.34 hrs, Volume= 43,695 cf, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
118,364	70	Woods, Good, HSG C
118,364		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.2	50	0.0100	0.05		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
8.3	361	0.0208	0.72		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
24.5	411	Total			

Summary for Subcatchment EX-S2: Central-East

Runoff = 44.51 cfs @ 12.18 hrs, Volume= 174,031 cf, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
465,089	70	Woods, Good, HSG C
5,273	98	Paved parking, HSG C
1,062	98	Unconnected roofs, HSG C
471,424	70	Weighted Average
465,089		98.66% Pervious Area
6,335		1.34% Impervious Area
1,062		16.76% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.1400	0.15		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
1.7	107	0.0467	1.08		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
4.5	490	0.1347	1.84		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
0.0	14	0.0714	5.42		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
1.0	106	0.1226	1.75		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
12.9	767	Total			

Summary for Subcatchment EX-S3: South

Runoff = 34.25 cfs @ 12.25 hrs, Volume= 149,899 cf, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
406,052	70	Woods, Good, HSG C
406,052		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
6.3	666	0.1230	1.75		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
5.9	483	0.0745	1.36		**Shallow Concentrated Flow, C-D** Woodland Kv= 5.0 fps
17.6	1,199	Total			

Summary for Subcatchment EX-S4: North

Runoff = 5.63 cfs @ 12.13 hrs, Volume= 19,638 cf, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
53,196	70	Woods, Good, HSG C
53,196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.21"
3.5	206	0.0388	0.98		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
8.9	256	Total			

Summary for Link DP-1: Western Wetlands

Inflow Area = 118,364 sf, 0.00% Impervious, Inflow Depth = 4.43" for 100-YR event
Inflow = 8.71 cfs @ 12.34 hrs, Volume= 43,695 cf
Primary = 8.71 cfs @ 12.34 hrs, Volume= 43,695 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-2: Eastern Wetlands

Inflow Area = 877,476 sf, 0.72% Impervious, Inflow Depth = 4.43" for 100-YR event
Inflow = 77.26 cfs @ 12.21 hrs, Volume= 323,930 cf
Primary = 77.26 cfs @ 12.21 hrs, Volume= 323,930 cf, Atten= 0%, Lag= 0.0 min

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

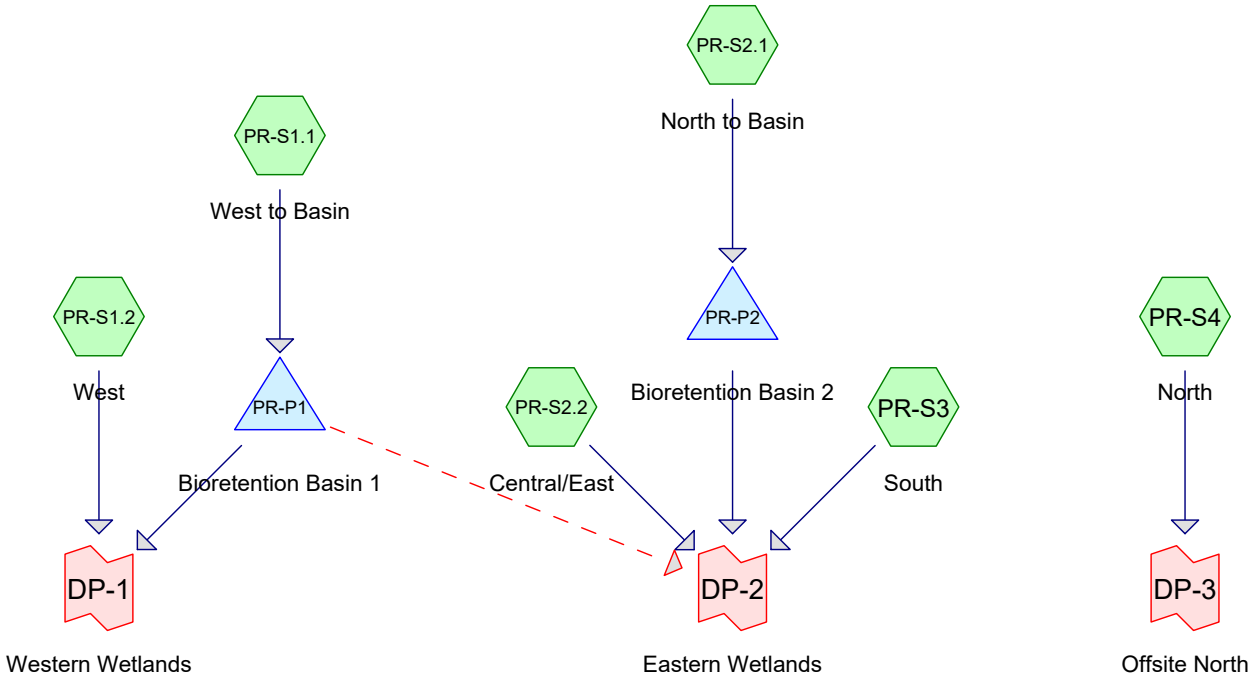
Summary for Link DP-3: Northwestern Wetlands

Inflow Area = 53,196 sf, 0.00% Impervious, Inflow Depth = 4.43" for 100-YR event
Inflow = 5.63 cfs @ 12.13 hrs, Volume= 19,638 cf
Primary = 5.63 cfs @ 12.13 hrs, Volume= 19,638 cf, Atten= 0%, Lag= 0.0 min

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

Appendix B.2:

Proposed HydroCAD Analysis



Subcat Reach Pond Link

Routing Diagram for PR_2021-09
Prepared by wood., Printed 9/22/2021

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
8,121	98	Basin Area (PR-S1.1, PR-S2.1)
206,727	65	Brush, Good, HSG C (PR-S1.1, PR-S1.2, PR-S2.1, PR-S2.2, PR-S3, PR-S4)
21,631	72	Crushed Stone Access Drive (PR-S2.2)
337,433	71	Meadow, non-grazed, HSG C (PR-S1.1, PR-S2.1, PR-S2.2, PR-S3, PR-S4)
475,124	70	Woods, Good, HSG C (PR-S1.1, PR-S1.2, PR-S2.1, PR-S2.2, PR-S3, PR-S4)
1,049,036	**70**	**TOTAL AREA**

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 Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-S1.1: West to Basin Runoff Area=53,826 sf 6.48% Impervious Runoff Depth=0.94"
Flow Length=251' Tc=14.3 min CN=72 Runoff=0.95 cfs 4,198 cf

Subcatchment PR-S1.2: West Runoff Area=64,538 sf 0.00% Impervious Runoff Depth=0.79"
Flow Length=136' Tc=6.6 min CN=69 Runoff=1.16 cfs 4,223 cf

Subcatchment PR-S2.1: North to Basin Runoff Area=110,956 sf 4.17% Impervious Runoff Depth=0.88"
Flow Length=567' Tc=9.8 min CN=71 Runoff=2.08 cfs 8,175 cf

Subcatchment PR-S2.2: Central/East Runoff Area=360,469 sf 0.00% Impervious Runoff Depth=0.83"
Flow Length=490' Tc=9.9 min CN=70 Runoff=6.26 cfs 25,050 cf

Subcatchment PR-S3: South Runoff Area=406,051 sf 0.00% Impervious Runoff Depth=0.79"
Flow Length=1,198' Tc=16.0 min CN=69 Runoff=5.48 cfs 26,570 cf

Subcatchment PR-S4: North Runoff Area=53,196 sf 0.00% Impervious Runoff Depth=0.79"
Flow Length=255' Tc=8.8 min CN=69 Runoff=0.88 cfs 3,481 cf

Pond PR-P1: Bioretention Basin 1 Peak Elev=893.23' Storage=1,014 cf Inflow=0.95 cfs 4,198 cf
Primary=0.00 cfs 0 cf Secondary=0.25 cfs 4,196 cf Outflow=0.25 cfs 4,196 cf

Pond PR-P2: Bioretention Basin 2 Peak Elev=843.51' Storage=2,522 cf Inflow=2.08 cfs 8,175 cf
Outflow=0.47 cfs 8,175 cf

Link DP-1: Western Wetlands Inflow=1.16 cfs 4,223 cf
Primary=1.16 cfs 4,223 cf

Link DP-2: Eastern Wetlands Inflow=11.53 cfs 63,991 cf
Primary=11.53 cfs 63,991 cf

Link DP-3: Offsite North Inflow=0.88 cfs 3,481 cf
Primary=0.88 cfs 3,481 cf

Total Runoff Area = 1,049,036 sf Runoff Volume = 71,696 cf Average Runoff Depth = 0.82"
99.23% Pervious = 1,040,915 sf 0.77% Impervious = 8,121 sf

Summary for Subcatchment PR-S1.1: West to Basin

Runoff = 0.95 cfs @ 12.22 hrs, Volume= 4,198 cf, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

	Area (sf)	CN	Description
	684	70	Woods, Good, HSG C
	5,425	65	Brush, Good, HSG C
	44,228	71	Meadow, non-grazed, HSG C
*	3,489	98	Basin Area
	53,826	72	Weighted Average
	50,337		93.52% Pervious Area
	3,489		6.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
3.5	201	0.0187	0.96		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
14.3	251	Total			

Summary for Subcatchment PR-S1.2: West

Runoff = 1.16 cfs @ 12.11 hrs, Volume= 4,223 cf, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

Area (sf)	CN	Description
53,885	70	Woods, Good, HSG C
10,653	65	Brush, Good, HSG C
64,538	69	Weighted Average
64,538		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	86	0.2326	2.41		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.6	136	Total			

Summary for Subcatchment PR-S2.1: North to Basin

Runoff = 2.08 cfs @ 12.16 hrs, Volume= 8,175 cf, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

	Area (sf)	CN	Description
	17,874	65	Brush, Good, HSG C
	88,061	71	Meadow, non-grazed, HSG C
	389	70	Woods, Good, HSG C
*	4,632	98	Basin Area
	110,956	71	Weighted Average
	106,324		95.83% Pervious Area
	4,632		4.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
1.1	107	0.0560	1.66		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
2.7	410	0.1268	2.49		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
9.8	567	Total			

Summary for Subcatchment PR-S2.2: Central/East

Runoff = 6.26 cfs @ 12.16 hrs, Volume= 25,050 cf, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

	Area (sf)	CN	Description
	147,162	70	Woods, Good, HSG C
	66,061	65	Brush, Good, HSG C
	125,615	71	Meadow, non-grazed, HSG C
*	21,631	72	Crushed Stone Access Drive
	360,469	70	Weighted Average
	360,469		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
1.7	195	0.0718	1.88		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.6	108	0.1852	3.01		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0909	4.85		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.3	115	0.0870	1.47		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
9.9	490	Total			

Summary for Subcatchment PR-S3: South

Runoff = 5.48 cfs @ 12.26 hrs, Volume= 26,570 cf, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

Area (sf)	CN	Description
238,302	70	Woods, Good, HSG C
91,506	65	Brush, Good, HSG C
76,243	71	Meadow, non-grazed, HSG C
406,051	69	Weighted Average
406,051		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
5.4	581	0.1310	1.81		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.3	151	0.0730	1.89		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
2.8	304	0.0690	1.84		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0380	1.36		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
0.5	60	0.1330	1.82		**Shallow Concentrated Flow, F-G** Woodland Kv= 5.0 fps
16.0	1,198	Total			

Summary for Subcatchment PR-S4: North

Runoff = 0.88 cfs @ 12.15 hrs, Volume= 3,481 cf, Depth= 0.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.21"

Area (sf)	CN	Description
34,702	70	Woods, Good, HSG C
15,208	65	Brush, Good, HSG C
3,286	71	Meadow, non-grazed, HSG C
53,196	69	Weighted Average
53,196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.4	33	0.0606	1.23		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.9	110	0.0182	0.94		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
1.1	62	0.0323	0.90		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
8.8	255	Total			

Summary for Pond PR-P1: Bioretention Basin 1

Inflow Area = 53,826 sf, 6.48% Impervious, Inflow Depth = 0.94" for 2-YR event
Inflow = 0.95 cfs @ 12.22 hrs, Volume= 4,198 cf
Outflow = 0.25 cfs @ 12.78 hrs, Volume= 4,196 cf, Atten= 74%, Lag= 33.8 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.25 cfs @ 12.78 hrs, Volume= 4,196 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 893.23' @ 12.78 hrs Surf.Area= 4,455 sf Storage= 1,014 cf

Plug-Flow detention time= 28.0 min calculated for 4,196 cf (100% of inflow)
Center-of-Mass det. time= 27.7 min (904.0 - 876.2)

Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	3,540 cf	**Outer Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
893.00	4,232	319.0	0	0	4,232
893.50	4,717	328.0	2,236	2,236	4,723
893.75	5,730	347.0	1,304	3,540	5,747

Device	Routing	Invert	Outlet Devices
#1	Secondary	889.60'	**6.0" Round HDPE Underdrain Outlet Pipe** L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 889.60' / 889.20' S= 0.0068 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Device 1	893.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Primary	893.50'	**12.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=893.00' (Free Discharge)
└**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.25 cfs @ 12.78 hrs HW=893.23' (Free Discharge)
└**1=HDPE Underdrain Outlet Pipe** (Passes 0.25 cfs of 1.27 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.25 cfs)

Summary for Pond PR-P2: Bioretention Basin 2

Inflow Area = 110,956 sf, 4.17% Impervious, Inflow Depth = 0.88" for 2-YR event
Inflow = 2.08 cfs @ 12.16 hrs, Volume= 8,175 cf
Outflow = 0.47 cfs @ 12.72 hrs, Volume= 8,175 cf, Atten= 78%, Lag= 33.6 min
Primary = 0.47 cfs @ 12.72 hrs, Volume= 8,175 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 843.51' @ 12.72 hrs Surf.Area= 5,230 sf Storage= 2,522 cf

Plug-Flow detention time= 77.2 min calculated for 8,169 cf (100% of inflow)
Center-of-Mass det. time= 77.1 min (952.6 - 875.5)

Volume	Invert	Avail.Storage	Storage Description
#1	843.00'	10,129 cf	**Outer Storage (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
843.00	4,632	392.0	0	0	4,632
844.00	5,835	410.0	5,222	5,222	5,849
844.75	7,276	434.0	4,907	10,129	7,491

Device	Routing	Invert	Outlet Devices
#1	Primary	835.00'	**12.0" Round HDPE Outlet Pipe** L= 73.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 835.00' / 832.00' S= 0.0411 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	843.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Device 1	843.50'	**1.2" x 21.0" Horiz. MassDOT Drop Inlet Grate X 10.00** C= 0.600 Limited to weir flow at low heads
#4	Primary	844.25'	**10.0' long Overflow Weir** 2 End Contraction(s)

Primary OutFlow Max=0.44 cfs @ 12.72 hrs HW=843.51' (Free Discharge)
└**1=HDPE Outlet Pipe** (Passes 0.44 cfs of 10.49 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.29 cfs)
└**3=MassDOT Drop Inlet Grate** (Weir Controls 0.15 cfs @ 0.35 fps)
└**4=Overflow Weir** (Controls 0.00 cfs)

Summary for Link DP-1: Western Wetlands

Inflow Area = 118,364 sf, 2.95% Impervious, Inflow Depth = 0.43" for 2-YR event
Inflow = 1.16 cfs @ 12.11 hrs, Volume= 4,223 cf
Primary = 1.16 cfs @ 12.11 hrs, Volume= 4,223 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-2: Eastern Wetlands

Inflow Area = 877,476 sf, 0.53% Impervious, Inflow Depth = 0.88" for 2-YR event
Inflow = 11.53 cfs @ 12.20 hrs, Volume= 63,991 cf
Primary = 11.53 cfs @ 12.20 hrs, Volume= 63,991 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-3: Offsite North

Inflow Area = 53,196 sf, 0.00% Impervious, Inflow Depth = 0.79" for 2-YR event
Inflow = 0.88 cfs @ 12.15 hrs, Volume= 3,481 cf
Primary = 0.88 cfs @ 12.15 hrs, Volume= 3,481 cf, Atten= 0%, Lag= 0.0 min

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

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 Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-S1.1: West to Basin Runoff Area=53,826 sf 6.48% Impervious Runoff Depth=2.24"
Flow Length=251' Tc=14.3 min CN=72 Runoff=2.45 cfs 10,032 cf

Subcatchment PR-S1.2: West Runoff Area=64,538 sf 0.00% Impervious Runoff Depth=1.99"
Flow Length=136' Tc=6.6 min CN=69 Runoff=3.27 cfs 10,723 cf

Subcatchment PR-S2.1: North to Basin Runoff Area=110,956 sf 4.17% Impervious Runoff Depth=2.15"
Flow Length=567' Tc=9.8 min CN=71 Runoff=5.51 cfs 19,920 cf

Subcatchment PR-S2.2: Central/East Runoff Area=360,469 sf 0.00% Impervious Runoff Depth=2.07"
Flow Length=490' Tc=9.9 min CN=70 Runoff=17.10 cfs 62,285 cf

Subcatchment PR-S3: South Runoff Area=406,051 sf 0.00% Impervious Runoff Depth=1.99"
Flow Length=1,198' Tc=16.0 min CN=69 Runoff=15.54 cfs 67,464 cf

Subcatchment PR-S4: North Runoff Area=53,196 sf 0.00% Impervious Runoff Depth=1.99"
Flow Length=255' Tc=8.8 min CN=69 Runoff=2.48 cfs 8,838 cf

Pond PR-P1: Bioretention Basin 1 Peak Elev=893.59' Storage=2,674 cf Inflow=2.45 cfs 10,032 cf
Primary=1.05 cfs 1,761 cf Secondary=0.28 cfs 8,272 cf Outflow=1.33 cfs 10,033 cf

Pond PR-P2: Bioretention Basin 2 Peak Elev=843.70' Storage=3,538 cf Inflow=5.51 cfs 19,920 cf
Outflow=4.09 cfs 19,920 cf

Link DP-1: Western Wetlands Inflow=3.27 cfs 12,483 cf
Primary=3.27 cfs 12,483 cf

Link DP-2: Eastern Wetlands Inflow=34.90 cfs 157,942 cf
Primary=34.90 cfs 157,942 cf

Link DP-3: Offsite North Inflow=2.48 cfs 8,838 cf
Primary=2.48 cfs 8,838 cf

Total Runoff Area = 1,049,036 sf Runoff Volume = 179,262 cf Average Runoff Depth = 2.05"
99.23% Pervious = 1,040,915 sf 0.77% Impervious = 8,121 sf

Summary for Subcatchment PR-S1.1: West to Basin

Runoff = 2.45 cfs @ 12.21 hrs, Volume= 10,032 cf, Depth= 2.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

	Area (sf)	CN	Description
	684	70	Woods, Good, HSG C
	5,425	65	Brush, Good, HSG C
	44,228	71	Meadow, non-grazed, HSG C
*	3,489	98	Basin Area
	53,826	72	Weighted Average
	50,337		93.52% Pervious Area
	3,489		6.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
3.5	201	0.0187	0.96		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
14.3	251	Total			

Summary for Subcatchment PR-S1.2: West

Runoff = 3.27 cfs @ 12.10 hrs, Volume= 10,723 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
53,885	70	Woods, Good, HSG C
10,653	65	Brush, Good, HSG C
64,538	69	Weighted Average
64,538		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	86	0.2326	2.41		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.6	136	Total			

Summary for Subcatchment PR-S2.1: North to Basin

Runoff = 5.51 cfs @ 12.15 hrs, Volume= 19,920 cf, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

	Area (sf)	CN	Description
	17,874	65	Brush, Good, HSG C
	88,061	71	Meadow, non-grazed, HSG C
	389	70	Woods, Good, HSG C
*	4,632	98	Basin Area
	110,956	71	Weighted Average
	106,324		95.83% Pervious Area
	4,632		4.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
1.1	107	0.0560	1.66		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
2.7	410	0.1268	2.49		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
9.8	567	Total			

Summary for Subcatchment PR-S2.2: Central/East

Runoff = 17.10 cfs @ 12.15 hrs, Volume= 62,285 cf, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

	Area (sf)	CN	Description
	147,162	70	Woods, Good, HSG C
	66,061	65	Brush, Good, HSG C
	125,615	71	Meadow, non-grazed, HSG C
*	21,631	72	Crushed Stone Access Drive
	360,469	70	Weighted Average
	360,469		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
1.7	195	0.0718	1.88		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.6	108	0.1852	3.01		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0909	4.85		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.3	115	0.0870	1.47		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
9.9	490	Total			

Summary for Subcatchment PR-S3: South

Runoff = 15.54 cfs @ 12.23 hrs, Volume= 67,464 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
238,302	70	Woods, Good, HSG C
91,506	65	Brush, Good, HSG C
76,243	71	Meadow, non-grazed, HSG C
406,051	69	Weighted Average
406,051		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
5.4	581	0.1310	1.81		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.3	151	0.0730	1.89		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
2.8	304	0.0690	1.84		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0380	1.36		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
0.5	60	0.1330	1.82		**Shallow Concentrated Flow, F-G** Woodland Kv= 5.0 fps
16.0	1,198	Total			

Summary for Subcatchment PR-S4: North

Runoff = 2.48 cfs @ 12.13 hrs, Volume= 8,838 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.05"

Area (sf)	CN	Description
34,702	70	Woods, Good, HSG C
15,208	65	Brush, Good, HSG C
3,286	71	Meadow, non-grazed, HSG C
53,196	69	Weighted Average
53,196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.4	33	0.0606	1.23		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.9	110	0.0182	0.94		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
1.1	62	0.0323	0.90		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
8.8	255	Total			

Summary for Pond PR-P1: Bioretention Basin 1

Inflow Area = 53,826 sf, 6.48% Impervious, Inflow Depth = 2.24" for 10-YR event
Inflow = 2.45 cfs @ 12.21 hrs, Volume= 10,032 cf
Outflow = 1.33 cfs @ 12.49 hrs, Volume= 10,033 cf, Atten= 46%, Lag= 16.8 min
Primary = 1.05 cfs @ 12.49 hrs, Volume= 1,761 cf
Secondary = 0.28 cfs @ 12.49 hrs, Volume= 8,272 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 893.59' @ 12.49 hrs Surf.Area= 5,068 sf Storage= 2,674 cf

Plug-Flow detention time= 67.1 min calculated for 10,026 cf (100% of inflow)
Center-of-Mass det. time= 67.1 min (916.9 - 849.7)

Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	3,540 cf	**Outer Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
893.00	4,232	319.0	0	0	4,232
893.50	4,717	328.0	2,236	2,236	4,723
893.75	5,730	347.0	1,304	3,540	5,747

Device	Routing	Invert	Outlet Devices
#1	Secondary	889.60'	**6.0" Round HDPE Underdrain Outlet Pipe** L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 889.60' / 889.20' S= 0.0068 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Device 1	893.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Primary	893.50'	**12.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=1.04 cfs @ 12.49 hrs HW=893.59' (Free Discharge)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.04 cfs @ 0.98 fps)

Secondary OutFlow Max=0.28 cfs @ 12.49 hrs HW=893.59' (Free Discharge)
└**1=HDPE Underdrain Outlet Pipe** (Passes 0.28 cfs of 1.33 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.28 cfs)

Summary for Pond PR-P2: Bioretention Basin 2

Inflow Area = 110,956 sf, 4.17% Impervious, Inflow Depth = 2.15" for 10-YR event
Inflow = 5.51 cfs @ 12.15 hrs, Volume= 19,920 cf
Outflow = 4.09 cfs @ 12.26 hrs, Volume= 19,920 cf, Atten= 26%, Lag= 6.7 min
Primary = 4.09 cfs @ 12.26 hrs, Volume= 19,920 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 843.70' @ 12.26 hrs Surf.Area= 5,462 sf Storage= 3,538 cf

Plug-Flow detention time= 56.2 min calculated for 19,906 cf (100% of inflow)
Center-of-Mass det. time= 56.2 min (904.3 - 848.1)

Volume	Invert	Avail.Storage	Storage Description
#1	843.00'	10,129 cf	**Outer Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
843.00	4,632	392.0	0	0	4,632
844.00	5,835	410.0	5,222	5,222	5,849
844.75	7,276	434.0	4,907	10,129	7,491

Device	Routing	Invert	Outlet Devices
#1	Primary	835.00'	**12.0" Round HDPE Outlet Pipe** L= 73.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 835.00' / 832.00' S= 0.0411 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	843.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Device 1	843.50'	**1.2" x 21.0" Horiz. MassDOT Drop Inlet Grate X 10.00** C= 0.600 Limited to weir flow at low heads
#4	Primary	844.25'	**10.0' long Overflow Weir** 2 End Contraction(s)

Primary OutFlow Max=4.07 cfs @ 12.26 hrs HW=843.70' (Free Discharge)
└**1=HDPE Outlet Pipe** (Passes 4.07 cfs of 10.59 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.30 cfs)
└**3=MassDOT Drop Inlet Grate** (Orifice Controls 3.77 cfs @ 2.15 fps)
└**4=Overflow Weir** (Controls 0.00 cfs)

Summary for Link DP-1: Western Wetlands

Inflow Area = 118,364 sf, 2.95% Impervious, Inflow Depth = 1.27" for 10-YR event
Inflow = 3.27 cfs @ 12.10 hrs, Volume= 12,483 cf
Primary = 3.27 cfs @ 12.10 hrs, Volume= 12,483 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-2: Eastern Wetlands

Inflow Area = 877,476 sf, 0.53% Impervious, Inflow Depth = 2.16" for 10-YR event
Inflow = 34.90 cfs @ 12.19 hrs, Volume= 157,942 cf
Primary = 34.90 cfs @ 12.19 hrs, Volume= 157,942 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-3: Offsite North

Inflow Area = 53,196 sf, 0.00% Impervious, Inflow Depth = 1.99" for 10-YR event
Inflow = 2.48 cfs @ 12.13 hrs, Volume= 8,838 cf
Primary = 2.48 cfs @ 12.13 hrs, Volume= 8,838 cf, Atten= 0%, Lag= 0.0 min

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

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 Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-S1.1: West to Basin Runoff Area=53,826 sf 6.48% Impervious Runoff Depth=3.16"
Flow Length=251' Tc=14.3 min CN=72 Runoff=3.50 cfs 14,163 cf

Subcatchment PR-S1.2: West Runoff Area=64,538 sf 0.00% Impervious Runoff Depth=2.87"
Flow Length=136' Tc=6.6 min CN=69 Runoff=4.78 cfs 15,433 cf

Subcatchment PR-S2.1: North to Basin Runoff Area=110,956 sf 4.17% Impervious Runoff Depth=3.06"
Flow Length=567' Tc=9.8 min CN=71 Runoff=7.91 cfs 28,300 cf

Subcatchment PR-S2.2: Central/East Runoff Area=360,469 sf 0.00% Impervious Runoff Depth=2.96"
Flow Length=490' Tc=9.9 min CN=70 Runoff=24.79 cfs 89,058 cf

Subcatchment PR-S3: South Runoff Area=406,051 sf 0.00% Impervious Runoff Depth=2.87"
Flow Length=1,198' Tc=16.0 min CN=69 Runoff=22.76 cfs 97,100 cf

Subcatchment PR-S4: North Runoff Area=53,196 sf 0.00% Impervious Runoff Depth=2.87"
Flow Length=255' Tc=8.8 min CN=69 Runoff=3.63 cfs 12,721 cf

Pond PR-P1: Bioretention Basin 1 Peak Elev=893.65' Storage=3,000 cf Inflow=3.50 cfs 14,163 cf
Primary=2.32 cfs 4,346 cf Secondary=0.30 cfs 9,812 cf Outflow=2.62 cfs 14,159 cf

Pond PR-P2: Bioretention Basin 2 Peak Elev=843.90' Storage=4,660 cf Inflow=7.91 cfs 28,300 cf
Outflow=5.67 cfs 28,300 cf

Link DP-1: Western Wetlands Inflow=4.78 cfs 19,780 cf
Primary=4.78 cfs 19,780 cf

Link DP-2: Eastern Wetlands Inflow=50.59 cfs 224,271 cf
Primary=50.59 cfs 224,271 cf

Link DP-3: Offsite North Inflow=3.63 cfs 12,721 cf
Primary=3.63 cfs 12,721 cf

Total Runoff Area = 1,049,036 sf Runoff Volume = 256,776 cf Average Runoff Depth = 2.94"
99.23% Pervious = 1,040,915 sf 0.77% Impervious = 8,121 sf

Summary for Subcatchment PR-S1.1: West to Basin

Runoff = 3.50 cfs @ 12.20 hrs, Volume= 14,163 cf, Depth= 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

	Area (sf)	CN	Description
	684	70	Woods, Good, HSG C
	5,425	65	Brush, Good, HSG C
	44,228	71	Meadow, non-grazed, HSG C
*	3,489	98	Basin Area
	53,826	72	Weighted Average
	50,337		93.52% Pervious Area
	3,489		6.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
3.5	201	0.0187	0.96		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
14.3	251	Total			

Summary for Subcatchment PR-S1.2: West

Runoff = 4.78 cfs @ 12.10 hrs, Volume= 15,433 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

Area (sf)	CN	Description
53,885	70	Woods, Good, HSG C
10,653	65	Brush, Good, HSG C
64,538	69	Weighted Average
64,538		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	86	0.2326	2.41		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.6	136	Total			

Summary for Subcatchment PR-S2.1: North to Basin

Runoff = 7.91 cfs @ 12.14 hrs, Volume= 28,300 cf, Depth= 3.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

	Area (sf)	CN	Description
	17,874	65	Brush, Good, HSG C
	88,061	71	Meadow, non-grazed, HSG C
	389	70	Woods, Good, HSG C
*	4,632	98	Basin Area
	110,956	71	Weighted Average
	106,324		95.83% Pervious Area
	4,632		4.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
1.1	107	0.0560	1.66		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
2.7	410	0.1268	2.49		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
9.8	567	Total			

Summary for Subcatchment PR-S2.2: Central/East

Runoff = 24.79 cfs @ 12.15 hrs, Volume= 89,058 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

	Area (sf)	CN	Description
	147,162	70	Woods, Good, HSG C
	66,061	65	Brush, Good, HSG C
	125,615	71	Meadow, non-grazed, HSG C
*	21,631	72	Crushed Stone Access Drive
	360,469	70	Weighted Average
	360,469		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
1.7	195	0.0718	1.88		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.6	108	0.1852	3.01		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0909	4.85		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.3	115	0.0870	1.47		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
9.9	490	Total			

Summary for Subcatchment PR-S3: South

Runoff = 22.76 cfs @ 12.23 hrs, Volume= 97,100 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

Area (sf)	CN	Description
238,302	70	Woods, Good, HSG C
91,506	65	Brush, Good, HSG C
76,243	71	Meadow, non-grazed, HSG C
406,051	69	Weighted Average
406,051		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
5.4	581	0.1310	1.81		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.3	151	0.0730	1.89		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
2.8	304	0.0690	1.84		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0380	1.36		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
0.5	60	0.1330	1.82		**Shallow Concentrated Flow, F-G** Woodland Kv= 5.0 fps
16.0	1,198	Total			

Summary for Subcatchment PR-S4: North

Runoff = 3.63 cfs @ 12.13 hrs, Volume= 12,721 cf, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.20"

Area (sf)	CN	Description
34,702	70	Woods, Good, HSG C
15,208	65	Brush, Good, HSG C
3,286	71	Meadow, non-grazed, HSG C
53,196	69	Weighted Average
53,196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.4	33	0.0606	1.23		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.9	110	0.0182	0.94		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
1.1	62	0.0323	0.90		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
8.8	255	Total			

Summary for Pond PR-P1: Bioretention Basin 1

Inflow Area = 53,826 sf, 6.48% Impervious, Inflow Depth = 3.16" for 25-YR event
Inflow = 3.50 cfs @ 12.20 hrs, Volume= 14,163 cf
Outflow = 2.62 cfs @ 12.35 hrs, Volume= 14,159 cf, Atten= 25%, Lag= 8.9 min
Primary = 2.32 cfs @ 12.35 hrs, Volume= 4,346 cf
Secondary = 0.30 cfs @ 12.35 hrs, Volume= 9,812 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 893.65' @ 12.35 hrs Surf.Area= 5,322 sf Storage= 3,000 cf

Plug-Flow detention time= 59.7 min calculated for 14,149 cf (100% of inflow)
Center-of-Mass det. time= 59.5 min (899.2 - 839.7)

Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	3,540 cf	**Outer Storage (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
893.00	4,232	319.0	0	0	4,232
893.50	4,717	328.0	2,236	2,236	4,723
893.75	5,730	347.0	1,304	3,540	5,747

Device	Routing	Invert	Outlet Devices
#1	Secondary	889.60'	**6.0" Round HDPE Underdrain Outlet Pipe** L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 889.60' / 889.20' S= 0.0068 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Device 1	893.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Primary	893.50'	**12.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=2.32 cfs @ 12.35 hrs HW=893.65' (Free Discharge)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 2.32 cfs @ 1.27 fps)

Secondary OutFlow Max=0.30 cfs @ 12.35 hrs HW=893.65' (Free Discharge)
└**1=HDPE Underdrain Outlet Pipe** (Passes 0.30 cfs of 1.34 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.30 cfs)

Summary for Pond PR-P2: Bioretention Basin 2

Inflow Area = 110,956 sf, 4.17% Impervious, Inflow Depth = 3.06" for 25-YR event
Inflow = 7.91 cfs @ 12.14 hrs, Volume= 28,300 cf
Outflow = 5.67 cfs @ 12.26 hrs, Volume= 28,300 cf, Atten= 28%, Lag= 7.1 min
Primary = 5.67 cfs @ 12.26 hrs, Volume= 28,300 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 843.90' @ 12.26 hrs Surf.Area= 5,712 sf Storage= 4,660 cf

Plug-Flow detention time= 49.8 min calculated for 28,281 cf (100% of inflow)
Center-of-Mass det. time= 49.7 min (887.6 - 837.8)

Volume	Invert	Avail.Storage	Storage Description
#1	843.00'	10,129 cf	**Outer Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
843.00	4,632	392.0	0	0	4,632
844.00	5,835	410.0	5,222	5,222	5,849
844.75	7,276	434.0	4,907	10,129	7,491

Device	Routing	Invert	Outlet Devices
#1	Primary	835.00'	**12.0" Round HDPE Outlet Pipe** L= 73.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 835.00' / 832.00' S= 0.0411 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	843.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Device 1	843.50'	**1.2" x 21.0" Horiz. MassDOT Drop Inlet Grate X 10.00** C= 0.600 Limited to weir flow at low heads
#4	Primary	844.25'	**10.0' long Overflow Weir** 2 End Contraction(s)

Primary OutFlow Max=5.64 cfs @ 12.26 hrs HW=843.90' (Free Discharge)
└**1=HDPE Outlet Pipe** (Passes 5.64 cfs of 10.69 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.32 cfs)
└**3=MassDOT Drop Inlet Grate** (Orifice Controls 5.33 cfs @ 3.04 fps)
└**4=Overflow Weir** (Controls 0.00 cfs)

Summary for Link DP-1: Western Wetlands

Inflow Area = 118,364 sf, 2.95% Impervious, Inflow Depth = 2.01" for 25-YR event
Inflow = 4.78 cfs @ 12.10 hrs, Volume= 19,780 cf
Primary = 4.78 cfs @ 12.10 hrs, Volume= 19,780 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-2: Eastern Wetlands

Inflow Area = 877,476 sf, 0.53% Impervious, Inflow Depth = 3.07" for 25-YR event
Inflow = 50.59 cfs @ 12.18 hrs, Volume= 224,271 cf
Primary = 50.59 cfs @ 12.18 hrs, Volume= 224,271 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-3: Offsite North

Inflow Area = 53,196 sf, 0.00% Impervious, Inflow Depth = 2.87" for 25-YR event
Inflow = 3.63 cfs @ 12.13 hrs, Volume= 12,721 cf
Primary = 3.63 cfs @ 12.13 hrs, Volume= 12,721 cf, Atten= 0%, Lag= 0.0 min

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

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 Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PR-S1.1: West to Basin Runoff Area=53,826 sf 6.48% Impervious Runoff Depth=4.66"
Flow Length=251' Tc=14.3 min CN=72 Runoff=5.17 cfs 20,900 cf

Subcatchment PR-S1.2: West Runoff Area=64,538 sf 0.00% Impervious Runoff Depth=4.32"
Flow Length=136' Tc=6.6 min CN=69 Runoff=7.24 cfs 23,210 cf

Subcatchment PR-S2.1: North to Basin Runoff Area=110,956 sf 4.17% Impervious Runoff Depth=4.54"
Flow Length=567' Tc=9.8 min CN=71 Runoff=11.78 cfs 42,020 cf

Subcatchment PR-S2.2: Central/East Runoff Area=360,469 sf 0.00% Impervious Runoff Depth=4.43"
Flow Length=490' Tc=9.9 min CN=70 Runoff=37.21 cfs 133,071 cf

Subcatchment PR-S3: South Runoff Area=406,051 sf 0.00% Impervious Runoff Depth=4.32"
Flow Length=1,198' Tc=16.0 min CN=69 Runoff=34.69 cfs 146,032 cf

Subcatchment PR-S4: North Runoff Area=53,196 sf 0.00% Impervious Runoff Depth=4.32"
Flow Length=255' Tc=8.8 min CN=69 Runoff=5.49 cfs 19,131 cf

Pond PR-P1: Bioretention Basin 1 Peak Elev=893.73' Storage=3,435 cf Inflow=5.17 cfs 20,900 cf
Primary=4.36 cfs 9,104 cf Secondary=0.32 cfs 11,804 cf Outflow=4.67 cfs 20,908 cf

Pond PR-P2: Bioretention Basin 2 Peak Elev=844.25' Storage=6,751 cf Inflow=11.78 cfs 42,020 cf
Outflow=7.66 cfs 42,020 cf

Link DP-1: Western Wetlands Inflow=8.69 cfs 32,315 cf
Primary=8.69 cfs 32,315 cf

Link DP-2: Eastern Wetlands Inflow=75.99 cfs 332,927 cf
Primary=75.99 cfs 332,927 cf

Link DP-3: Offsite North Inflow=5.49 cfs 19,131 cf
Primary=5.49 cfs 19,131 cf

Total Runoff Area = 1,049,036 sf Runoff Volume = 384,364 cf Average Runoff Depth = 4.40"
99.23% Pervious = 1,040,915 sf 0.77% Impervious = 8,121 sf

Summary for Subcatchment PR-S1.1: West to Basin

Runoff = 5.17 cfs @ 12.20 hrs, Volume= 20,900 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

	Area (sf)	CN	Description
	684	70	Woods, Good, HSG C
	5,425	65	Brush, Good, HSG C
	44,228	71	Meadow, non-grazed, HSG C
*	3,489	98	Basin Area
	53,826	72	Weighted Average
	50,337		93.52% Pervious Area
	3,489		6.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
3.5	201	0.0187	0.96		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
14.3	251	Total			

Summary for Subcatchment PR-S1.2: West

Runoff = 7.24 cfs @ 12.10 hrs, Volume= 23,210 cf, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
53,885	70	Woods, Good, HSG C
10,653	65	Brush, Good, HSG C
64,538	69	Weighted Average
64,538		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	86	0.2326	2.41		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.6	136	Total			

Summary for Subcatchment PR-S2.1: North to Basin

Runoff = 11.78 cfs @ 12.14 hrs, Volume= 42,020 cf, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

	Area (sf)	CN	Description
	17,874	65	Brush, Good, HSG C
	88,061	71	Meadow, non-grazed, HSG C
	389	70	Woods, Good, HSG C
*	4,632	98	Basin Area
	110,956	71	Weighted Average
	106,324		95.83% Pervious Area
	4,632		4.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
1.1	107	0.0560	1.66		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
2.7	410	0.1268	2.49		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
9.8	567	Total			

Summary for Subcatchment PR-S2.2: Central/East

Runoff = 37.21 cfs @ 12.14 hrs, Volume= 133,071 cf, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

	Area (sf)	CN	Description
	147,162	70	Woods, Good, HSG C
	66,061	65	Brush, Good, HSG C
	125,615	71	Meadow, non-grazed, HSG C
*	21,631	72	Crushed Stone Access Drive
	360,469	70	Weighted Average
	360,469		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
1.7	195	0.0718	1.88		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.6	108	0.1852	3.01		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0909	4.85		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.3	115	0.0870	1.47		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
9.9	490	Total			

Summary for Subcatchment PR-S3: South

Runoff = 34.69 cfs @ 12.22 hrs, Volume= 146,032 cf, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
238,302	70	Woods, Good, HSG C
91,506	65	Brush, Good, HSG C
76,243	71	Meadow, non-grazed, HSG C
406,051	69	Weighted Average
406,051		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
5.4	581	0.1310	1.81		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.3	151	0.0730	1.89		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
2.8	304	0.0690	1.84		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0380	1.36		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
0.5	60	0.1330	1.82		**Shallow Concentrated Flow, F-G** Woodland Kv= 5.0 fps
16.0	1,198	Total			

Summary for Subcatchment PR-S4: North

Runoff = 5.49 cfs @ 12.13 hrs, Volume= 19,131 cf, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
34,702	70	Woods, Good, HSG C
15,208	65	Brush, Good, HSG C
3,286	71	Meadow, non-grazed, HSG C
53,196	69	Weighted Average
53,196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.4	33	0.0606	1.23		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.9	110	0.0182	0.94		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
1.1	62	0.0323	0.90		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
8.8	255	Total			

Summary for Pond PR-P1: Bioretention Basin 1

Inflow Area = 53,826 sf, 6.48% Impervious, Inflow Depth = 4.66" for 100-YR event
Inflow = 5.17 cfs @ 12.20 hrs, Volume= 20,900 cf
Outflow = 4.67 cfs @ 12.27 hrs, Volume= 20,908 cf, Atten= 10%, Lag= 4.3 min
Primary = 4.36 cfs @ 12.27 hrs, Volume= 9,104 cf
Secondary = 0.32 cfs @ 12.27 hrs, Volume= 11,804 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 893.73' @ 12.27 hrs Surf.Area= 5,652 sf Storage= 3,435 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 50.9 min (879.4 - 828.5)

Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	3,540 cf	**Outer Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
893.00	4,232	319.0	0	0	4,232
893.50	4,717	328.0	2,236	2,236	4,723
893.75	5,730	347.0	1,304	3,540	5,747

Device	Routing	Invert	Outlet Devices
#1	Secondary	889.60'	**6.0" Round HDPE Underdrain Outlet Pipe** L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 889.60' / 889.20' S= 0.0068 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Device 1	893.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Primary	893.50'	**12.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=4.28 cfs @ 12.27 hrs HW=893.73' (Free Discharge)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 4.28 cfs @ 1.56 fps)

Secondary OutFlow Max=0.31 cfs @ 12.27 hrs HW=893.73' (Free Discharge)
└**1=HDPE Underdrain Outlet Pipe** (Passes 0.31 cfs of 1.35 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.31 cfs)

Summary for Pond PR-P2: Bioretention Basin 2

Inflow Area = 110,956 sf, 4.17% Impervious, Inflow Depth = 4.54" for 100-YR event
Inflow = 11.78 cfs @ 12.14 hrs, Volume= 42,020 cf
Outflow = 7.66 cfs @ 12.28 hrs, Volume= 42,020 cf, Atten= 35%, Lag= 8.5 min
Primary = 7.66 cfs @ 12.28 hrs, Volume= 42,020 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 844.25' @ 12.28 hrs Surf.Area= 6,301 sf Storage= 6,751 cf

Plug-Flow detention time= 44.6 min calculated for 41,991 cf (100% of inflow)
Center-of-Mass det. time= 44.6 min (871.1 - 826.4)

Volume	Invert	Avail.Storage	Storage Description
#1	843.00'	10,129 cf	**Outer Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
843.00	4,632	392.0	0	0	4,632
844.00	5,835	410.0	5,222	5,222	5,849
844.75	7,276	434.0	4,907	10,129	7,491

Device	Routing	Invert	Outlet Devices
#1	Primary	835.00'	**12.0" Round HDPE Outlet Pipe** L= 73.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 835.00' / 832.00' S= 0.0411 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	843.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Device 1	843.50'	**1.2" x 21.0" Horiz. MassDOT Drop Inlet Grate X 10.00** C= 0.600 Limited to weir flow at low heads
#4	Primary	844.25'	**10.0' long Overflow Weir** 2 End Contraction(s)

Primary OutFlow Max=7.64 cfs @ 12.28 hrs HW=844.25' (Free Discharge)
└**1=HDPE Outlet Pipe** (Passes 7.64 cfs of 10.86 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.35 cfs)
└**3=MassDOT Drop Inlet Grate** (Orifice Controls 7.29 cfs @ 4.17 fps)
└**4=Overflow Weir** (Controls 0.00 cfs)

Summary for Link DP-1: Western Wetlands

Inflow Area = 118,364 sf, 2.95% Impervious, Inflow Depth = 3.28" for 100-YR event
Inflow = 8.69 cfs @ 12.17 hrs, Volume= 32,315 cf
Primary = 8.69 cfs @ 12.17 hrs, Volume= 32,315 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-2: Eastern Wetlands

Inflow Area = 877,476 sf, 0.53% Impervious, Inflow Depth = 4.55" for 100-YR event
Inflow = 75.99 cfs @ 12.17 hrs, Volume= 332,927 cf
Primary = 75.99 cfs @ 12.17 hrs, Volume= 332,927 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP-3: Offsite North

Inflow Area = 53,196 sf, 0.00% Impervious, Inflow Depth = 4.32" for 100-YR event
Inflow = 5.49 cfs @ 12.13 hrs, Volume= 19,131 cf
Primary = 5.49 cfs @ 12.13 hrs, Volume= 19,131 cf, Atten= 0%, Lag= 0.0 min

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

Appendix B.3:

Runoff Velocity Analysis

Summary for Subcatchment PR-S1.1: West to Basin

Runoff = 5.17 cfs @ 12.20 hrs, Volume= 20,900 cf, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

	Area (sf)	CN	Description
	684	70	Woods, Good, HSG C
	5,425	65	Brush, Good, HSG C
	44,228	71	Meadow, non-grazed, HSG C
*	3,489	98	Basin Area
	53,826	72	Weighted Average
	50,337		93.52% Pervious Area
	3,489		6.48% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
3.5	201	0.0187	0.96		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
14.3	251	Total			

Summary for Subcatchment PR-S1.2: West

Runoff = 7.24 cfs @ 12.10 hrs, Volume= 23,210 cf, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
53,885	70	Woods, Good, HSG C
10,653	65	Brush, Good, HSG C
64,538	69	Weighted Average
64,538		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.6	86	0.2326	2.41		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
6.6	136	Total			

Summary for Subcatchment PR-S2.1: North to Basin

Runoff = 11.78 cfs @ 12.14 hrs, Volume= 42,020 cf, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

	Area (sf)	CN	Description
	17,874	65	Brush, Good, HSG C
	88,061	71	Meadow, non-grazed, HSG C
	389	70	Woods, Good, HSG C
*	4,632	98	Basin Area
	110,956	71	Weighted Average
	106,324		95.83% Pervious Area
	4,632		4.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
1.1	107	0.0560	1.66		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
2.7	410	0.1268	2.49		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
9.8	567	Total			

Summary for Subcatchment PR-S2.2: Central/East

Runoff = 37.21 cfs @ 12.14 hrs, Volume= 133,071 cf, Depth= 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

	Area (sf)	CN	Description
	147,162	70	Woods, Good, HSG C
	66,061	65	Brush, Good, HSG C
	125,615	71	Meadow, non-grazed, HSG C
*	21,631	72	Crushed Stone Access Drive
	360,469	70	Weighted Average
	360,469		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	50	0.0400	0.13		**Sheet Flow, A-B** Grass: Dense n= 0.240 P2= 3.21"
1.7	195	0.0718	1.88		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.6	108	0.1852	3.01		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	22	0.0909	4.85		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.3	115	0.0870	1.47		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
9.9	490	Total			

Summary for Subcatchment PR-S3: South

Runoff = 34.69 cfs @ 12.22 hrs, Volume= 146,032 cf, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
238,302	70	Woods, Good, HSG C
91,506	65	Brush, Good, HSG C
76,243	71	Meadow, non-grazed, HSG C
406,051	69	Weighted Average
406,051		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
5.4	581	0.1310	1.81		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.3	151	0.0730	1.89		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
2.8	304	0.0690	1.84		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.6	52	0.0380	1.36		**Shallow Concentrated Flow, E-F** Short Grass Pasture Kv= 7.0 fps
0.5	60	0.1330	1.82		**Shallow Concentrated Flow, F-G** Woodland Kv= 5.0 fps
16.0	1,198	Total			

Summary for Subcatchment PR-S4: North

Runoff = 5.49 cfs @ 12.13 hrs, Volume= 19,131 cf, Depth= 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=7.96"

Area (sf)	CN	Description
34,702	70	Woods, Good, HSG C
15,208	65	Brush, Good, HSG C
3,286	71	Meadow, non-grazed, HSG C
53,196	69	Weighted Average
53,196		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1600	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
0.4	33	0.0606	1.23		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
1.9	110	0.0182	0.94		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
1.1	62	0.0323	0.90		**Shallow Concentrated Flow, D-E** Woodland Kv= 5.0 fps
8.8	255	Total			

Summary for Pond PR-P1: Bioretention Basin 1

Inflow Area = 53,826 sf, 6.48% Impervious, Inflow Depth = 4.66" for 100-YR event
Inflow = 5.17 cfs @ 12.20 hrs, Volume= 20,900 cf
Outflow = 4.67 cfs @ 12.27 hrs, Volume= 20,908 cf, Atten= 10%, Lag= 4.3 min
Primary = 4.36 cfs @ 12.27 hrs, Volume= 9,104 cf
Secondary = 0.32 cfs @ 12.27 hrs, Volume= 11,804 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 893.73' @ 12.27 hrs Surf.Area= 5,652 sf Storage= 3,435 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 50.9 min (879.4 - 828.5)

Volume	Invert	Avail.Storage	Storage Description
#1	893.00'	3,540 cf	**Outer Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
893.00	4,232	319.0	0	0	4,232
893.50	4,717	328.0	2,236	2,236	4,723
893.75	5,730	347.0	1,304	3,540	5,747

Device	Routing	Invert	Outlet Devices
#1	Secondary	889.60'	**6.0" Round HDPE Underdrain Outlet Pipe** L= 59.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 889.60' / 889.20' S= 0.0068 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf
#2	Device 1	893.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Primary	893.50'	**12.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Runoff velocities within all subwatersheds are non-erosive (<5ft/s) in proposed conditions.

Primary OutFlow Max=4.28 cfs @ 12.27 hrs HW=893.73' (Free Discharge)
└**3=Sharp-Crested Rectangular Weir** (Weir Controls 4.28 cfs @ 1.56 fps)

Secondary OutFlow Max=0.31 cfs @ 12.27 hrs HW=893.73' (Free Discharge)
└**1=HDPE Underdrain Outlet Pipe** (Passes 0.31 cfs of 1.35 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.31 cfs)

The overflow weir discharges stormwater at a velocity of 1.56 fps for the 100-year storm, which is a non-erosive velocity. However, the overflow weir includes riprap protection to help mitigate any erosion potential.

Summary for Pond PR-P2: Bioretention Basin 2

Inflow Area = 110,956 sf, 4.17% Impervious, Inflow Depth = 4.54" for 100-YR event
Inflow = 11.78 cfs @ 12.14 hrs, Volume= 42,020 cf
Outflow = 7.66 cfs @ 12.28 hrs, Volume= 42,020 cf, Atten= 35%, Lag= 8.5 min
Primary = 7.66 cfs @ 12.28 hrs, Volume= 42,020 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 844.25' @ 12.28 hrs Surf.Area= 6,301 sf Storage= 6,751 cf

Plug-Flow detention time= 44.6 min calculated for 41,991 cf (100% of inflow)
Center-of-Mass det. time= 44.6 min (871.1 - 826.4)

Volume	Invert	Avail.Storage	Storage Description
#1	843.00'	10,129 cf	**Outer Storage (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
843.00	4,632	392.0	0	0	4,632
844.00	5,835	410.0	5,222	5,222	5,849
844.75	7,276	434.0	4,907	10,129	7,491

Device	Routing	Invert	Outlet Devices
#1	Primary	835.00'	**12.0" Round HDPE Outlet Pipe** L= 73.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 835.00' / 832.00' S= 0.0411 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	843.00'	**2.410 in/hr Exfiltration over Surface area**
#3	Device 1	843.50'	**1.2" x 21.0" Horiz. MassDOT Drop Inlet Grate X 10.00** C= 0.600 Limited to weir flow at low heads
#4	Primary	844.25'	**10.0' long Overflow Weir** 2 End Contraction(s)

Primary OutFlow Max=7.64 cfs @ 12.28 hrs HW=844.25' (Free Discharge)
└**1=HDPE Outlet Pipe** (Passes 7.64 cfs of 10.86 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.35 cfs)
└**3=MassDOT Drop Inlet Grate** (Orifice Controls 7.29 cfs @ 4.17 fps)
└**4=Overflow Weir** (Controls 0.00 cfs)

Runoff velocities less than 5 feet per second are generally considered non-erosive. With 4.17 fps being directed to the pipe outlet, this velocity is considered non-erosive. However, The pipe outlet includes a riprap plunge pool to dissipate velocity. Additionally, the overflow weir includes riprap protection to help mitigate any erosion potential.

Appendix C:

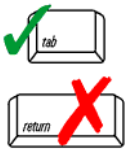
MassDEP Checklist for Stormwater Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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 8[2]
- 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.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

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.

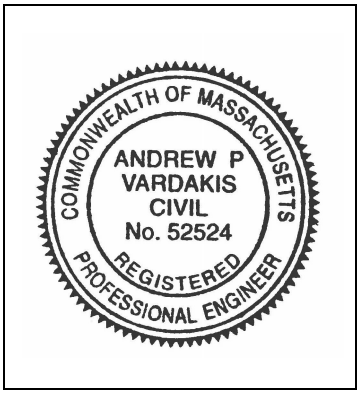
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



4/28/2021

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 — A wetland crossing is proposed in order to maximize site utilization. However, it spans the resource area and results in no permanent disturbance to the wetlands.
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only) — Not applicable
- ☒ Minimizing disturbance to existing trees and shrubs — No tree clearing proposed within the 50-ft wetland buffer area
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe — No curb and gutter conveyance proposed.
- ☒ Bioretention Cells (includes Rain Gardens) — Two bioretention basins proposed
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs) — No water quality to treat
- ☐ Treebox Filter — No water quality to treat
- ☐ Water Quality Swale — No water quality to treat
- ☐ Grass Channel — All stormwater within solar area to utilize existing drainage patterns.
- ☐ Green Roof — No building structures proposed
- ☒ Other (describe): Crushed Stone access Road

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 Standard not applicable

☐ 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 Field[1]

☐ 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 Standard not applicable

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) Standard not applicable

☐ 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 Standard not applicable

☐ 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.
Included in SWPPP, to be provided under separate cover

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. SWPPP provided under separate cover

☐ 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

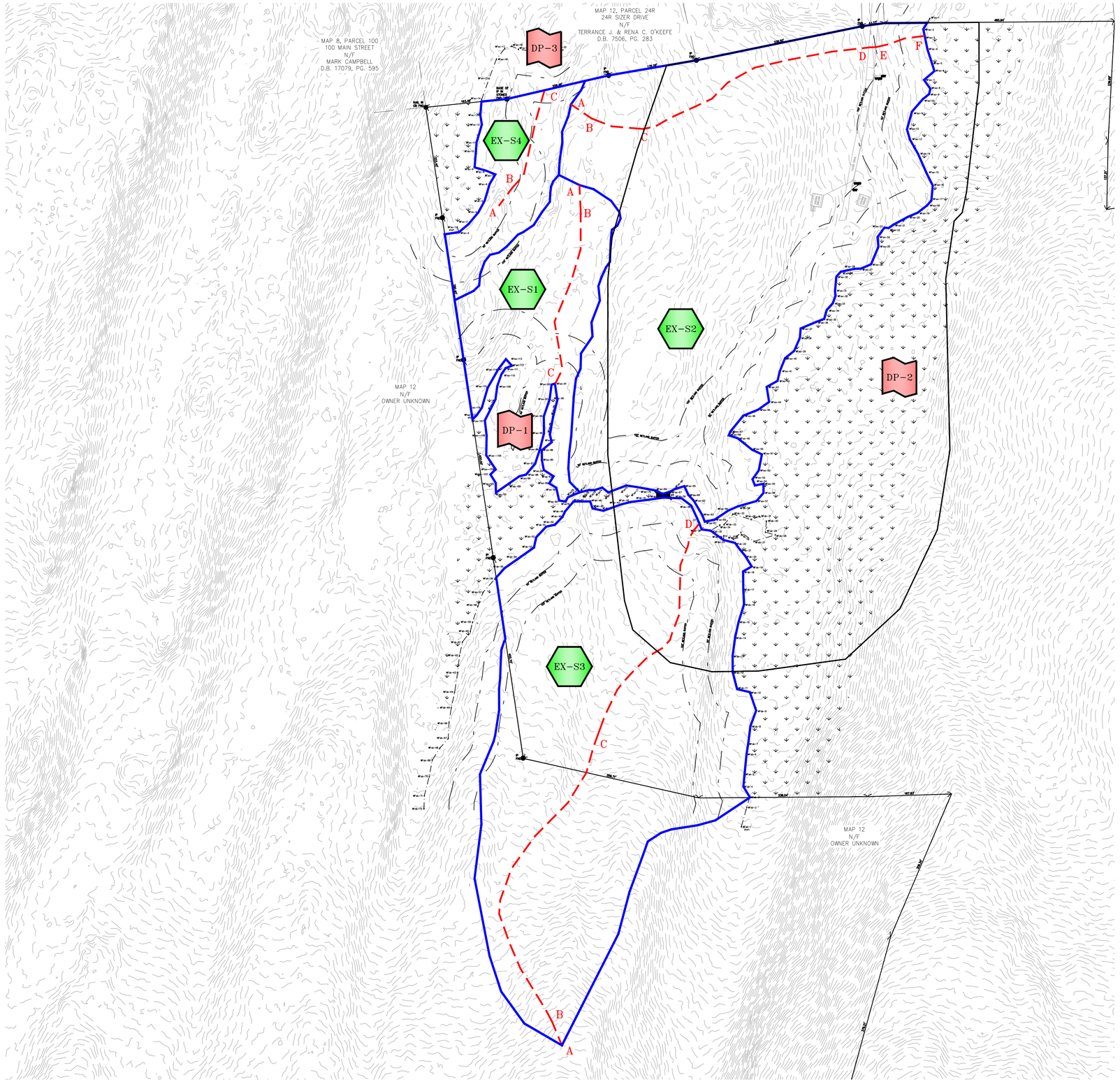
☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges; provided under separate cover

☒ 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.

Appendix D:

Existing and Proposed Development Drainage Figures



SUBCATCHMENT AREA

TIME OF CONCENTRATION

S-1 SUBCATCHMENT

P-1 STORMWATER POND

DP-1 DESIGN POINT

ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION

WOOD MASSACHUSETTS, INC.
271 MILL ROAD
CHELMSFORD MASSACHUSETTS 01824
TELEPHONE: (978) 692-9090
FAX: (978) 692-6633
WEB: WWW.WOODPLC.COM

REVISION	DATE	ISSUE / REVISION DESCRIPTION	ISSUED BY	APPROVED
1	3/12/2021	CONSERVATION COMMISSION COMMENTS	MJW	APV
0	1/13/2021	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	MJW	APV

PROJECT:
GROUND-MOUNT SOLAR PV DEVELOPMENT
40 SIZER DRIVE
WALES, MA

TITLE:
EXISTING WATERSHED MAP

CLIENT:
SUNPIN SOLAR
DEVELOPMENT, LLC

SUNPIN
Securing a brighter future through solar

SEAL:

DESIGNED BY: MJW	DRAWN BY: MJW
CHECKED BY: APV/GAA	SCALE: AS SHOWN
PROJECT NUMBER: 3652200259	
DRAWING NUMBER: W-1	
SHEET NUMBER: 1 OF 2	

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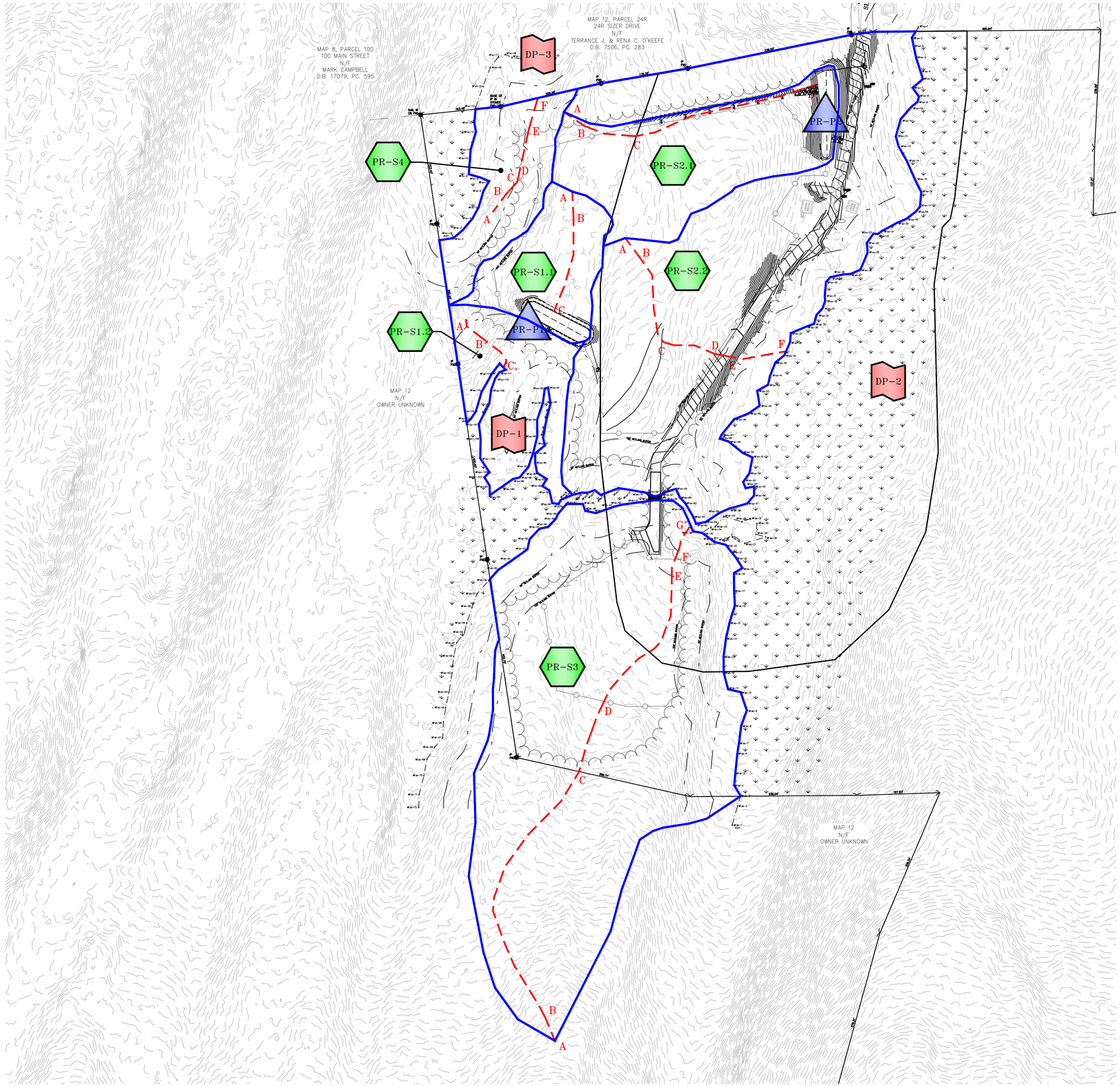

LEGEND

- SUBCATCHMENT AREA
- TIME OF CONCENTRATION
- S-1 SUBCATCHMENT
- P-1 STORMWATER POND
- R-1 STORMWATER REACH
- DP-1 DESIGN POINT

ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION

wood.
WOOD MASSACHUSETTS, INC.
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REVISION	DATE	ISSUE / REVISION DESCRIPTION	ISSUED BY	APPROVED
2	9/21/2021	CC PEER REVIEW	MJW	APV
2	4/28/2021	CONSERVATION COMMISSION COMMENTS	MJW	APV
1	3/12/2021	CONSERVATION COMMISSION COMMENTS	MJW	APV
0	1/13/2021	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	MJW	APV

PROJECT:
GROUND-MOUNT SOLAR PV DEVELOPMENT
40 SIZER DRIVE
WALES, MA

TITLE:
PROPOSED WATERSHED MAP

CLIENT:
SUNPIN SOLAR DEVELOPMENT, LLC
SUNPIN Securing a brighter future through solar

SEAL:

DESIGNED BY: MJW	DRAWN BY: MJW
CHECKED BY: APV/GAA	SCALE: AS SHOWN
PROJECT NUMBER: 365220025	
DRAWING NUMBER: W-2	
SHEET NUMBER: 2 OF 2	

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