Project #47561.00

DRAINAGE ANALYSIS REPORT

F O R

Casset Holdings, LLC

Iron Horse Drive
Fremont, New Hampshire
Rockingham County

Tax Map 151, Lot 2-7

Owned by Pakara Holdings, LLC
Prepared for Casset Holdings, LLC

December 20th, 2023

Prepared By:

TFM Since 1968

Civil Engineers
Structural Engineers
Traffic Engineers
Land Surveyors
Landscape Architects
Scientists

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1.0 - SUMMARY & PROJECT DESCRIPTION

The project includes the development of a commercial building on Iron Horse Drive. The existing Tax Map 151 Lot 2-7 is approximately 6.2 acres and currently contains a vacant lot. The site is within the Main Street Zoning District and Aquifer Protection Overlay District and is adjacent to an empty lot to the southeast and existing research facility, Altaeros, to the North.

The proposed project is to construct 2-story building. Associated improvements include and are not limited to access, grading, utilities, stormwater management system, lighting, and landscaping. The project proposes a 12,737 SF building footprint and total 36,682 SF of impervious area within the property lines and approximately 60,000 SF of disturbance to facilitate the development.

This analysis has been completed to verify the project will not pose adverse stormwater effects on-site and off-site. Compared to the pre-development conditions, the post-development stormwater management system has been designed to reduce peak runoff rates, reduces the runoff volume, reduces the risk of erosion and sedimentation, and improves stormwater runoff quality. In addition, Best Management Practices are employed to formulate a plan that assures stormwater quality both during and after construction. The following summarizes the findings from the study.

2.0 - CALCULATION METHODS

The design storms analyzed in this study are the 2-year, 10-year, 25-year, and 50-year 24-hour storm events. The software program, HydroCAD version 10.00[1] was utilized to calculate the peak runoff rates from these storm events. The program estimates the peak rates using the TR-20 method. A Type III storm pattern was used in the model. Rainfall frequencies for the analyzed region were also incorporated into the model. Rainfall frequencies from the higher of the Extreme Precipitation Rates from Cornell University's Northeast Regional Climate Center (see Appendix A) and Town Site Plan Review Regulations were used to determine the storm-event intensities, see Table 1. Design standards were taken from the New Hampshire Stormwater Manual, December 2008[2].

	24-HOUR RAINFALL RATES	
Storm-Event (year)	Northeast Regional Climate Center Extreme Precipitation (in)	Design Rainfall (in)
2	3.10	0.00
10	4.72	0.00
25	6.01	0.00
50	7.21	0.00

Table 1 – 24-Hour Rainfall Rates

Time of Concentration is the time it takes for water to flow from the hydraulically most remote point in the watershed (with the longest travel time) to the watershed outlet. This time is

[1] HydroCAD version 10.00, HydroCAD Software Solutions LLC, Chocorua, NH, 2013.
[2] New Hampshire Stormwater Manual: Volume One - Stormwater and Antidegradation, December 2008; Volume Two - Post-Construction Best Management Practices Selection and Design, December 2008; Volume Three - Erosion and Sediment Controls During Construction, December 2008.

determined by calculating the time it takes runoff to travel this route under one of three hydrologic conditions: sheet flow, shallow concentrated flow, or channel flow. Because the Intensity-Duration-Frequency (IDF) curve is steep with short TC's, estimating the actual intensity is subject to error and overestimates actual runoff. Due to this, the TC's are adjusted to a minimum of 6 minutes.

3.0 – EXISTING SITE CONDITIONS

The soils within the proposed area of disturbance are identified per the NRCS Web Soil (see Appendix B for detail and soil locations). The soils are composed of Deerfield loamy fine sand (HSG A) and Hinckley loamy sand (HSG A). These soils are classified as moderately well drained and excessively drained, respectively.

Five test pits and infiltration tests, at least one in/near each basin area, were conducted. In nearly all test pit locations, fill material was discovered. Infiltration tests were determined per Ksat testing using a Compact Constant Head Permeameter (Amoozemeter) per Env-Wq 1504.14(d). The highest Estimated Seasonal High-Water Table (ESWT) observed were: elevation 139.5' at Test Pit 2, elevation 138.5' at Test Pit 3, and elevation 141.0' at location of proposed Subsurface Infiltration Basin #1 (Test Pit 4). It is noted that no ESHWT was encountered in Test Pit 4, therefore the termination was used for the elevation. Test Pit 4, near the Subsurface Infiltration Basin had an observed K_{SAT} average of 6.99 in/hr. The design K_{SAT} used was 3.50 in/hr.

4.0 - PRE-DEVELOPMENT CONDITIONS

The pre-development condition is characterized by one subcatchment composing two watershed, which flows towards the tidal perennial stream, which ultimately discharges to the Piscataqua River. The first water shed, ES-01 are from offsite flows that come onto the property through a cross culvert. ES-02 encompasses the east side of the road and the project area. Pre-development subcatchment areas are depicted on the attached plan entitled "Pre-Development Drainage Map," Sheet D-01 in Appendix H.

Stormwater runoff from the site primarily infiltrates into the well-drained soils on-site. The remaining stormwater runoff discharges towards the existing wetland system on the east of the site, Existing Point of Interest 1 (EPOI-1). EPOI-1 includes the runoff from both the onsite and offsite runoff.

In the pre-development condition, there is no impervious cover on the existing lot. There is 10,105 sf of impervious over a total drainage analysis area of 260,466 SF.

5.0 - POST-DEVELOPMENT CONDITIONS

The post-development condition is characterized by one watershed divided into six subcatchment areas. Post-development subcatchment areas are depicted on the attached plan entitled "Post-Development Drainage Map," sheet D-02 in Appendix I.

In the post-development condition, the total impervious area (Pavement and Gravel) is 49,419 SF over a total drainage analysis area of 260,466 SF. Impervious area from the project consists of a 12,737 SF footprint commercial building and associated improvements. Two BMPs are

proposed to treat and mitigate the stormwater runoff from the impact of the new impervious area from the proposed development.

The existing offsite drainage from the culvert and drainage hole as mentioned in Pre-Development Conditions are modelled in subcatchment PS-01 (the subcatchment as ES-01). These are being directed to a new 24" pipe to the existing detention basin on the site to the North (to be discussed the Planning Board). Therefore, the flow from this pipe is analyzed in Point of Interest 2 (PPOI-2), but not included in Table 2 Surface Water Peak Ruoff Comparison.

The surface runoff from the easterly side of the road is analyzed in 5 subcatchments (PS-02 through PS-06). The runoff from these subcatchments continues on to the existing wetland east of the site and analyzed in the Point of Interest 1 (PPOI-1).

5 test pits and infiltration tests, at least one near each basin area, were conducted. Infiltration tests were determined per default published Ksat values for the design infiltration rates per Env-Wq 1504.14(c) and/or Ksat testing using a Compact Constant Head Permeameter (Amoozemeter) per Env-Wq 1504.14(d). Refer to the Infiltration Test Data in Appendix C.

Table 2 summarizes the pre- and post-development peak runoff rates entering the existing wetland for the 2-year, 25-year, 10-year, and 50-year 24-hour Type III storm events for all discharge. Table 3 summarizes the pre- and post-development peak runoff volumes for the 2-year 24-hour Type III storm events for all discharge.

TABLE 2 – SURFACE WATER PEAK RUNOFF RATE COMPARISON (CF)					
POINT OF INTEREST		DESIGN STORM			
		2-year	10-year	25-year	50-year
POI-1	Pre	1.7	6.4	11.3	16.3
	Post	0.8	3.6	6.3	9.5

Table 2 - Pre and Post- Development Peak Runoff Rate Comparison

TABLE 3 – SURFACE WATER PEAK RUNOFF VOLUME COMPARISON (CF)		
POINT OF INTEREST		DESIGN STORM
		2-year
POI-1	Pre	9,859
	Post	5,525

Table 3 - Pre and Post- Development Peak Runoff Volume Comparison

The proposed project reduces peak rates of runoff compared to existing conditions for all storm events, in accordance with Town stormwater regulations. Additionally, per NHDES, the 2-year 24-hour storm does not result in an increased peak flow rate and reduces or increases volume within the limits of Env-Wq 1507.05(b)(1) from the pre-development to post-development condition. There will be no adverse effects on the abutting properties from the proposed stormwater management system.

Appendices D and F summarize all 24-hour storm events for pre- and post-development drainage calculations using HydroCAD analysis. Appendices E and G provide a full summary of the 10-year, 24-hour storm for the pre- and post-development drainage calculations using HydroCAD analysis.

6.0 – REGULATORY COMPLIANCE

The project meets the stricter of the stormwater standards identified in the New Hampshire Department of Environmental Services (DES) Env-Wq 1500 Alteration of Terrain Regulations and Town stormwater management regulations.

7.0 – BEST MANAGEMENT PRACTICES

Best Management Practices will be developed in accordance with the New Hampshire Stormwater Manual, Volumes Two and Three, December 2008[3] to formulate a plan that assures stormwater quality both during and after construction. The intent of the outlined measures is to minimize erosion and sedimentation during construction, stabilize and protect the site from erosion after construction is complete and mitigate any adverse impacts to stormwater quality resulting from development. Best Management Practices for this project include:

- Temporary practices to be implemented during construction.

- Permanent practices to be implemented after construction.

7.1 – TEMPORARY PRACTICES

1. Erosion, sediment, and stormwater detention measures must be installed as directed by the engineer.
2. All disturbed areas, as well as loam stockpiles, shall be seeded and contained by a silt barrier.
3. Silt barriers must be installed prior to any construction commencing. All erosion control devices including silt barriers and storm drain inlet filters shall be inspected at least once per week and following any rainfall. All necessary maintenance shall be completed within twenty-four (24) hours.
4. Any silt barriers found to be failing must be replaced immediately. Sediment is to be removed from behind the silt fence if found to be one-third the height of the silt barrier or greater.
5. Any area of the site, which has been disturbed and where construction activity will not occur for more than twenty-one (21) days, shall be temporarily stabilized by mulching and seeding.
6. No construction materials shall be buried on-site.

[3] New Hampshire Stormwater Manual: Volume One - Stormwater and Antidegradation, December 2008; Volume Two - Post-Construction Best Management Practices Selection and Design, December 2008; Volume Three - Erosion and Sediment Controls During Construction, December 2008.

7. After all areas have been stabilized, temporary practices are to be removed, and the area they are removed from must be smoothed and revegetated.
8. Areas must be temporarily stabilized within 14 days of disturbance or seeded and mulched within 3 days of final stabilization.
9. After November 15th, incomplete driveways or parking areas must be protected with a minimum of 3" of crushed gravel, meeting the standards of NHDOT item 304.3.
10. An area shall be considered stable if one of the following has occurred:
    a) Base course gravels are installed in areas to be paved.
    b) A minimum of 85% vegetated growth has been established.
    c) A minimum of 3" of non-erosive material such as stone or rip rap has been installed.
    d) Erosion control blankets have been properly installed.

7.2 – PERMANENT PRACTICES

The objectives for developing permanent Best Management Practices for this site include the following:

1. Maintain existing runoff flow characteristics.
    a) Drainage is structured to minimize any offsite increase in runoff
2. Treatment BMP's are established to ensure the water quality.
3. Maintenance schedules are set to safeguard the long term working of the stormwater BMP's.

7.3 – BEST MANAGEMENT PRACTICE EFFICIENCIES

Appendix E of Volume 2 of the New Hampshire Stormwater [4] lists the pollutant removal efficiencies of various BMP's. All proposed BMP's meet all state and Town requirements for total suspended solids (TSS) and pollutant removal, Total Nitrogen (TN), and Total Phosphorous (TP).

In-Ground and Subsurface Infiltration Basins (greater than 75 FT from surface water) have a 90% TSS removal efficiency, 60% TN removal efficiency, and 65% TP efficiency.

Vegetative buffers have a 73% TSS removal efficiency, 40% TN removal efficiency, and 45% TP efficiency.

[4] New Hampshire Stormwater Manual: Volume One - Stormwater and Antidegradation, December 2008; Volume Two - Post-Construction Best Management Practices Selection and Design, December 2008; Volume Three - Erosion and Sediment Controls During Construction, December 2008.

9.0 – CONCLUSION

The proposed stormwater management system will treat, infiltrate, and mitigate the runoff generated from the proposed development and provide protection of groundwater and surface waters as required through the stormwater management regulations. The project has been designed in accordance with NHDES and Town regulations. There is little change in the flow characteristics of the site. The proposed project has been designed to pose no adverse effects on surrounding properties.

Respectfully,
TFMoran, Inc. Seacoast Division

John McTigue, PE, CPESC
Civil Project Manager

APPENDIX A – EXTREME PRECIPITATION RATES

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Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Metadata for Point	
Smoothing	Yes
State	New Hampshire
Location	New Hampshire, United States
Latitude	42.978 degrees North
Longitude	71.112 degrees West
Elevation	50 feet
Date/Time	Tue Oct 24 2023 09:27:25 GMT-0400 (Eastern Daylight Time)

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.40	0.50	0.66	0.82	1.04	**1yr**	0.71	0.99	1.21	1.55	2.00	2.60	2.78	**1yr**	2.30	2.68	3.09	3.78	4.39	**1yr**
2yr	0.32	0.50	0.62	0.81	1.02	1.30	**2yr**	0.88	1.18	1.51	1.91	2.43	3.10	3.44	**2yr**	2.75	3.31	3.82	4.53	5.17	**2yr**
5yr	0.38	0.59	0.74	0.99	1.26	1.62	**5yr**	1.09	1.47	1.89	2.42	3.08	3.94	4.42	**5yr**	3.49	4.25	4.87	5.79	6.54	**5yr**
10yr	0.42	0.66	0.84	1.14	1.48	1.92	**10yr**	1.28	1.74	2.25	2.89	3.70	4.72	5.35	**10yr**	4.18	5.14	5.85	6.97	7.82	**10yr**
25yr	0.49	0.78	1.00	1.38	1.83	2.39	**25yr**	1.58	2.17	2.83	3.65	4.69	6.01	6.88	**25yr**	5.32	6.61	7.46	8.92	9.91	**25yr**
50yr	0.56	0.89	1.14	1.60	2.15	2.84	**50yr**	1.86	2.56	3.37	4.37	5.63	7.21	8.33	**50yr**	6.38	8.01	8.97	10.76	11.86	**50yr**
100yr	0.63	1.01	1.31	1.85	2.53	3.38	**100yr**	2.18	3.03	4.03	5.24	6.75	8.65	10.08	**100yr**	7.66	9.70	10.78	12.99	14.21	**100yr**
200yr	0.71	1.17	1.51	2.16	2.98	4.01	**200yr**	2.57	3.59	4.79	6.25	8.09	10.38	12.21	**200yr**	9.19	11.74	12.96	15.68	17.03	**200yr**
500yr	0.85	1.39	1.82	2.64	3.70	5.03	**500yr**	3.19	4.50	6.04	7.93	10.28	13.23	15.74	**500yr**	11.71	15.14	16.55	20.15	21.66	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.36	0.44	0.59	0.73	0.88	**1yr**	0.63	0.86	1.00	1.29	1.56	2.13	2.55	**1yr**	1.89	2.45	2.85	3.48	3.92	**1yr**
2yr	0.31	0.49	0.60	0.81	1.00	1.18	**2yr**	0.86	1.16	1.35	1.79	2.29	3.00	3.29	**2yr**	2.65	3.17	3.68	4.33	4.95	**2yr**
5yr	0.36	0.55	0.68	0.94	1.19	1.41	**5yr**	1.03	1.38	1.60	2.09	2.69	3.58	3.94	**5yr**	3.16	3.79	4.35	5.42	5.90	**5yr**
10yr	0.39	0.61	0.75	1.05	1.36	1.61	**10yr**	1.17	1.58	1.81	2.36	3.02	4.06	4.47	**10yr**	3.59	4.30	4.94	6.34	6.65	**10yr**
25yr	0.46	0.69	0.86	1.23	1.62	1.92	**25yr**	1.40	1.88	2.12	2.74	3.52	4.76	5.29	**25yr**	4.21	5.09	5.87	7.79	8.60	**25yr**
50yr	0.50	0.77	0.96	1.37	1.85	2.20	**50yr**	1.60	2.15	2.38	3.08	3.95	5.36	5.98	**50yr**	4.75	5.75	6.66	9.12	9.95	**50yr**
100yr	0.57	0.86	1.07	1.55	2.13	2.52	**100yr**	1.84	2.46	2.68	3.45	4.43	5.88	6.74	**100yr**	5.20	6.48	7.60	10.69	11.49	**100yr**
200yr	0.63	0.95	1.21	1.75	2.44	2.87	**200yr**	2.11	2.81	3.01	3.86	4.97	6.54	9.28	**200yr**	5.79	8.93	8.67	12.54	13.28	**200yr**
500yr	0.74	1.11	1.42	2.07	2.94	3.44	**500yr**	2.54	3.37	3.52	4.49	5.80	7.50	11.37	**500yr**	6.64	10.93	10.33	15.52	16.08	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.29	0.44	0.54	0.73	0.90	1.08	**1yr**	0.78	1.05	1.25	1.67	2.12	2.86	3.21	**1yr**	2.53	3.08	3.49	4.05	4.86	**1yr**
2yr	0.33	0.51	0.63	0.86	1.05	1.26	**2yr**	0.91	1.23	1.46	1.91	2.44	3.29	3.65	**2yr**	2.91	3.51	4.03	4.76	5.50	**2yr**
5yr	0.41	0.63	0.78	1.07	1.36	1.61	**5yr**	1.17	1.57	1.86	2.43	3.10	4.32	4.98	**5yr**	3.82	4.79	5.44	6.18	7.24	**5yr**
10yr	0.48	0.74	0.92	1.29	1.66	1.97	**10yr**	1.44	1.92	2.25	2.94	3.72	5.39	6.34	**10yr**	4.77	6.09	6.85	7.65	9.07	**10yr**
25yr	0.61	0.92	1.15	1.64	2.16	2.55	**25yr**	1.86	2.50	2.91	3.79	4.74	7.21	8.77	**25yr**	6.38	8.43	9.28	10.17	11.21	**25yr**
50yr	0.72	1.09	1.36	1.95	2.63	3.11	**50yr**	2.27	3.04	3.54	4.58	5.70	9.00	11.24	**50yr**	7.96	10.81	11.69	12.61	13.78	**50yr**
100yr	0.86	1.29	1.62	2.34	3.21	3.79	**100yr**	2.77	3.71	4.32	5.56	6.88	11.45	14.38	**100yr**	10.14	13.83	14.71	15.65	16.97	**100yr**
200yr	1.02	1.53	1.94	2.80	3.91	4.63	**200yr**	3.38	4.53	5.26	6.75	8.28	14.39	15.59	**200yr**	12.73	15.00	18.51	19.42	20.91	**200yr**
500yr	1.28	1.91	2.46	3.57	5.08	6.03	**500yr**	4.38	5.89	6.84	8.74	10.61	19.47	21.00	**500yr**	17.23	20.19	25.08	25.86	27.62	**500yr**

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APPENDIX B – NRCS WEB SOIL REPORT

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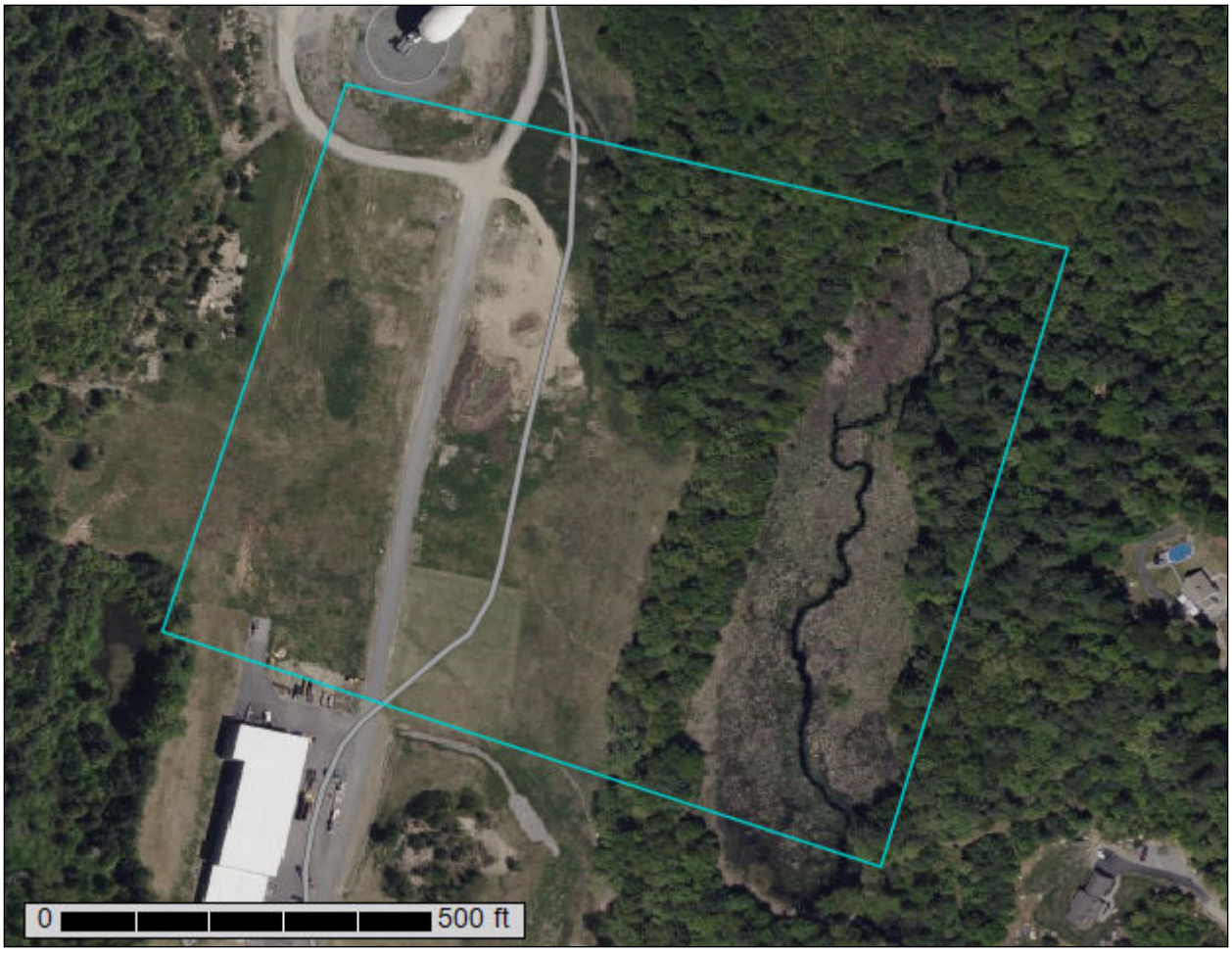
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Rockingham County, New Hampshire



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

71° 6' 57" W
42° 58' 47" N
42° 58' 34" N
71° 6' 26" W
327490
327550
327610
327670
327730
327790
327850
327910
327970
328030
328090
328150
4760720
4760660
4760600
4760540
4760480
4760420
4760360

Map Scale: 1:1,880 if printed on B landscape (17" x 11") sheet.

N

0 25 50 100 150 Meters

0 50 100 200 300 Feet

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Rockingham County, New Hampshire
Survey Area Data: Version 26, Aug 22, 2023

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
12B	Hinckley loamy sand, 3 to 8 percent slopes	6.0	31.3%
12C	Hinckley loamy sand, 8 to 15 percent slopes	0.8	4.3%
295	Freetown mucky peat, 0 to 2 percent slopes	4.9	25.6%
313B	Deerfield loamy fine sand, 3 to 8 percent slopes	6.7	35.0%
314A	Pipestone sand, 0 to 5 percent slopes	0.7	3.8%
Totals for Area of Interest		**19.2**	**100.0%**

Map Unit Descriptions

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, 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 and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils 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. Other minor components, however, have properties and behavioral 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*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one 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.

Rockingham County, New Hampshire

12B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Hinckley

Setting

Landform: Outwash plains, eskers, moraines, kame terraces, kames, outwash terraces, outwash deltas
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Side slope, base slope, crest, nose slope, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A

Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor
Percent of map unit: 8 percent
Landform: Kame terraces, outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Side slope, base slope, crest, nose slope, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury
Percent of map unit: 5 percent
Landform: Kame terraces, outwash plains, moraines, outwash terraces, outwash deltas
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope, head slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Agawam
Percent of map unit: 2 percent
Landform: Kame terraces, outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Side slope, base slope, crest, nose slope, riser, tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

12C—Hinckley loamy sand, 8 to 15 percent slopes

Map Unit Setting
National map unit symbol: 2svm9
Elevation: 0 to 1,480 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Hinckley and similar soils: 85 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Kame terraces, outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Landform: Eskers, moraines, outwash terraces, outwash plains, kames
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, head slope, nose slope, crest, riser
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent

Landform: Outwash terraces, kame terraces, outwash plains, moraines, outwash deltas
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: No

Windsor

Percent of map unit: 5 percent
Landform: Kame terraces, outwash plains, outwash terraces, outwash deltas, kames, eskers, moraines
Landform position (two-dimensional): Shoulder, backslope, footslope, toeslope
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, riser
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

295—Freetown mucky peat, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2w68v
Elevation: 0 to 860 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

Freetown and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Swamps, bogs, marshes, kettles, depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Moderately decomposed organic material

Typical profile

Oe1 - 0 to 2 inches: mucky peat
Oe2 - 2 to 79 inches: mucky peat

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained

Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 20.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 8 percent
Landform: Kettles, swamps, bogs, depressions, marshes
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Natchaug

Percent of map unit: 6 percent
Landform: Depressions, depressions, depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 3 percent
Landform: Drainageways, depressions, outwash deltas, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 1 percent
Landform: Hills, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

313B—Deerfield loamy fine sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2xfg9
Elevation: 0 to 1,190 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

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

Description of Deerfield

Setting

Landform: Kame terraces, outwash plains, outwash terraces, outwash deltas
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Parent material: Sandy outwash derived from granite, gneiss, and/or quartzite

Typical profile

Ap - 0 to 9 inches: loamy fine sand
Bw - 9 to 25 inches: loamy fine sand
BC - 25 to 33 inches: fine sand
Cg - 33 to 60 inches: sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: About 15 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 11.0
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 7 percent
Landform: Outwash deltas, kame terraces, outwash plains, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Wareham

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sudbury

Percent of map unit: 2 percent
Landform: Outwash plains, outwash terraces, outwash deltas, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, convex, linear
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Ninigret

Percent of map unit: 1 percent
Landform: Kame terraces, outwash terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, concave
Hydric soil rating: No

314A—Pipestone sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 9cn2
Elevation: 0 to 2,100 feet
Mean annual precipitation: 28 to 55 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 100 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Pipestone and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pipestone

Setting

Landform: Outwash terraces

Typical profile

H1 - 0 to 6 inches: sand
H2 - 6 to 33 inches: sand
H3 - 33 to 60 inches: sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: Yes

Minor Components

Chocorua

Percent of map unit: 5 percent
Landform: Bogs
Hydric soil rating: Yes

Not named wet

Percent of map unit: 5 percent
Landform: Outwash terraces
Hydric soil rating: Yes

Squamscott

Percent of map unit: 5 percent
Landform: Marine terraces
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Deerfield

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

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (47561-00 Soils)

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.

Map—Hydrologic Soil Group (47561-00 Soils)

Map Scale: 1:1,880 if printed on B landscape (17" x 11") sheet.

N

0 25 50 100 150 Meters

0 50 100 200 300 Feet

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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Soil Survey Area: Rockingham County, New Hampshire
Survey Area Data: Version 26, Aug 22, 2023

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

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

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

Table—Hydrologic Soil Group (47561-00 Soils)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
12B	Hinckley loamy sand, 3 to 8 percent slopes	A	6.0	31.3%
12C	Hinckley loamy sand, 8 to 15 percent slopes	A	0.8	4.3%
295	Freetown mucky peat, 0 to 2 percent slopes	B/D	4.9	25.6%
313B	Deerfield loamy fine sand, 3 to 8 percent slopes	A	6.7	35.0%
314A	Pipestone sand, 0 to 5 percent slopes	A/D	0.7	3.8%
Totals for Area of Interest			**19.2**	**100.0%**

Rating Options—Hydrologic Soil Group (47561-00 Soils)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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APPENDIX C – TEST PIT LOGS & INFILTRATION TEST DATA

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TEST PIT INSPECTION REPORT

Dates of Observation:	10-26-23
Weather:	Sunny, 47°F
Town:	Fremont, NH
Location:	Iron Horse Drive
Engineer:	B. Levesque, PE
TFM Project Number	

OBSERVATIONS:

The undersigned traveled to the site to observe and document the excavation of 3 test pits at locations previously marked to ascertain soil conditions and permeability for proposed stormwater systems for the development at Iron Horse Drive in Fremont, NH. The first test pit, approximately 3' x 7' x 4.5' (Width x Length x Depth), was excavated at the location shown on the test pit plan as TP-1. No evidence of a Seasonal High-Water Table was observed in the soil profile, but it would appear based on surrounding topography that the water table would likely exist around 10 ft below the existing ground elevation at the test pit.

The following strata were noted:

SECTION DEPTH (in)	SOIL DESCRIPTION
0 to 6 inches	A5YR 2.5/4/6 - dry, loose, f-m SAND, little to some Silt, some f-c Gravel, few cobbles, trace Organics (TOPSOIL/FILL)
6 to 54 inches	A5YR 2.5/4/6 - dry, med. dense, f-m SAND, little to some Silt, some f-c Gravel, few cobbles (FILL)
	B.O.E. @ 4.5 ft below existing grade

The following photograph illustrate soil conditions found in this test pit:

Photo 1: View of TP-1

The second test pit, TP-2, approximately 3’ x 7’ x 6.5’ (Width x Length x Depth), was excavated at the location shown on the test pit plan. Groundwater was encountered at the bottom of the excavation, approximately 6 ft below the bottom of the excavation as measured from the existing ground surface. The following strata were noted:

SECTION DEPTH (in)	SOIL DESCRIPTION
0 to 8 inches	A7.5YR 6/1 - dry, med. dense, f-m SAND, little to some Silt, some f-c Gravel, few cobbles, trace Organics (TOPSOIL/FILL)
8 to 40 inches	A7.5YR 6/3 – dry to damp, med. dense to dense, f-m SAND, little to some Silt, some f-c Gravel, few cobbles (FILL)
40 to 78 inches	A7.5YR 3/4 – damp to moist, med. dense to dense, f-m SAND, little to some Silt, some f-c Gravel, few cobbles (FILL)
	B.O.E. @ 6.5 ft Water at 6 ft.

Photo 2: View of TP-2

The third test pit, approximately 4’ x 8’ x 5’ (Width x Length x Depth), was excavated at the location shown on the test pit plan as TP-3. Seasonal High-Water Table noted at 4.5 ft as measured from existing ground surface. The following strata were noted:

SECTION DEPTH (in)	SOIL DESCRIPTION
0 to 4 inches	A7.5YR 5/2 - dry, loose, f-m SAND, little to some Silt, some f-c Gravel, few cobbles, trace Organics (TOPSOIL/FILL)
4 to 40 inches	A7.5YR 6/3 – dry to moist, med. dense, f-m SAND, little to some Silt, some f-c Gravel, few cobbles (FILL)
40 to 60 inches	A7.5YR 5/1 moist, med. Dense, f-m SAND, little Silt, little f Gravel B.O.E. @ 5 ft (FILL/OUTWASH DEPOSITS)

The following photograph illustrate soil conditions found in this test pit:

Photo 3: View of TP-3

Another test pit, indicated as TP-3A was excavated 25 ft east of the location of TP-3, parallel to the proposed building. This test pit, approximately 4' x 8' x 8' (Width x Length x Depth) and was noted to be about 3 ft higher in elevation than TP-3. Seasonal High-Water Table noted at 7 ft as measured from existing ground surface. The following strata were noted:

SECTION DEPTH (in)	SOIL DESCRIPTION
0 to 4 inches	A7.5YR 5/2 - dry, loose, f-m SAND, little to some Silt, some f-c Gravel, few cobbles, trace Organics (TOPSOIL/FILL)
4 to 40 inches	A7.5YR 6/3 – dry to moist, med. dense, f-m SAND, little to some Silt, some f-c Gravel, few cobbles (FILL)
40 to 96 inches	A7.5YR 5/1 moist, med. dense, f-m SAND, little Silt, little f Gravel B.O.E. @ 8 ft Water at 7 ft (FILL/OUTWASH DEPOSITS)

The following photograph illustrate soil conditions found in this test pit:

Photo 4: View of TP-3A

The fifth test pit, approximately 4' x 8' x 5' (Width x Length x Depth), was excavated at the location shown on the test pit plan as TP-4. No water was encountered in the excavation. The following strata were noted:

SECTION DEPTH (in)	SOIL DESCRIPTION
0 to 12 inches	A7.5YR 4/1 - dry, loose, f-m SAND, little to some Silt, some f-c Gravel, few cobbles, trace Organics (TOPSOIL/FILL)
4 to 40 inches	A7.5YR 5/3 – dry to damp, med. dense, f-m SAND, little to some Silt, some f-c Gravel, few cobbles (FILL)
40 to 60 inches	A7.5YR 4/3 damp, med. dense, f-m SAND, little Silt, little f Gravel B.O.E. @ 5 ft (FILL/OUTWASH DEPOSITS)

The following photograph illustrate soil conditions found in this test pit:

Photo 5: View of TP-4

ANALYSIS: It is understood that the site had formerly been quarried for construction aggregates. The varying fill materials that were encountered in the test pits are likely whatever leftovers used to level the site for future use. As these materials will be expected to vary from very silty to very gravelly, it is expected that the saturated permeabilities or k_{sat} will also be highly variable. Infiltration testing at site indicated saturated permeabilities ranging from 13.43 in/hr to 0.39 in/hr, with the mean values being around 4 to 7 in/hr. Groundwater was encountered at depths of 6 ft at TP-2, 4.5 ft at TP-3 and 7 ft at TP-3Aas measured from the existing ground elevation at the sides of the test pits.

CONCLUSIONS: The site soils should not present a problem with stormwater infiltration, however given their variability, consideration should be made to utilize a soil layer or infiltration soil mix having an in-place permeability that may be required for the local and state design requirements.

Bryan Levesque, PE, CPESC
Geotechnical Engineer

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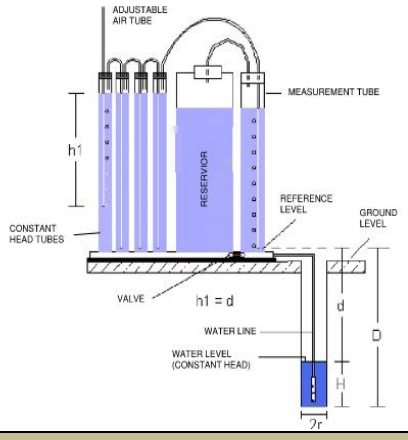
PROJECT NAME:	Casset Holdings, LLC	ENGINEER:	BCH
PROJECT NUMBER:	47561-00	DATE OF TESTING:	10/26/2023
PROJECT LOCATION:	Fremont, NH		

Amoozemeter Field Data Sheet

Test Pit 1

Ksat (Average) = 8.601

SETUP CALCULATIONS			Test 1	Test 2	Test 3
D- REF LINE OF A-METER TO HOLE BOTTOM (cm)			50.8	50.8	50.8
H - DEPTH OF H20 IN HOLE (cm)			15.2	15.2	15.2
d - TOP OF WATER TO OUTFLOW LENGTH (cm)			35.6	35.6	35.6
AUGER DIAMETER (cm)			12.7	12.7	12.7
AREA OF AUGER HOLE (cm^2)			126.7	126.7	126.7
DEPTH TO IMPERVIOUS LAYER/SHWT, "s" (cm)			182.88	182.88	182.88
GLOVER SOLUTION A OR B			A	A	A
SOIL DESCRIPTION AT TEST 1 DEPTH:					
SOIL HORIZON AT TEST 1 DEPTH:					
SOIL DESCRIPTION AT TEST 2 DEPTH:					
SOIL HORIZON AT TEST 2 DEPTH:					
SOIL DESCRIPTION AT TEST 3 DEPTH:					
SOIL HORIZON AT TEST 3 DEPTH:					
ONE OR BOTH CHAMBERS USED:			1	1	1



TEST #1

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
6.6	20	A	0.000689	20.0	6.6	0.0045468	6.44430803	
6.5	20	A	0.000689	20.0	6.5	0.0044779	6.346667	
4.9	20	A	0.000689	20.0	4.9	0.0033757	4.78441051	
4.5	20	A	0.000689	20.0	4.5	0.0031001	4.39384638	
4.9	20	A	0.000689	20.0	4.9	0.0033757	4.78441051	
4.5	20	A	0.000689	20.0	4.5	0.0031001	4.39384638	

Average Ksat (3 consecutive readings w/same outflow per time): 5.191248

TEST #2

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
9.2	20	A	0.000689	20.0	9.2	0.006338	8.98297483	
8.8	10	A	0.000689	20.0	17.6	0.0121248	17.1848214	
7.2	10	A	0.000689	20.0	14.4	0.0099203	14.0603084	

Average Ksat (3 consecutive readings w/same outflow per time): 13.40937

TEST #3

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
7	20	A	0.000689	20.0	7	0.0048224	6.83487215	
7.9	20	A	0.000689	20.0	7.9	0.0054424	7.71364143	
7.4	20	A	0.000689	20.0	7.4	0.0050979	7.22543627	
7.2	20	A	0.000689	20.0	7.2	0.0049602	7.03015421	

Average Ksat (3 consecutive readings w/same outflow per time): 7.201026

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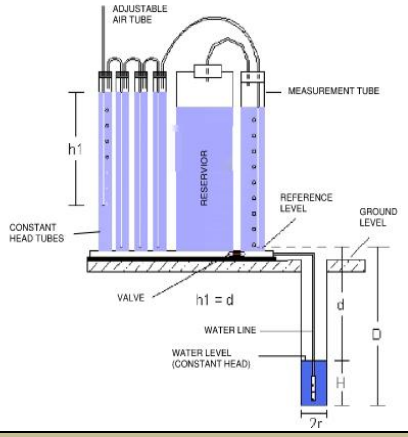
PROJECT LOCATION:	Fremont, NH		

Amoozemeter Field Data Sheet

Test Pit 2

Ksat (Average) = 11.491

SETUP CALCULATIONS			Test 1	Test 2	Test 3
D- REF LINE OF A-METER TO HOLE BOTTOM (cm)			71.1	71.1	71.1
H - DEPTH OF H20 IN HOLE (cm)			15.2	15.2	15.2
d - TOP OF WATER TO OUTFLOW LENGTH (cm)			55.9	55.9	55.9
AUGER DIAMETER (cm)			12.7	12.7	12.7
AREA OF AUGER HOLE (cm^2)			126.7	126.7	126.7
DEPTH TO IMPERVIOUS LAYER/SHWT, "s" (cm)					
GLOVER SOLUTION A OR B			B	B	B
SOIL DESCRIPTION AT TEST 1 DEPTH:					
SOIL HORIZON AT TEST 1 DEPTH:					
SOIL DESCRIPTION AT TEST 2 DEPTH:					
SOIL HORIZON AT TEST 2 DEPTH:					
SOIL DESCRIPTION AT TEST 3 DEPTH:					
SOIL HORIZON AT TEST 3 DEPTH:					
ONE OR BOTH CHAMBERS USED:			1	1	1



TEST #1

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
9.7	20	B	0.001250	20.0	9.7	0.0121279	17.1891982	
6.8	20	B	0.001250	20.0	6.8	0.0085021	12.0501596	
7.2	20	B	0.001250	20.0	7.2	0.0090022	12.7589925	
7.3	20	B	0.001250	20.0	7.3	0.0091272	12.9362007	
6.1	20	B	0.001250	20.0	6.1	0.0076268	10.809702	

Average Ksat (3 consecutive readings w/same outflow per time): 13.14885

TEST #2

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
11.5	30	B	0.001250	20.0	7.66667	0.0095857	13.5859642	
9.1	60	B	0.001250	20.0	3.03333	0.0037926	5.37531629	
6.9	90	B	0.001250	20.0	2.3	0.0028757	4.07578927	

Average Ksat (3 consecutive readings w/same outflow per time): 7.679023

TEST #3

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
7.8	20	B	0.001250	20.0	7.8	0.0097524	13.8222419	
7.6	20	B	0.001250	20.0	7.6	0.0095023	13.4678254	

Average Ksat (3 consecutive readings w/same outflow per time): 13.64503

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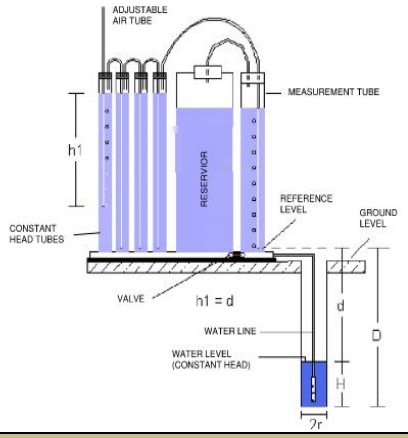
Amoozemeter Field Data Sheet

Test Pit 3A

Ksat (Average) = 2.207

SETUP CALCULATIONS			Test 1	Test 2	Test 3
D- REF LINE OF A-METER TO HOLE BOTTOM (cm)			53.3	24.1	
H - DEPTH OF H20 IN HOLE (cm)			15.2	14.0	
d - TOP OF WATER TO OUTFLOW LENGTH (cm)			38.1	10.2	0.0
AUGER DIAMETER (cm)			12.7	12.7	
AREA OF AUGER HOLE (cm^2)			126.7	126.7	0.0
DEPTH TO IMPERVIOUS LAYER/SHWT, "s" (cm)			228.6	228.6	
GLOVER SOLUTION A OR B			A	A	A
SOIL DESCRIPTION AT TEST 1 DEPTH:					
SOIL HORIZON AT TEST 1 DEPTH:					
SOIL DESCRIPTION AT TEST 2 DEPTH:					
SOIL HORIZON AT TEST 2 DEPTH:					
SOIL DESCRIPTION AT TEST 3 DEPTH:					
SOIL HORIZON AT TEST 3 DEPTH:					
ONE OR BOTH CHAMBERS USED:			1	1	1



TEST #1

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
3.8	20	A	0.000689	20.0	3.8	0.0026179	3.71035917	
4.8	20	A	0.000689	20.0	4.8	0.0033068	4.68676948	
4.4	20	A	0.000689	20.0	4.4	0.0030312	4.29620535	
4.3	20	A	0.000689	20.0	4.3	0.0029623	4.19856432	
3.8	20	A	0.000689	20.0	3.8	0.0026179	3.71035917	
3.9	20	A	0.000689	20.0	3.9	0.0026868	3.8080002	
3.8	20	A	0.000689	20.0	3.8	0.0026179	3.71035917	

Average Ksat (3 consecutive readings w/same outflow per time): 4.017231

TEST #2

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
0.4	20	A	0.000755	20.0	0.4	0.0003018	0.4277702	
0.5	20	A	0.000755	20.0	0.5	0.0003773	0.53471275	
0.3	20	A	0.000755	20.0	0.3	0.0002264	0.32082765	
0.3	20	A	0.000755	20.0	0.3	0.0002264	0.32082765	
0.3	20	A	0.000755	20.0	0.3	0.0002264	0.32082765	
0.5	20	A	0.000755	20.0	0.5	0.0003773	0.53471275	
0.3	20	A	0.000755	20.0	0.3	0.0002264	0.32082765	

Average Ksat (3 consecutive readings w/same outflow per time): 0.397215

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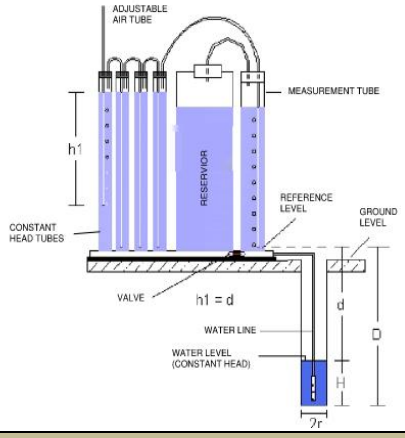
PROJECT LOCATION:	Fremont, NH		

Amoozemeter Field Data Sheet

Test Pit 4

Ksat (Average) = 6.992

SETUP CALCULATIONS			Test 1	Test 2	Test 3
D- REF LINE OF A-METER TO HOLE BOTTOM (cm)			45.7	80.0	47.0
H - DEPTH OF H20 IN HOLE (cm)			12.7	14.0	16.5
d - TOP OF WATER TO OUTFLOW LENGTH (cm)			33.0	66.0	30.5
AUGER DIAMETER (cm)			5.1	5.1	5.1
AREA OF AUGER HOLE (cm^2)			20.3	20.3	20.3
DEPTH TO IMPERVIOUS LAYER/SHWT, "s" (cm)			213.4	213.4	213.4
GLOVER SOLUTION A OR B			A	A	A
SOIL DESCRIPTION AT TEST 1 DEPTH:					
SOIL HORIZON AT TEST 1 DEPTH:					
SOIL DESCRIPTION AT TEST 2 DEPTH:					
SOIL HORIZON AT TEST 2 DEPTH:					
SOIL DESCRIPTION AT TEST 3 DEPTH:					
SOIL HORIZON AT TEST 3 DEPTH:					
ONE OR BOTH CHAMBERS USED:			1	1	1



TEST #1

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
1.7	20	A	0.001507	20.0	1.7	0.0025626	3.63208766	
2.3	20	A	0.001507	20.0	2.3	0.0034671	4.91400096	
1.9	20	A	0.001507	20.0	1.9	0.0028641	4.0593921	
1.8	20	A	0.001507	20.0	1.8	0.0027134	3.84573988	
1.9	20	A	0.001507	20.0	1.9	0.0028641	4.0593921	
2.1	20	A	0.001507	20.0	2.1	0.0031656	4.48669653	
2.3	20	A	0.001507	20.0	2.3	0.0034671	4.91400096	

Average Ksat (3 consecutive readings w/same outflow per time): 4.273044

TEST #2

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
9.9	20	A	0.001348	20.0	9.9	0.0133425	18.910681	
6.8	20	A	0.001348	20.0	6.8	0.0091646	12.9891546	
6.4	20	A	0.001348	20.0	6.4	0.0086255	12.2250867	
6.5	20	A	0.001348	20.0	6.5	0.0087603	12.4161037	
6.5	20	A	0.001348	20.0	6.5	0.0087603	12.4161037	
6.1	20	A	0.001348	20.0	6.1	0.0082212	11.6520358	

Average Ksat (3 consecutive readings w/same outflow per time): 13.43486

TEST #3

READING (Δ)	TIME INTERVAL (sec)	COEFFICIENT A or B	COEFFICIENT A or B 1/cm	CONVERSION FACTOR cm^3	OUTFLOW cm^3/s	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) cm/sec	SATURATED HYDRAULIC CONDUCTIVITY (Ksat) in/hr	COMMENTS
1.7	20	A	0.001213	20.0	1.7	0.0020628	2.92365211	
2.8	20	A	0.001213	20.0	2.8	0.0033976	4.81542701	
1.8	20	A	0.001213	20.0	1.8	0.0021841	3.09563165	
1.9	20	A	0.001213	20.0	1.9	0.0023055	3.26761118	
1.8	20	A	0.001213	20.0	1.8	0.0021841	3.09563165	
1.7	20	A	0.001213	20.0	1.7	0.0020628	2.92365211	
1.6	20	A	0.001213	20.0	1.6	0.0019415	2.75167258	

Average Ksat (3 consecutive readings w/same outflow per time): 3.267611

The averate Ksat of the three tests is: 6.99

APPENDIX D – PRE-DEVELOPMENT CALCULATIONS

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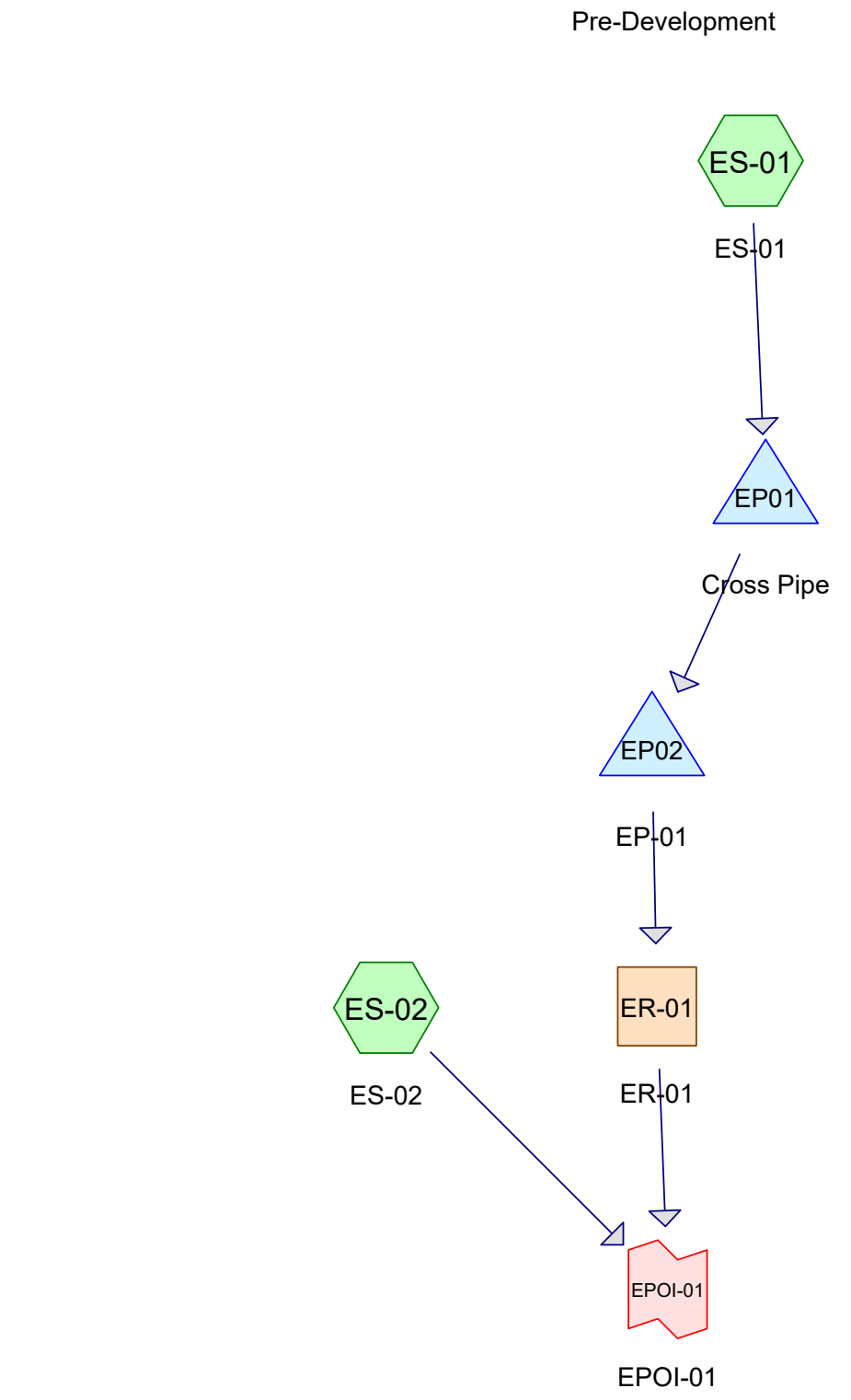

Routing Diagram for 47561-00 Pre and Post_R1
Prepared by TFMoran, Inc., Printed 12/21/2023
HydroCAD® 10.10-7a s/n 00866 © 2021 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
105,285	61	>75% Grass cover, Good, HSG B (ES-01, ES-02)
21,170	74	>75% Grass cover, Good, HSG C (ES-01, ES-02)
28,619	48	Brush, Good, HSG B (ES-02)
2,831	96	Gravel surface, HSG C (ES-01)
6,098	98	Paved roads w/curbs & sewers, HSG B (ES-01, ES-02)
1,176	98	Paved roads w/curbs & sewers, HSG C (ES-01, ES-02)
57,891	55	Woods, Good, HSG B (ES-01, ES-02)
37,374	70	Woods, Good, HSG C (ES-01, ES-02)
260,444	**62**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
197,893	HSG B	ES-01, ES-02
62,551	HSG C	ES-01, ES-02
0	HSG D	
0	Other	
260,444		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment ES-01: ES-01 Runoff Area=84,829 sf 2.54% Impervious Runoff Depth>0.77"
Flow Length=332' Tc=11.5 min CN=70 Runoff=1.3 cfs 5,430 cf

Subcatchment ES-02: ES-02 Runoff Area=175,615 sf 2.91% Impervious Runoff Depth>0.31"
Flow Length=336' Tc=10.9 min CN=58 Runoff=0.6 cfs 4,471 cf

Reach ER-01: ER-01 Avg. Flow Depth=0.10' Max Vel=1.09 fps Inflow=1.3 cfs 5,430 cf
n=0.030 L=364.0' S=0.0111 '/' Capacity=64.3 cfs Outflow=1.1 cfs 5,389 cf

Pond EP01: Cross Pipe Peak Elev=146.40' Storage=12 cf Inflow=1.3 cfs 5,430 cf
24.0" Round Culvert n=0.013 L=98.0' S=0.0077 '/' Outflow=1.3 cfs 5,430 cf

Pond EP02: EP-01 Peak Elev=145.22' Storage=3 cf Inflow=1.3 cfs 5,430 cf
Outflow=1.3 cfs 5,430 cf

Link EPOI-01: EPOI-01 Inflow=1.7 cfs 9,859 cf
Primary=1.7 cfs 9,859 cf

Total Runoff Area = 260,444 sf Runoff Volume = 9,901 cf Average Runoff Depth = 0.46"
97.21% Pervious = 253,170 sf 2.79% Impervious = 7,274 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment ES-01: ES-01 Runoff Area=84,829 sf 2.54% Impervious Runoff Depth>1.83"
Flow Length=332' Tc=11.5 min CN=70 Runoff=3.4 cfs 12,913 cf

Subcatchment ES-02: ES-02 Runoff Area=175,615 sf 2.91% Impervious Runoff Depth>1.02"
Flow Length=336' Tc=10.9 min CN=58 Runoff=3.3 cfs 14,856 cf

Reach ER-01: ER-01 Avg. Flow Depth=0.18' Max Vel=1.59 fps Inflow=3.4 cfs 12,912 cf
n=0.030 L=364.0' S=0.0111 '/' Capacity=64.3 cfs Outflow=3.2 cfs 12,851 cf

Pond EP01: Cross Pipe Peak Elev=146.76' Storage=31 cf Inflow=3.4 cfs 12,913 cf
24.0" Round Culvert n=0.013 L=98.0' S=0.0077 '/' Outflow=3.4 cfs 12,912 cf

Pond EP02: EP-01 Peak Elev=145.32' Storage=7 cf Inflow=3.4 cfs 12,912 cf
Outflow=3.4 cfs 12,912 cf

Link EPOI-01: EPOI-01 Inflow=6.4 cfs 27,706 cf
Primary=6.4 cfs 27,706 cf

Total Runoff Area = 260,444 sf Runoff Volume = 27,769 cf Average Runoff Depth = 1.28"
97.21% Pervious = 253,170 sf 2.79% Impervious = 7,274 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment ES-01: ES-01 Runoff Area=84,829 sf 2.54% Impervious Runoff Depth>2.81"
Flow Length=332' Tc=11.5 min CN=70 Runoff=5.3 cfs 19,842 cf

Subcatchment ES-02: ES-02 Runoff Area=175,615 sf 2.91% Impervious Runoff Depth>1.76"
Flow Length=336' Tc=10.9 min CN=58 Runoff=6.5 cfs 25,734 cf

Reach ER-01: ER-01 Avg. Flow Depth=0.24' Max Vel=1.88 fps Inflow=5.3 cfs 19,840 cf
n=0.030 L=364.0' S=0.0111 '/' Capacity=64.3 cfs Outflow=5.1 cfs 19,764 cf

Pond EP01: Cross Pipe Peak Elev=147.02' Storage=49 cf Inflow=5.3 cfs 19,842 cf
24.0" Round Culvert n=0.013 L=98.0' S=0.0077 '/' Outflow=5.3 cfs 19,841 cf

Pond EP02: EP-01 Peak Elev=145.39' Storage=10 cf Inflow=5.3 cfs 19,841 cf
Outflow=5.3 cfs 19,840 cf

Link EPOI-01: EPOI-01 Inflow=11.3 cfs 45,498 cf
Primary=11.3 cfs 45,498 cf

Total Runoff Area = 260,444 sf Runoff Volume = 45,576 cf Average Runoff Depth = 2.10"
97.21% Pervious = 253,170 sf 2.79% Impervious = 7,274 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment ES-01: ES-01 Runoff Area=84,829 sf 2.54% Impervious Runoff Depth>3.79"
Flow Length=332' Tc=11.5 min CN=70 Runoff=7.2 cfs 26,761 cf

Subcatchment ES-02: ES-02 Runoff Area=175,615 sf 2.91% Impervious Runoff Depth>2.55"
Flow Length=336' Tc=10.9 min CN=58 Runoff=9.8 cfs 37,273 cf

Reach ER-01: ER-01 Avg. Flow Depth=0.29' Max Vel=2.10 fps Inflow=7.2 cfs 26,759 cf
n=0.030 L=364.0' S=0.0111 '/' Capacity=64.3 cfs Outflow=6.9 cfs 26,672 cf

Pond EP01: Cross Pipe Peak Elev=147.24' Storage=71 cf Inflow=7.2 cfs 26,761 cf
24.0" Round Culvert n=0.013 L=98.0' S=0.0077 '/' Outflow=7.2 cfs 26,760 cf

Pond EP02: EP-01 Peak Elev=145.45' Storage=14 cf Inflow=7.2 cfs 26,760 cf
Outflow=7.2 cfs 26,759 cf

Link EPOI-01: EPOI-01 Inflow=16.3 cfs 63,945 cf
Primary=16.3 cfs 63,945 cf

Total Runoff Area = 260,444 sf Runoff Volume = 64,034 cf Average Runoff Depth = 2.95"
97.21% Pervious = 253,170 sf 2.79% Impervious = 7,274 sf

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APPENDIX E – PRE-DEVELOPMENT CALCULATIONS (10-YEAR STORM EVENT)

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Summary for Subcatchment ES-01: ES-01

Runoff = 3.4 cfs @ 12.17 hrs, Volume= 12,913 cf, Depth> 1.83"
Routed to Pond EP01 : Cross Pipe

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.72"

	Area (sf)	CN	Description
*	37,088	70	Woods, Good, HSG C
*	3,357	55	Woods, Good, HSG B
*	18,630	61	>75% Grass cover, Good, HSG B
*	20,768	74	>75% Grass cover, Good, HSG C
	1,267	98	Paved roads w/curbs & sewers, HSG B
*	2,831	96	Gravel surface, HSG C
	888	98	Paved roads w/curbs & sewers, HSG C
*	0	48	Brush, Good, HSG B
	84,829	70	Weighted Average
	82,674		97.46% Pervious Area
	2,155		2.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	100	0.0200	0.17		**Sheet Flow, Grass Short** Grass: Short n= 0.150 P2= 3.10"
0.5	70	0.0200	2.12		**Shallow Concentrated Flow, Grass Shallw** Grassed Waterway Kv= 15.0 fps
1.0	162	0.0300	2.60		**Shallow Concentrated Flow, Grass concentrated flow** Grassed Waterway Kv= 15.0 fps
11.5	332	Total			

Summary for Subcatchment ES-02: ES-02

Runoff = 3.3 cfs @ 12.18 hrs, Volume= 14,856 cf, Depth> 1.02"
Routed to Link EPOI-01 : EPOI-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.72"

	Area (sf)	CN	Description
*	286	70	Woods, Good, HSG C
*	54,534	55	Woods, Good, HSG B
*	86,655	61	>75% Grass cover, Good, HSG B
*	402	74	>75% Grass cover, Good, HSG C
	4,831	98	Paved roads w/curbs & sewers, HSG B
*	0	96	Gravel surface, HSG C
	288	98	Paved roads w/curbs & sewers, HSG C
*	28,619	48	Brush, Good, HSG B
	175,615	58	Weighted Average
	170,496		97.09% Pervious Area
	5,119		2.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	13	0.0200	0.90		**Sheet Flow, Sheet Pave** Smooth surfaces n= 0.011 P2= 3.10"
7.6	87	0.0300	0.19		**Sheet Flow, Sheet Grass** Grass: Short n= 0.150 P2= 3.10"
0.5	78	0.0300	2.60		**Shallow Concentrated Flow, Shallow Grass** Grassed Waterway Kv= 15.0 fps
2.6	158	0.0400	1.00		**Shallow Concentrated Flow, Grass concentrated flow** Woodland Kv= 5.0 fps
10.9	336	Total			

Summary for Reach ER-01: ER-01

Inflow Area = 84,829 sf, 2.54% Impervious, Inflow Depth > 1.83" for 10-year event
Inflow = 3.4 cfs @ 12.17 hrs, Volume= 12,912 cf
Outflow = 3.2 cfs @ 12.22 hrs, Volume= 12,851 cf, Atten= 5%, Lag= 2.8 min
Routed to Link EPOI-01 : EPOI-01

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.59 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 0.52 fps, Avg. Travel Time= 11.7 min

Peak Storage= 728 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.18' , Surface Width= 11.83'
Bank-Full Depth= 1.00' Flow Area= 15.0 sf, Capacity= 64.3 cfs

10.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 5.0 '/' Top Width= 20.00'
Length= 364.0' Slope= 0.0111 '/'
Inlet Invert= 145.05', Outlet Invert= 141.00'

‡

Summary for Pond EP01: Cross Pipe

Inflow Area = 84,829 sf, 2.54% Impervious, Inflow Depth > 1.83" for 10-year event
Inflow = 3.4 cfs @ 12.17 hrs, Volume= 12,913 cf
Outflow = 3.4 cfs @ 12.17 hrs, Volume= 12,912 cf, Atten= 0%, Lag= 0.2 min
Primary = 3.4 cfs @ 12.17 hrs, Volume= 12,912 cf
Routed to Pond EP02 : EP-01

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 146.76' @ 12.17 hrs Surf.Area= 64 sf Storage= 31 cf

Plug-Flow detention time= 0.2 min calculated for 12,885 cf (100% of inflow)
Center-of-Mass det. time= 0.1 min (854.6 - 854.5)

Volume	Invert	Avail.Storage	Storage Description
#1	145.88'	459 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
145.88	4	0	0
146.00	14	1	1
147.00	80	47	48
148.00	191	136	184
149.00	360	276	459

Device	Routing	Invert	Outlet Devices
#1	Primary	145.88'	**24.0" Round Existing Cross Pipe** L= 98.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 145.88' / 145.13' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=3.3 cfs @ 12.17 hrs HW=146.75' TW=145.31' (Dynamic Tailwater)
↑—**1=Existing Cross Pipe** (Inlet Controls 3.3 cfs @ 2.51 fps)

Summary for Pond EP02: EP-01

Inflow Area = 84,829 sf, 2.54% Impervious, Inflow Depth > 1.83" for 10-year event
Inflow = 3.4 cfs @ 12.17 hrs, Volume= 12,912 cf
Outflow = 3.4 cfs @ 12.17 hrs, Volume= 12,912 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.4 cfs @ 12.17 hrs, Volume= 12,912 cf
Routed to Reach ER-01 : ER-01

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 145.32' @ 12.20 hrs Surf.Area= 43 sf Storage= 7 cf

Plug-Flow detention time= 0.1 min calculated for 12,912 cf (100% of inflow)
Center-of-Mass det. time= 0.0 min (854.7 - 854.6)

Volume	Invert	Avail.Storage	Storage Description
#1	145.13'	304 cf	**Existing Depression (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
145.13	34	0	0
148.00	178	304	304

Device	Routing	Invert	Outlet Devices
#1	Primary	145.13'	**19.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=3.1 cfs @ 12.17 hrs HW=145.31' TW=145.22' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 3.1 cfs @ 0.89 fps)

Summary for Link EPOI-01: EPOI-01

Inflow Area = 260,444 sf, 2.79% Impervious, Inflow Depth > 1.28" for 10-year event
Inflow = 6.4 cfs @ 12.20 hrs, Volume= 27,706 cf
Primary = 6.4 cfs @ 12.20 hrs, Volume= 27,706 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

APPENDIX F – POST-DEVELOPMENT CALCULATIONS

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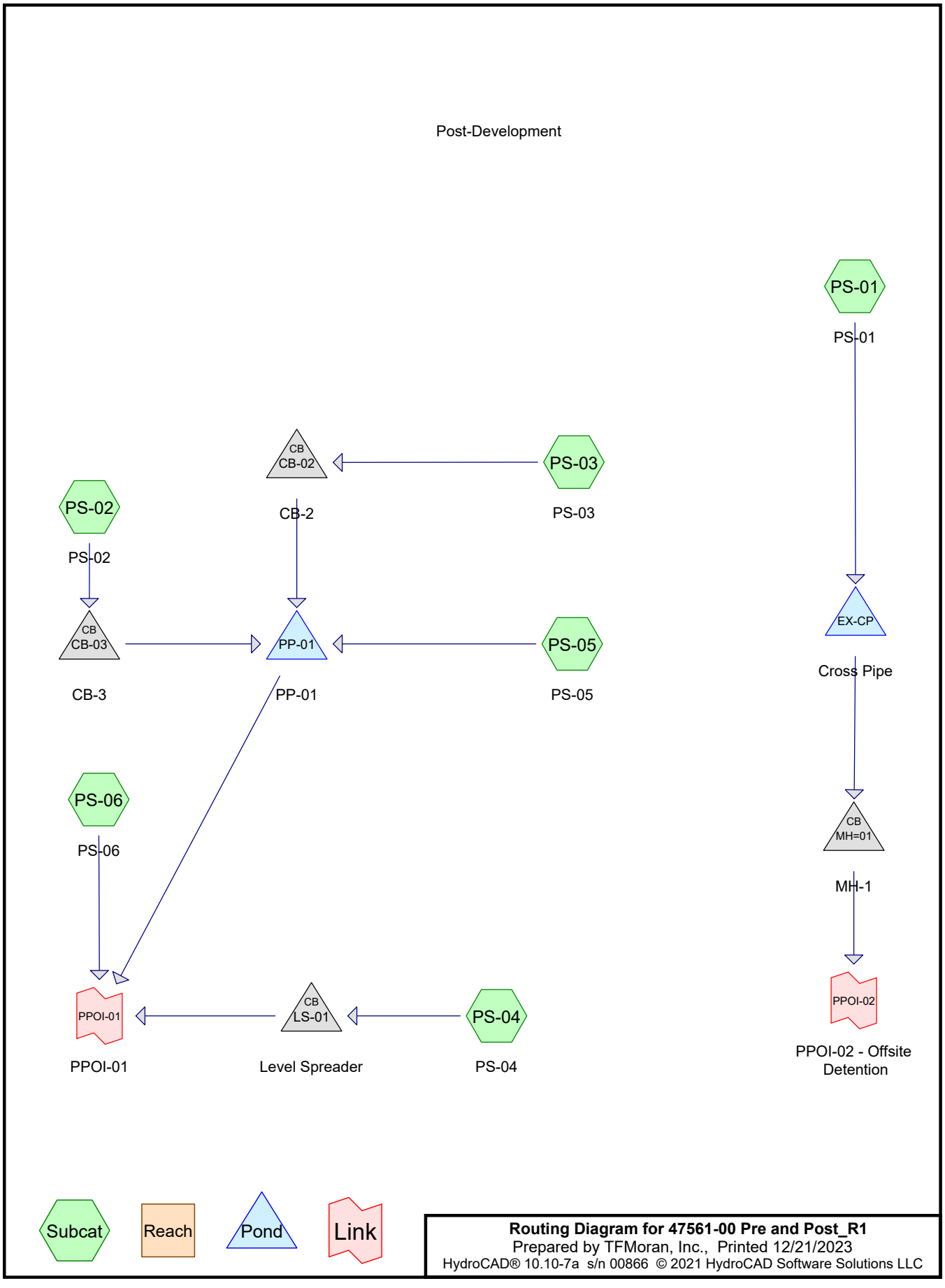
Post-Development
PS-01
PS-01
CB
CB-02
CB-2
PS-03
PS-03
PS-02
PS-02
EX-CP
Cross Pipe
CB
CB-03
CB-3
PP-01
PP-01
PS-05
PS-05
PS-06
PS-06
CB
MH=01
MH-1
PPOI-02
PPOI-02 - Offsite Detention
PPOI-01
PPOI-01
CB
LS-01
Level Spreader
PS-04
PS-04
Subcat
Reach
Pond
Link
Routing Diagram for 47561-00 Pre and Post_R1
Prepared by TFMoran, Inc., Printed 12/21/2023
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Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
65,959	61	>75% Grass cover, Good, HSG B (PS-01, PS-04, PS-06)
21,180	74	>75% Grass cover, Good, HSG C (PS-01, PS-06)
28,638	48	Brush, Good, HSG B (PS-06)
5,276	96	Gravel surface, HSG B (PS-04, PS-06)
2,852	96	Gravel surface, HSG C (PS-01)
19,442	98	Paved parking, HSG B (PS-02, PS-03, PS-04)
7,975	98	Paved roads w/curbs & sewers, HSG B (PS-01, PS-06)
249	98	Paved roads w/curbs & sewers, HSG C (PS-06)
888	98	Unconnected pavement, HSG C (PS-01)
12,737	98	Unconnected roofs, HSG B (PS-05)
3,357	55	Woods, Good, HSG B (PS-01)
37,088	70	Woods, Good, HSG C (PS-01)
54,519	58	Woods/grass comb., Good, HSG B (PS-06)
306	72	Woods/grass comb., Good, HSG C (PS-06)
260,466	**68**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
197,903	HSG B	PS-01, PS-02, PS-03, PS-04, PS-05, PS-06
62,563	HSG C	PS-01, PS-06
0	HSG D	
0	Other	
260,466		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PS-01: PS-01 Runoff Area=84,829 sf 2.52% Impervious Runoff Depth>0.76"
Flow Length=1,006' Tc=29.1 min CN=70 Runoff=0.9 cfs 5,400 cf

Subcatchment PS-02: PS-02 Runoff Area=3,408 sf 100.00% Impervious Runoff Depth>2.87"
Flow Length=65' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=0.2 cfs 814 cf

Subcatchment PS-03: PS-03 Runoff Area=11,116 sf 100.00% Impervious Runoff Depth>2.87"
Flow Length=143' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=0.7 cfs 2,655 cf

Subcatchment PS-04: PS-04 Runoff Area=6,472 sf 75.99% Impervious Runoff Depth>2.16"
Flow Length=155' Tc=6.0 min CN=91 Runoff=0.4 cfs 1,167 cf

Subcatchment PS-05: PS-05 Runoff Area=12,737 sf 100.00% Impervious Runoff Depth>2.87"
Flow Length=28' Slope=0.4200 '/' Tc=6.0 min CN=98 Runoff=0.9 cfs 3,042 cf

Subcatchment PS-06: PS-06 Runoff Area=141,904 sf 4.92% Impervious Runoff Depth>0.37"
Flow Length=616' Tc=11.3 min CN=60 Runoff=0.6 cfs 4,359 cf

Pond CB-02: CB-2 Peak Elev=147.46' Inflow=0.7 cfs 2,655 cf
8.0" Round Culvert n=0.013 L=20.1' S=0.0050 '/' Outflow=0.7 cfs 2,655 cf

Pond CB-03: CB-3 Peak Elev=147.33' Inflow=0.2 cfs 814 cf
8.0" Round Culvert n=0.013 L=22.4' S=0.0049 '/' Outflow=0.2 cfs 814 cf

Pond EX-CP: Cross Pipe Peak Elev=146.31' Storage=9 cf Inflow=0.9 cfs 5,400 cf
24.0" Round Culvert n=0.013 L=98.0' S=0.0077 '/' Outflow=0.9 cfs 5,400 cf

Pond LS-01: Level Spreader Peak Elev=145.52' Inflow=0.4 cfs 1,167 cf
Outflow=0.4 cfs 1,167 cf

Pond MH=01: MH-1 Peak Elev=145.60' Inflow=0.9 cfs 5,400 cf
24.0" Round Culvert n=0.013 L=20.0' S=0.0065 '/' Outflow=0.9 cfs 5,400 cf

Pond PP-01: PP-01 Peak Elev=147.32' Storage=1,694 cf Inflow=1.8 cfs 6,511 cf
Discarded=0.4 cfs 6,503 cf Primary=0.0 cfs 0 cf Outflow=0.4 cfs 6,503 cf

Link PPOI-01: PPOI-01 Inflow=0.8 cfs 5,525 cf
Primary=0.8 cfs 5,525 cf

Link PPOI-02: PPOI-02 - Offsite Detention Inflow=0.9 cfs 5,400 cf
Primary=0.9 cfs 5,400 cf

Total Runoff Area = 260,466 sf Runoff Volume = 17,437 cf Average Runoff Depth = 0.80"
84.15% Pervious = 219,175 sf 15.85% Impervious = 41,291 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PS-01: PS-01 Runoff Area=84,829 sf 2.52% Impervious Runoff Depth>1.82"
Flow Length=1,006' Tc=29.1 min CN=70 Runoff=2.3 cfs 12,855 cf

Subcatchment PS-02: PS-02 Runoff Area=3,408 sf 100.00% Impervious Runoff Depth>4.48"
Flow Length=65' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=0.4 cfs 1,273 cf

Subcatchment PS-03: PS-03 Runoff Area=11,116 sf 100.00% Impervious Runoff Depth>4.48"
Flow Length=143' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=1.1 cfs 4,151 cf

Subcatchment PS-04: PS-04 Runoff Area=6,472 sf 75.99% Impervious Runoff Depth>3.71"
Flow Length=155' Tc=6.0 min CN=91 Runoff=0.6 cfs 2,000 cf

Subcatchment PS-05: PS-05 Runoff Area=12,737 sf 100.00% Impervious Runoff Depth>4.48"
Flow Length=28' Slope=0.4200 '/' Tc=6.0 min CN=98 Runoff=1.3 cfs 4,756 cf

Subcatchment PS-06: PS-06 Runoff Area=141,904 sf 4.92% Impervious Runoff Depth>1.14"
Flow Length=616' Tc=11.3 min CN=60 Runoff=3.1 cfs 13,451 cf

Pond CB-02: CB-2 Peak Elev=147.88' Inflow=1.1 cfs 4,151 cf
8.0" Round Culvert n=0.013 L=20.1' S=0.0050 '/' Outflow=1.1 cfs 4,151 cf

Pond CB-03: CB-3 Peak Elev=147.87' Inflow=0.4 cfs 1,273 cf
8.0" Round Culvert n=0.013 L=22.4' S=0.0049 '/' Outflow=0.4 cfs 1,273 cf

Pond EX-CP: Cross Pipe Peak Elev=146.62' Storage=22 cf Inflow=2.3 cfs 12,855 cf
24.0" Round Culvert n=0.013 L=98.0' S=0.0077 '/' Outflow=2.3 cfs 12,854 cf

Pond LS-01: Level Spreader Peak Elev=145.53' Inflow=0.6 cfs 2,000 cf
Outflow=0.6 cfs 2,000 cf

Pond MH=01: MH-1 Peak Elev=145.93' Inflow=2.3 cfs 12,854 cf
24.0" Round Culvert n=0.013 L=20.0' S=0.0065 '/' Outflow=2.3 cfs 12,854 cf

Pond PP-01: PP-01 Peak Elev=147.87' Storage=3,184 cf Inflow=2.8 cfs 10,179 cf
Discarded=0.4 cfs 10,167 cf Primary=0.0 cfs 0 cf Outflow=0.4 cfs 10,167 cf

Link PPOI-01: PPOI-01 Inflow=3.6 cfs 15,451 cf
Primary=3.6 cfs 15,451 cf

Link PPOI-02: PPOI-02 - Offsite Detention Inflow=2.3 cfs 12,854 cf
Primary=2.3 cfs 12,854 cf

Total Runoff Area = 260,466 sf Runoff Volume = 38,485 cf Average Runoff Depth = 1.77"
84.15% Pervious = 219,175 sf 15.85% Impervious = 41,291 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PS-01: PS-01 Runoff Area=84,829 sf 2.52% Impervious Runoff Depth>2.80"
Flow Length=1,006' Tc=29.1 min CN=70 Runoff=3.7 cfs 19,760 cf

Subcatchment PS-02: PS-02 Runoff Area=3,408 sf 100.00% Impervious Runoff Depth>5.77"
Flow Length=65' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=0.4 cfs 1,638 cf

Subcatchment PS-03: PS-03 Runoff Area=11,116 sf 100.00% Impervious Runoff Depth>5.77"
Flow Length=143' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=1.5 cfs 5,343 cf

Subcatchment PS-04: PS-04 Runoff Area=6,472 sf 75.99% Impervious Runoff Depth>4.96"
Flow Length=155' Tc=6.0 min CN=91 Runoff=0.8 cfs 2,677 cf

Subcatchment PS-05: PS-05 Runoff Area=12,737 sf 100.00% Impervious Runoff Depth>5.77"
Flow Length=28' Slope=0.4200 '/' Tc=6.0 min CN=98 Runoff=1.7 cfs 6,123 cf

Subcatchment PS-06: PS-06 Runoff Area=141,904 sf 4.92% Impervious Runoff Depth>1.92"
Flow Length=616' Tc=11.3 min CN=60 Runoff=5.8 cfs 22,741 cf

Pond CB-02: CB-2 Peak Elev=148.37' Inflow=1.5 cfs 5,343 cf
8.0" Round Culvert n=0.013 L=20.1' S=0.0050 '/' Outflow=1.5 cfs 5,343 cf

Pond CB-03: CB-3 Peak Elev=148.31' Inflow=0.4 cfs 1,638 cf
8.0" Round Culvert n=0.013 L=22.4' S=0.0049 '/' Outflow=0.4 cfs 1,638 cf

Pond EX-CP: Cross Pipe Peak Elev=146.85' Storage=37 cf Inflow=3.7 cfs 19,760 cf
24.0" Round Culvert n=0.013 L=98.0' S=0.0077 '/' Outflow=3.6 cfs 19,759 cf

Pond LS-01: Level Spreader Peak Elev=145.54' Inflow=0.8 cfs 2,677 cf
Outflow=0.8 cfs 2,677 cf

Pond MH=01: MH-1 Peak Elev=146.16' Inflow=3.6 cfs 19,759 cf
24.0" Round Culvert n=0.013 L=20.0' S=0.0065 '/' Outflow=3.6 cfs 19,759 cf

Pond PP-01: PP-01 Peak Elev=148.31' Storage=3,933 cf Inflow=3.6 cfs 13,104 cf
Discarded=0.7 cfs 12,582 cf Primary=0.4 cfs 506 cf Outflow=1.1 cfs 13,088 cf

Link PPOI-01: PPOI-01 Inflow=6.3 cfs 25,924 cf
Primary=6.3 cfs 25,924 cf

Link PPOI-02: PPOI-02 - Offsite Detention Inflow=3.6 cfs 19,759 cf
Primary=3.6 cfs 19,759 cf

Total Runoff Area = 260,466 sf Runoff Volume = 58,282 cf Average Runoff Depth = 2.69"
84.15% Pervious = 219,175 sf 15.85% Impervious = 41,291 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PS-01: PS-01 Runoff Area=84,829 sf 2.52% Impervious Runoff Depth>3.77"
Flow Length=1,006' Tc=29.1 min CN=70 Runoff=5.0 cfs 26,658 cf

Subcatchment PS-02: PS-02 Runoff Area=3,408 sf 100.00% Impervious Runoff Depth>6.97"
Flow Length=65' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=0.5 cfs 1,979 cf

Subcatchment PS-03: PS-03 Runoff Area=11,116 sf 100.00% Impervious Runoff Depth>6.97"
Flow Length=143' Slope=0.0200 '/' Tc=6.0 min CN=98 Runoff=1.8 cfs 6,453 cf

Subcatchment PS-04: PS-04 Runoff Area=6,472 sf 75.99% Impervious Runoff Depth>6.14"
Flow Length=155' Tc=6.0 min CN=91 Runoff=1.0 cfs 3,312 cf

Subcatchment PS-05: PS-05 Runoff Area=12,737 sf 100.00% Impervious Runoff Depth>6.97"
Flow Length=28' Slope=0.4200 '/' Tc=6.0 min CN=98 Runoff=2.0 cfs 7,394 cf

Subcatchment PS-06: PS-06 Runoff Area=141,904 sf 4.92% Impervious Runoff Depth>2.75"
Flow Length=616' Tc=11.3 min CN=60 Runoff=8.5 cfs 32,480 cf

Pond CB-02: CB-2 Peak Elev=148.66' Inflow=1.8 cfs 6,453 cf
8.0" Round Culvert n=0.013 L=20.1' S=0.0050 '/' Outflow=1.8 cfs 6,453 cf

Pond CB-03: CB-3 Peak Elev=148.48' Inflow=0.5 cfs 1,979 cf
8.0" Round Culvert n=0.013 L=22.4' S=0.0049 '/' Outflow=0.5 cfs 1,979 cf

Pond EX-CP: Cross Pipe Peak Elev=147.05' Storage=52 cf Inflow=5.0 cfs 26,658 cf
24.0" Round Culvert n=0.013 L=98.0' S=0.0077 '/' Outflow=4.9 cfs 26,657 cf

Pond LS-01: Level Spreader Peak Elev=145.54' Inflow=1.0 cfs 3,312 cf
Outflow=1.0 cfs 3,312 cf

Pond MH=01: MH-1 Peak Elev=146.35' Inflow=4.9 cfs 26,657 cf
24.0" Round Culvert n=0.013 L=20.0' S=0.0065 '/' Outflow=4.9 cfs 26,657 cf

Pond PP-01: PP-01 Peak Elev=148.47' Storage=4,184 cf Inflow=4.3 cfs 15,826 cf
Discarded=0.7 cfs 14,293 cf Primary=1.4 cfs 1,514 cf Outflow=2.1 cfs 15,807 cf

Link PPOI-01: PPOI-01 Inflow=9.5 cfs 37,305 cf
Primary=9.5 cfs 37,305 cf

Link PPOI-02: PPOI-02 - Offsite Detention Inflow=4.9 cfs 26,657 cf
Primary=4.9 cfs 26,657 cf

Total Runoff Area = 260,466 sf Runoff Volume = 78,276 cf Average Runoff Depth = 3.61"
84.15% Pervious = 219,175 sf 15.85% Impervious = 41,291 sf

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APPENDIX G – POST-DEVELOPMENT CALCULATIONS (10-YEAR STORM EVENT)

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Summary for Subcatchment PS-01: PS-01

Runoff = 2.3 cfs @ 12.43 hrs, Volume= 12,855 cf, Depth> 1.82"
Routed to Pond EX-CP : Cross Pipe

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.72"

Area (sf)	CN	Description
1,246	98	Paved roads w/curbs & sewers, HSG B
888	98	Unconnected pavement, HSG C
2,852	96	Gravel surface, HSG C
3,357	55	Woods, Good, HSG B
37,088	70	Woods, Good, HSG C
18,630	61	>75% Grass cover, Good, HSG B
20,768	74	>75% Grass cover, Good, HSG C
84,829	70	Weighted Average
82,695		97.48% Pervious Area
2,134		2.52% Impervious Area
888		41.61% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	100	0.0200	0.08		**Sheet Flow, Woods Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.10"
4.7	296	0.0439	1.05		**Shallow Concentrated Flow, Woods Shallow Conc. Flow** Woodland Kv= 5.0 fps
1.9	340	0.0400	3.00		**Shallow Concentrated Flow, Grass Shallow Conc. Flow** Grassed Waterway Kv= 15.0 fps
0.2	100	0.0075	6.76	21.22	**Pipe Channel, Pipe Flow** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.012 Corrugated PP, smooth interior
0.5	170	0.0060	5.58	17.52	**Pipe Channel, Prop. Pipe Flow** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013 Corrugated PE, smooth interior
29.1	1,006	Total			

Summary for Subcatchment PS-02: PS-02

Runoff = 0.4 cfs @ 12.09 hrs, Volume= 1,273 cf, Depth> 4.48"
Routed to Pond CB-03 : CB-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.72"

Area (sf)	CN	Description
3,408	98	Paved parking, HSG B
3,408		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	65	0.0200	1.24		**Sheet Flow, Pavement Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.9	65	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PS-03: PS-03

Runoff = 1.1 cfs @ 12.09 hrs, Volume= 4,151 cf, Depth> 4.48"
Routed to Pond CB-02 : CB-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.72"

Area (sf)	CN	Description
11,116	98	Paved parking, HSG B
11,116		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.35		**Sheet Flow, Pavement Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.2	43	0.0200	2.87		**Shallow Concentrated Flow, Pavement Shallow Con. Flow** Paved Kv= 20.3 fps
1.4	143	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PS-04: PS-04

Runoff = 0.6 cfs @ 12.09 hrs, Volume= 2,000 cf, Depth> 3.71"
Routed to Pond LS-01 : Level Spreader

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.72"

Area (sf)	CN	Description
4,918	98	Paved parking, HSG B
414	96	Gravel surface, HSG B
1,140	61	>75% Grass cover, Good, HSG B
6,472	91	Weighted Average
1,554		24.01% Pervious Area
4,918		75.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	100	0.0112	1.07		**Sheet Flow, Parking Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.2	27	0.0200	2.87		**Shallow Concentrated Flow, Parking shallow c flow** Paved Kv= 20.3 fps
0.1	10	0.0200	2.28		**Shallow Concentrated Flow, Gravel shallow c flow** Unpaved Kv= 16.1 fps
0.0	18	0.2900	8.08		**Shallow Concentrated Flow, Grass shallow c flow** Grassed Waterway Kv= 15.0 fps
1.9	155	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PS-05: PS-05

Runoff = 1.3 cfs @ 12.09 hrs, Volume= 4,756 cf, Depth> 4.48"
Routed to Pond PP-01 : PP-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.72"

Area (sf)	CN	Description
12,737	98	Unconnected roofs, HSG B
12,737		100.00% Impervious Area
12,737		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	28	0.4200	3.55		**Sheet Flow, Roof Sheet Flow** Smooth surfaces n= 0.011 P2= 3.10"
0.1	28	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment PS-06: PS-06

Runoff = 3.1 cfs @ 12.18 hrs, Volume= 13,451 cf, Depth> 1.14"
Routed to Link PPOI-01 : PPOI-01

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.72"

Area (sf)	CN	Description
4,862	96	Gravel surface, HSG B
6,729	98	Paved roads w/curbs & sewers, HSG B
249	98	Paved roads w/curbs & sewers, HSG C
54,519	58	Woods/grass comb., Good, HSG B
28,638	48	Brush, Good, HSG B
46,189	61	>75% Grass cover, Good, HSG B
412	74	>75% Grass cover, Good, HSG C
306	72	Woods/grass comb., Good, HSG C
141,904	60	Weighted Average
134,926		95.08% Pervious Area
6,978		4.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	48	0.0105	0.90		**Sheet Flow, Road sheet flow** Smooth surfaces n= 0.011 P2= 3.10"
4.2	52	0.0480	0.21		**Sheet Flow, Grass sheet flow** Grass: Short n= 0.150 P2= 3.10"
1.1	136	0.0190	2.07		**Shallow Concentrated Flow, Grass shallow conc.** Grassed Waterway Kv= 15.0 fps
0.3	65	0.0080	3.52	28.15	**Channel Flow, Swale flow** Area= 8.0 sf Perim= 11.3' r= 0.71' n= 0.030 Earth, grassed & winding
0.6	103	0.0313	2.65		**Shallow Concentrated Flow, Grass shallow c flow** Grassed Waterway Kv= 15.0 fps
2.6	122	0.0254	0.80		**Shallow Concentrated Flow, Woods Shallow conc flow** Woodland Kv= 5.0 fps
1.6	90	0.0333	0.91		**Shallow Concentrated Flow, Wetland shallow flow** Woodland Kv= 5.0 fps
11.3	616	Total			

Summary for Pond CB-02: CB-2

Inflow Area = 11,116 sf,100.00% Impervious, Inflow Depth > 4.48" for 10-year event
Inflow = 1.1 cfs @ 12.09 hrs, Volume= 4,151 cf
Outflow = 1.1 cfs @ 12.09 hrs, Volume= 4,151 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.1 cfs @ 12.09 hrs, Volume= 4,151 cf
Routed to Pond PP-01 : PP-01

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 147.88' @ 12.68 hrs
Flood Elev= 148.87'

Device	Routing	Invert	Outlet Devices
#1	Primary	146.80'	**8.0" Round Culvert** L= 20.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.80' / 146.70' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=1.1 cfs @ 12.09 hrs HW=147.78' TW=147.30' (Dynamic Tailwater)
1=Culvert (Barrel Controls 1.1 cfs @ 3.21 fps)

Summary for Pond CB-03: CB-3

Inflow Area = 3,408 sf,100.00% Impervious, Inflow Depth > 4.48" for 10-year event
Inflow = 0.4 cfs @ 12.09 hrs, Volume= 1,273 cf
Outflow = 0.4 cfs @ 12.09 hrs, Volume= 1,273 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.4 cfs @ 12.09 hrs, Volume= 1,273 cf
Routed to Pond PP-01 : PP-01

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 147.87' @ 12.70 hrs
Flood Elev= 149.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	146.61'	**8.0" Round Culvert** L= 22.4' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.61' / 146.50' S= 0.0049 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.0 cfs @ 12.09 hrs HW=147.23' TW=147.30' (Dynamic Tailwater)
1=Culvert (Controls 0.0 cfs)

Summary for Pond EX-CP: Cross Pipe

Inflow Area = 84,829 sf, 2.52% Impervious, Inflow Depth > 1.82" for 10-year event
Inflow = 2.3 cfs @ 12.43 hrs, Volume= 12,855 cf
Outflow = 2.3 cfs @ 12.43 hrs, Volume= 12,854 cf, Atten= 0%, Lag= 0.2 min
Primary = 2.3 cfs @ 12.43 hrs, Volume= 12,854 cf
Routed to Pond MH=01 : MH-1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 146.62' @ 12.44 hrs Surf.Area= 55 sf Storage= 22 cf

Plug-Flow detention time= 0.2 min calculated for 12,827 cf (100% of inflow)
Center-of-Mass det. time= 0.1 min (868.3 - 868.1)

Volume	Invert	Avail.Storage	Storage Description
#1	145.88'	459 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
145.88	4	0	0
146.00	14	1	1
147.00	80	47	48
148.00	191	136	184
149.00	360	276	459

Device	Routing	Invert	Outlet Devices
#1	Primary	145.88'	**24.0" Round Existing Cross Pipe** L= 98.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 145.88' / 145.13' S= 0.0077 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=2.3 cfs @ 12.43 hrs HW=146.61' TW=145.92' (Dynamic Tailwater)
1=Existing Cross Pipe (Outlet Controls 2.3 cfs @ 3.28 fps)

Summary for Pond LS-01: Level Spreader

Inflow Area = 6,472 sf, 75.99% Impervious, Inflow Depth > 3.71" for 10-year event
Inflow = 0.6 cfs @ 12.09 hrs, Volume= 2,000 cf
Outflow = 0.6 cfs @ 12.09 hrs, Volume= 2,000 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.6 cfs @ 12.09 hrs, Volume= 2,000 cf
Routed to Link PPOI-01 : PPOI-01

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 145.53' @ 12.09 hrs
Flood Elev= 147.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	145.50'	**35.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.6 cfs @ 12.09 hrs HW=145.53' TW=0.00' (Dynamic Tailwater)
1=Sharp-Crested Rectangular Weir (Weir Controls 0.6 cfs @ 0.57 fps)

Summary for Pond MH=01: MH-1

Inflow Area = 84,829 sf, 2.52% Impervious, Inflow Depth > 1.82" for 10-year event
Inflow = 2.3 cfs @ 12.43 hrs, Volume= 12,854 cf
Outflow = 2.3 cfs @ 12.43 hrs, Volume= 12,854 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.3 cfs @ 12.43 hrs, Volume= 12,854 cf
Routed to Link PPOI-02 : PPOI-02 - Offsite Detention

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 145.93' @ 12.43 hrs
Flood Elev= 148.90'

Device	Routing	Invert	Outlet Devices
#1	Primary	145.13'	**24.0" Round Culvert** L= 20.0' Ke= 1.000 Inlet / Outlet Invert= 145.13' / 145.00' S= 0.0065 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=2.3 cfs @ 12.43 hrs HW=145.92' TW=0.00' (Dynamic Tailwater)
1=Culvert (Barrel Controls 2.3 cfs @ 2.96 fps)

Summary for Pond PP-01: PP-01

Inflow Area = 27,261 sf,100.00% Impervious, Inflow Depth > 4.48" for 10-year event
Inflow = 2.8 cfs @ 12.09 hrs, Volume= 10,179 cf
Outflow = 0.4 cfs @ 11.70 hrs, Volume= 10,167 cf, Atten= 88%, Lag= 0.0 min
Discarded = 0.4 cfs @ 11.70 hrs, Volume= 10,167 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link PPOI-01 : PPOI-01

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 147.87' @ 12.65 hrs Surf.Area= 4,340 sf Storage= 3,184 cf

Plug-Flow detention time= 59.3 min calculated for 10,167 cf (100% of inflow)
Center-of-Mass det. time= 58.5 min (807.0 - 748.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	146.50'	2,418 cf	**53.36'W x 81.33'L x 1.88'H Field A** 8,139 cf Overall - 2,094 cf Embedded = 6,045 cf x 40.0% Voids
#2A	146.83'	1,620 cf	**ADS N-12 12"** x 100 Inside #1 Inside= 12.2"W x 12.2"H => 0.81 sf x 20.00'L = 16.2 cf Outside= 14.5"W x 14.5"H => 1.05 sf x 20.00'L = 20.9 cf 100 Chambers in 25 Rows
#3	148.30'	440 cf	**55.00'W x 80.00'L x 0.50'H Prismatoid** 2,200 cf Overall x 20.0% Voids
		4,478 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	146.50'	**3.500 in/hr Exfiltration over Horizontal area** Phase-In= 0.10'
#2	Primary	146.50'	**12.0" Round Culvert** L= 28.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 146.50' / 146.22' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	148.20'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.4 cfs @ 11.70 hrs HW=146.63' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.4 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=146.50' TW=0.00' (Dynamic Tailwater)
2=Culvert (Controls 0.0 cfs)
3=Orifice/Grate (Controls 0.0 cfs)

Summary for Link PPOI-01: PPOI-01

Inflow Area = 175,637 sf, 22.29% Impervious, Inflow Depth > 1.06" for 10-year event
Inflow = 3.6 cfs @ 12.17 hrs, Volume= 15,451 cf
Primary = 3.6 cfs @ 12.17 hrs, Volume= 15,451 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link PPOI-02: PPOI-02 - Offsite Detention

Inflow Area = 84,829 sf, 2.52% Impervious, Inflow Depth > 1.82" for 10-year event
Inflow = 2.3 cfs @ 12.43 hrs, Volume= 12,854 cf
Primary = 2.3 cfs @ 12.43 hrs, Volume= 12,854 cf, Atten= 0%, Lag= 0.0 min
Routed to nonexistent node 1L

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

APPENDIX H – PRE-DEVELOPMENT DRAINAGE MAP

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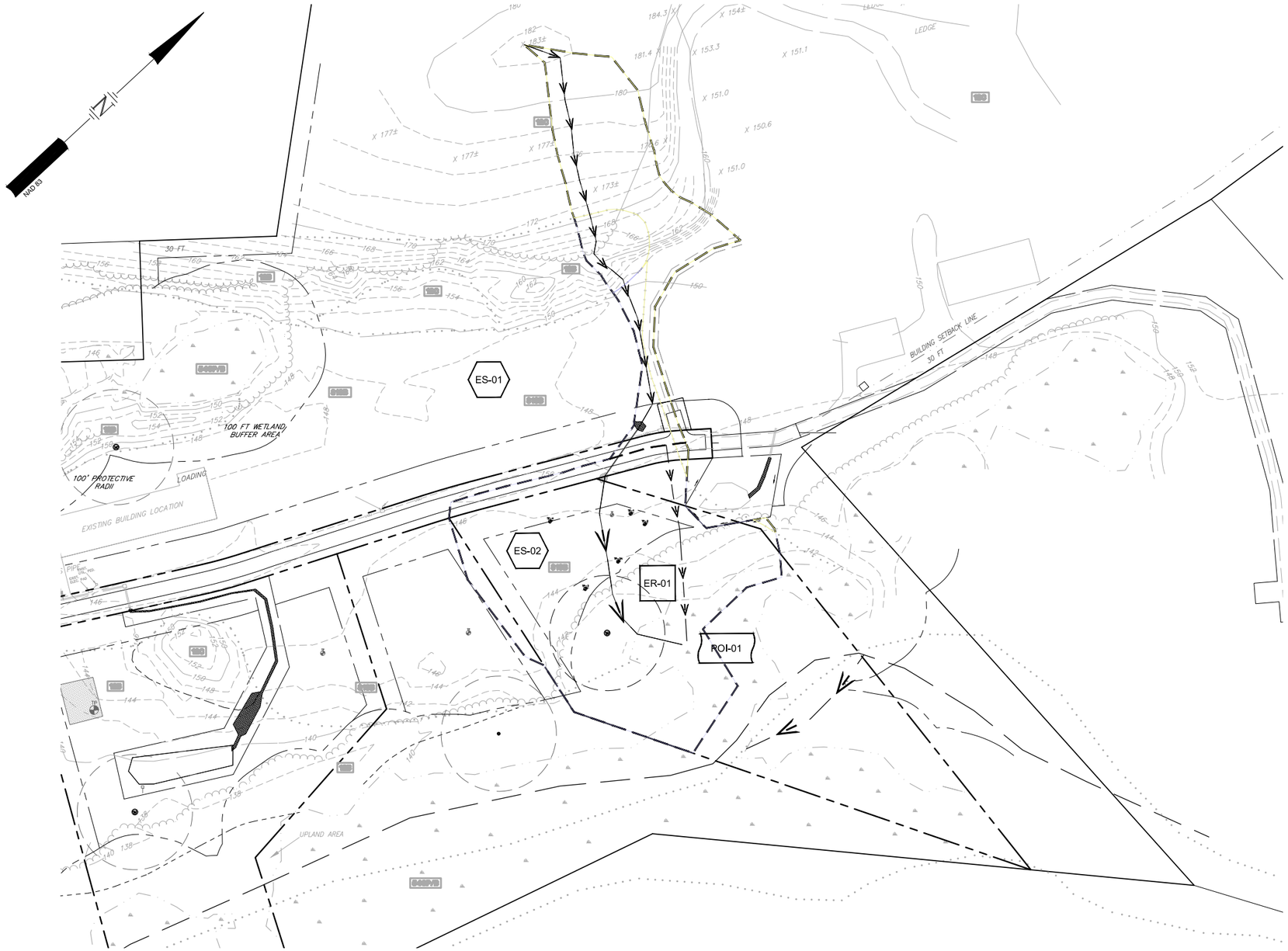

LEGEND

- PROPERTY LINE
- LIMITS OF DRAINAGE SUBCATCHMENT
- SOIL GROUP BREAKLINE
- FLOW PATH (Tc LINE)
- REACH
- POI-1 — POINT OF INTEREST
- ES-1 — SUBCATCHMENT AREA
- EP-1 — POND, CULVERT, OR CATCH BASIN
- ER-1 — REACH

SITE DEVELOPMENT PLANS

TAX MAP 151 LOT 2-7

PRE-DEVELOPMENT DRAINAGE MAP

CASSET HOLDINGS, LLC

IRON HORSE DRIVE, FREMONT, NH

OWNED BY

PAKARA HOLDINGS LLC

PREPARED FOR

CASSET HOLDINGS, LLC

1"=200' (11"X17")

SCALE: 1"=100' (22"X34") **DECEMBER 20, 2023**

DIG SAFE — CONTACT DIG SAFE 72 BUSINESS HOURS PRIOR TO CONSTRUCTION

HORIZONTAL SCALE 1"=20'
20 10 0 20

REV	DATE	DESCRIPTION	DR	CK

TFM
Civil Engineers
Structural Engineers
Traffic Engineers
Land Surveyors
Landscape Architects
Scientists

170 Commerce Way, Suite 2
Portsmouth, NH 03801
Phone (603) 431-2222
Fax (603) 431-0190
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APPENDIX I – POST-DEVELOPMENT DRAINAGE MAP

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SOIL PHASE LEGEND (PERCENT)

A	B	C	D	E	F
0–3	3–8	8–15	15–25	25–50	50+

SOIL LEGEND (PER USDA NRCS SOIL SURVEY)

SYMBOL	DESCRIPTION	HYDROLOGIC SOIL GROUP	DRAINAGE CLASS
313	DEERFIELD	B	MODERATELY WELL TO SOMEWHAT POOR
546/P	WALPPOLE POORLY DRAINED	C	POOR
12	HINCKLEY	B	EXCESSIVELY
12	HINCKLEY	C	EXCESSIVELY

SITE DEVELOPMENT PLANS

TAX MAP 151 LOT 2-7

POST-DEVELOPMENT DRAINAGE MAP

CASSET HOLDINGS, LLC

IRON HORSE DRIVE, FREMONT, NH

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CASSET HOLDINGS, LLC

1"=160' (11"X17")

SCALE: 1"=80' (22"X34") **DECEMBER 20, 2023**

HORIZONTAL SCALE 1"=80'
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REV	DATE	DESCRIPTION	DR	CK

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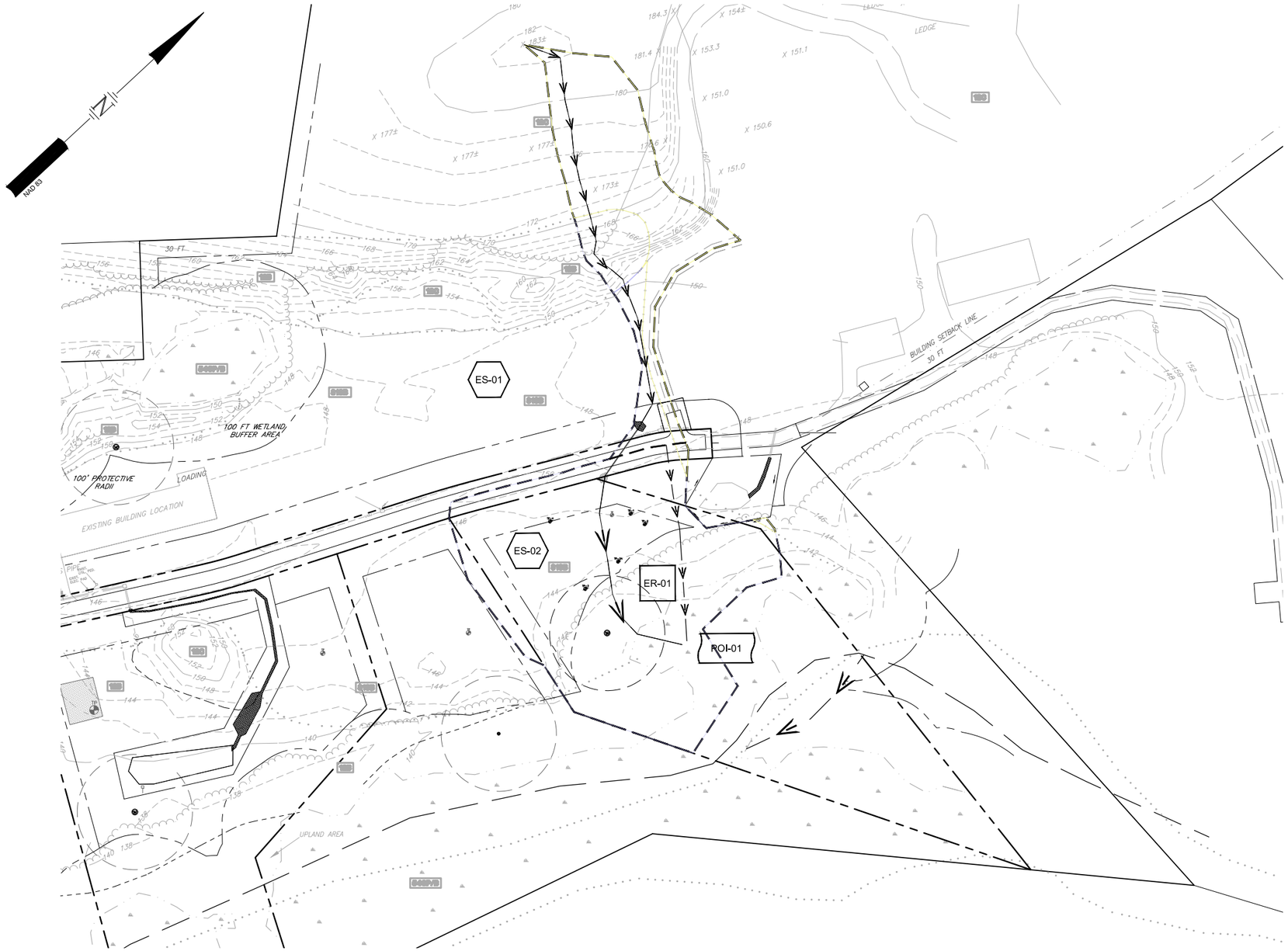

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