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# Stormwater Management Report

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## Rock Road Townhomes

Map 17; Lot 25  
295 Rockingham Road  
Londonderry, New Hampshire

February 20, 2026

KNA Project No. 21-0113-1

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**KNA** 

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*KEACH-NORDSTROM ASSOCIATES, INC.*

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## **I. INTRODUCTION**

### **A. Project Description**

The project proposes to develop the site to accommodate a proposed townhouse development, consisting of one 7-unit building and one 5-unit building with an associated paved driveway and parking areas. Site work will include construction of the proposed buildings, driveway, parking lot, utilities, and the necessary stormwater management provisions. The proposed stormwater management system includes two detention ponds.

### **B. Existing Site Conditions**

The subject property consists of one lot, approximately 7.901 acres in total area, which is located at 295 Rockingham Road in Londonderry's Commercial II (C-II) Zoning District. The lot is currently wooded and undeveloped. There are two wetland areas on the site which drain to an existing 18" RCP that crosses under Page Road. The lot is bordered by commercial use to the north, Rockingham Road to the east, Page Road to the south, and an undeveloped lot under review for proposed multi-family residential use to the west.

According to a High Intensity Soil Survey, completed on July 8, 2022, by Luke Hurley, CSS #095, the predominant soil types onsite are Montauk soils, Scituate-Newfields Complex soils, and 115/NP Scarborough soils all with slopes ranging from 0-8%. Montauk and Scituate-Newfields soils are classified as Hydrologic Soil Group (HSG) 'C', whereas Scarborough soils are classified as HSG 'D'.

## **II. STORM DRAINAGE ANALYSIS & DESIGN**

### **A. Methodology**

In accordance with the provisions of the Town of Londonderry, and generally accepted engineering practices, the 25-year and 50-year frequency storms have each been used in the various aspects of analysis and design of stormwater management considerations for the subject site. All proposed stormwater measures have been designed for the 25-year frequency storm while the proposed detention pond has been designed to provide one foot of freeboard in the 50-year frequency storm.

KNA utilizes HydroCAD version 10.0 to analyze both pre and post-development watershed characteristics. This computer software system is based largely on hydrology techniques (TR-20) developed by the Soil Conservation Service (now the Natural Resources Conservation Service). In addition, the software derives Time of Concentration values using the methodology contained within USDA-S.C.S. publication Urban Hydrology for Small Watersheds Technical Release No. 55 (TR 55).

All design and analysis calculations performed using the referenced methodologies are attached to this report. The minimum time of concentrations used for the analysis is 6 minutes. These calculations document each catchment area, a breakdown of surface type, time of concentration, rainfall intensity, peak discharge volume, Manning's "n" value, peak velocity, and other descriptive design data for each watershed and pipe segment evaluated. In addition, the "Pre/Post Development Drainage Area Plans" graphically define and illustrate the extent of each watershed or catchment area investigated.

## **B. Pre-Development Drainage Conditions**

In the pre-development scenario, thirteen (13) points of analysis (POA) have been identified as the appropriate points to compare pre vs. post development rates of stormwater discharge. These points of analysis reflect the main discharge points of the site and were analyzed to show the impact of the proposed improvements.

The pre-development drainage model's POA's are further described as follows:

➤ Link A	Map 15 Lot 233
➤ Link B	Map 17 Lot 235
➤ Link C	Page Road
➤ Link D	Mammoth Road
➤ Link E	Map 17 Lot 7
➤ Link F	Map 15 Lot 239
➤ Link G	Map 15 Lot 238
➤ Link H	Map 15 Lot 240
➤ Link I	Map 15 Lot 241
➤ Link J	Map 15 Lot 231
➤ Link K	Map 15 Lot 232
➤ Link L	Map 15 Lot 234
➤ Link M	Rockingham Road

In general, the site slopes from east to west and runoff ultimately drains to an existing 18" RCP underneath Page Road (Link A). Runoff from the majority of Lots 25 and 235 and the abutting lots to the north flows through a wetland channel, located along the western property line, or to a roadside swale along Page Road, which both ultimately drain to Link A as well. Runoff from a small portion of the northern corner of the lot drains to Rockingham Road (Link M) while runoff from the southeastern corner of the lot drains to an existing 15" RCP underneath Page Road (Link L). All other points of analysis represent the abutting properties, which are either located upstream or across the road from the proposed development. For a more visual description of the information presented in this section, please refer to the attached "Pre-Development Drainage Areas Plan" attached in the appendix of this report.

## **C. Post-Development Drainage Conditions:**

The same POA's that were identified in the pre-development scenario have been analyzed in the post-development scenario. The proposed stormwater management system utilizes both closed and open practices for the collection, storage, and detention of runoff.

Stormwater runoff generated from the southeastern portion of the proposed buildings and driveway will be directed by bituminous asphalt curbing towards proposed Detention Pond #1, located directly north of the proposed driveway. Runoff generated from the rest of the development will be directed by bituminous asphalt curbing towards proposed Detention Pond #2, located west of the proposed fire turnaround. Both ponds are designed to decrease peak rates in all design storms while providing greater than one foot of freeboard in the 50-year storm event. Runoff leaving Detention Pond #1 will be directed to the adjacent wetland via a custom concrete weir outlet structure, while runoff leaving Detention Pond #2 will be directed to the existing wetland channel to the west via a 15" HDPE.

The peak stormwater runoff rate for the specific storm frequencies are presented and analyzed in the subsequent summary section of this report (Table 1). For a more visual description of the information presented in this section, please refer to the attached "Post-Development Drainage Areas Plan" attached in the appendix of this report.

**D. Summary:**

The subject site complies with the Town of Londonderry regulations regarding stormwater mitigation. As reported below, there is no increase in peak rates in all storm events. The results are reported below in Table 1. Table 2 summarizes all ponds in the drainage analysis, and Table 3 summarizes all pipes in the drainage analysis.

**Table 1: Peak Flow Discharge Rate**

<b>Site Pre-Development vs. Post-Development (cfs)</b>		
<b>Description</b>	<b>25-Year</b>	
24-hr Rainfall	4.42 in/hr	
	<b>Pre</b>	<b>Post</b>
<b>A</b>	13.14	12.99
<b>B</b>	2.19	2.19
<b>C</b>	1.74	1.74
<b>D</b>	0.00	0.00
<b>E</b>	0.00	0.00
<b>F</b>	0.00	0.00
<b>G</b>	0.00	0.00
<b>H</b>	0.00	0.00
<b>I</b>	0.00	0.00
<b>J</b>	0.00	0.00
<b>K</b>	0.00	0.00
<b>L</b>	4.80	4.79
<b>M</b>	1.14	1.14

**Table 2: Detention Pond Analysis**

<b>Location</b>	<b>Detention Pond #1 (17P)</b>		<b>Detention Pond #2 (20P)</b>	
	<b>25-Yr</b>	<b>50-Yr</b>	<b>25-Yr</b>	<b>50-Yr</b>
<b>Pond Bottom</b>	310.00		310.00	
<b>Pond Top</b>	312.00		313.50	
<b>Outlet Invert</b>	310.00		309.75	
<b>Storm Event</b>				
<b>Q-in (CFS)</b>	2.44	3.03	3.04	3.71
<b>Q-out (CFS)</b>	1.01	1.37	0.50	0.79
<b>Peak Elevation</b>	310.83	310.97	311.52	311.76

**Table 3: Pipe Summary Table (25-Year Design Storm)**

Location	Size (in)	Type	Length (ft)	Slope ('/')	Manning's 'N'	Peak Discharge (cfs)	Flow Depth (ft)	Peak Vel. (FPS)	HGL (ft)
15" RCP (1P)	15"	PVC	111.0	0.0317	0.011	4.79	0.51	10.10	305.30
EX CB (3P)	8"	PVC	228.7	0.0187	0.010	1.22	0.36	6.35	315.19
15" RCP (4P)	15"	RCP	24.6	0.0829	0.011	0.48	0.13	7.28	316.73
18" RCP (5P)	18"	RCP	112.5	0.0096	0.011	12.09	1.22	7.85	305.51
24" RCP (6P)	24"	RCP	43.9	0.0123	0.011	15.15	1.01	9.49	306.71
RCB (7P)	12"	RCP	44.4	0.0095	0.011	3.79	0.76	5.92	306.58
RCB (8P)	12"	RCP	315.8	0.0058	0.011	3.21	1.00	4.58	307.28
RCB (9P)	6"	PVC	141.2	0.0271	0.010	0.74	0.28	6.43	314.30
EX CB (10P)	12"	CMP	101.8	0.0127	0.025	2.48	1.00	3.03	314.24
15" HDPE (11P)	15"	HDPE	41.0	0.0707	0.013	3.14	0.33	11.99	322.08
DP#2 (20P)	15"	HDPE	30.0	0.0050	0.013	0.50	0.28	2.44	309.88

### **III. EROSION & SEDIMENTATION CONTROL PROVISIONS**

#### **A. Temporary Erosion Control Measures**

As an integral part of the engineering design of this site, an erosion and sedimentation control plan has been developed with the intent of limiting the potential for soil loss and associated receiving water quality degradation, both during and after the construction period. As the project plans indicate, traditional temporary erosion and sedimentation control devices and practices, such as siltation fencing and temporary block and sediment barriers at. In preparation of these provisions, reference was made to the New Hampshire Stormwater Manual; Volume 3: Erosion and Sediment Temporary Controls During Construction. Construction details for each temporary erosion control measure and practice specified have been added to the project plans. These plans also contain a number of erosion control notes, which are offered to the selected contractor in order to supplement the specified measures and practices to the extent practical.

#### **B. Construction Sequence**

A site-specific construction sequence sensitive to limiting soil loss due to erosion and associated water quality degradation was prepared specifically for this project and is shown on the project plans. As pointed out in the erosion control notes, it is important for the contractor to recognize that proper judgment in the implementation of work will be essential if erosion is to be limited and protection of completed work is to be realized. Moreover, any specific changes in sequence and/or field conditions affecting the ability of specific erosion control measures to adequately serve their intended purpose should be reported to this office by the contractor. Further, the contractor is encouraged to supplement specified erosion control measures during the construction period where and when in his/ her best judgment additional protection is warranted.

### **C. Permanent Erosion Control Measures**

In the design of this site, consideration was given to limiting the potential for long-term erosion of completed improvements. As a result, several permanent erosion control measures were incorporated into the site design. These provisions include:

- 1) Specification of a turf establishment schedule and seed mixture, utilizing materials and workmanship recognized as appropriate for the site conditions at hand; and
- 2) Detention ponds were designed to reduce runoff.

## **FIGURES AND SPREADSHEETS**

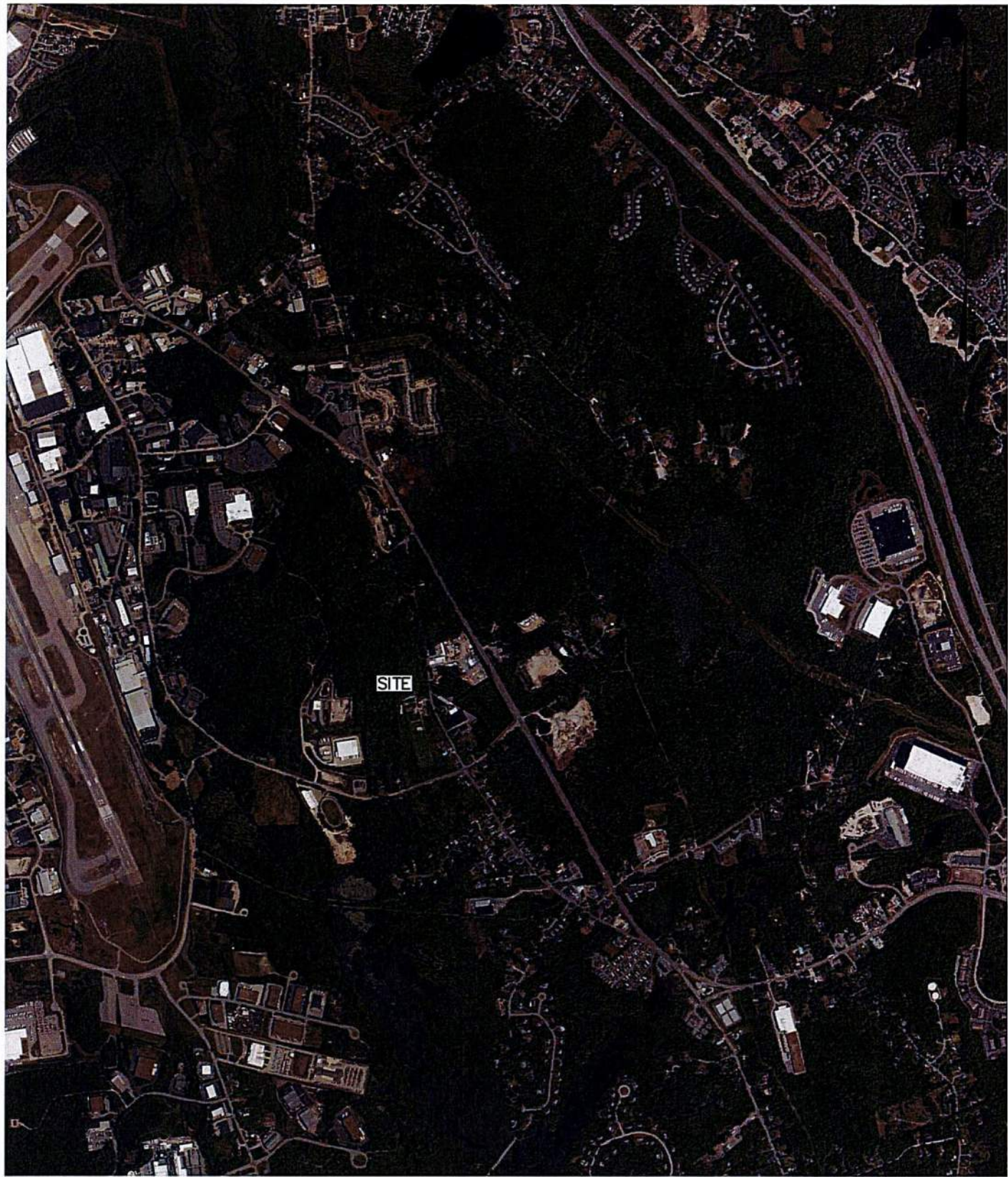
FIGURE NO. 1 – AERIAL IMAGE

FIGURE NO. 2 – USGS IMAGE

FIGURE NO. 3 – SCS SOILS MAP

FIGURE NO. 4 – EXTREME PRECIPITATION TABLES

FIGURE NO. 5 – RIP RAP OUTLET PROTECTION APRON CALCULATIONS



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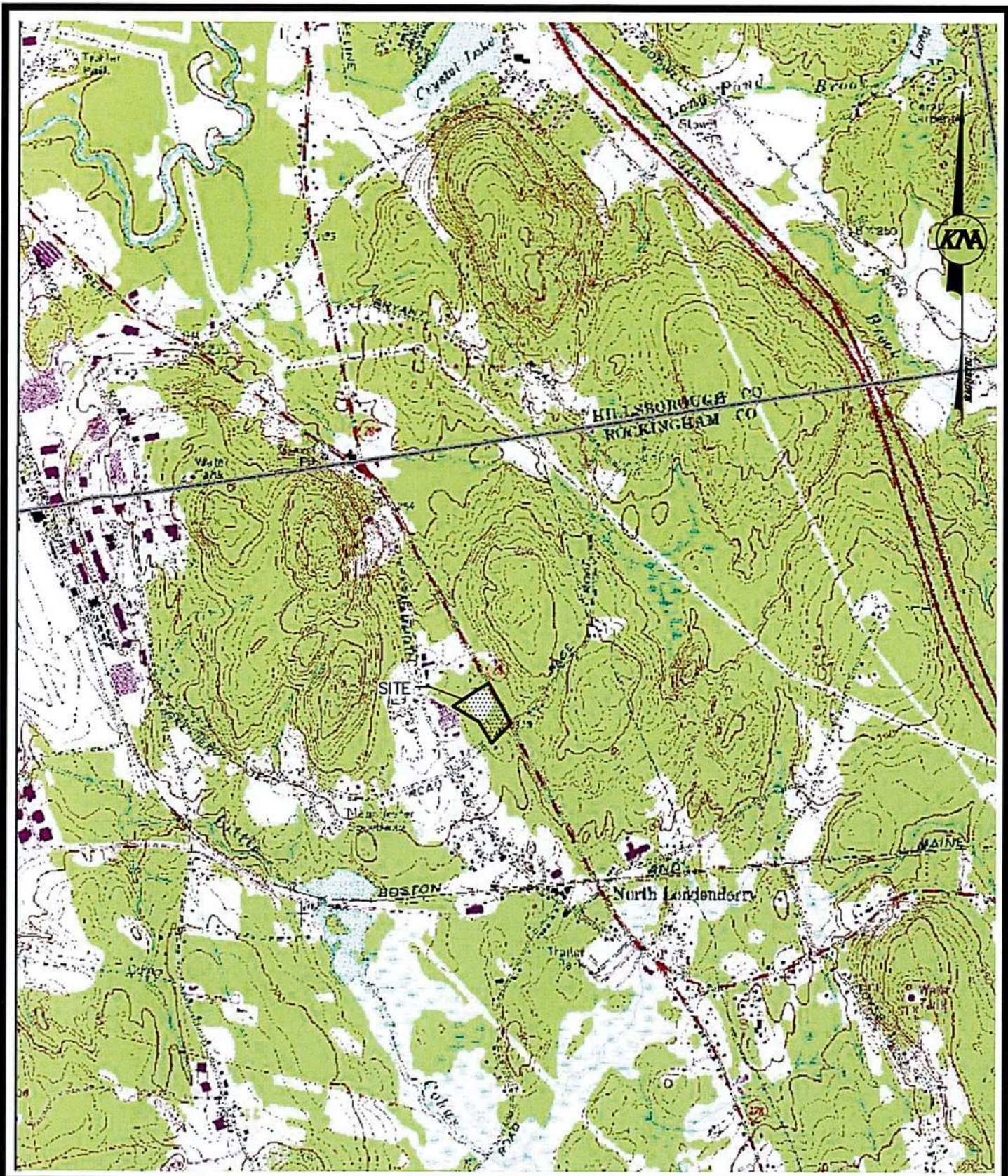
TITLE: AERIAL  
295 ROCKINGHAM ROAD  
MAP 17; LOT 25 - 295 ROCKINGHAM ROAD - LONDONDERRY, NH

DATE: JUNE 26, 2024

JOB. NO. 21-0113-1

SCALE: 1" = 2000'

SHEET 1 OF 1



**KMA** KEACH-NORDSTROM ASSOCIATES, INC.

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TITLE: USGS  
 295 ROCKINGHAM ROAD

MAP 17; LOT 25 - 295 ROCKINGHAM ROAD - LONDONDERRY, NH

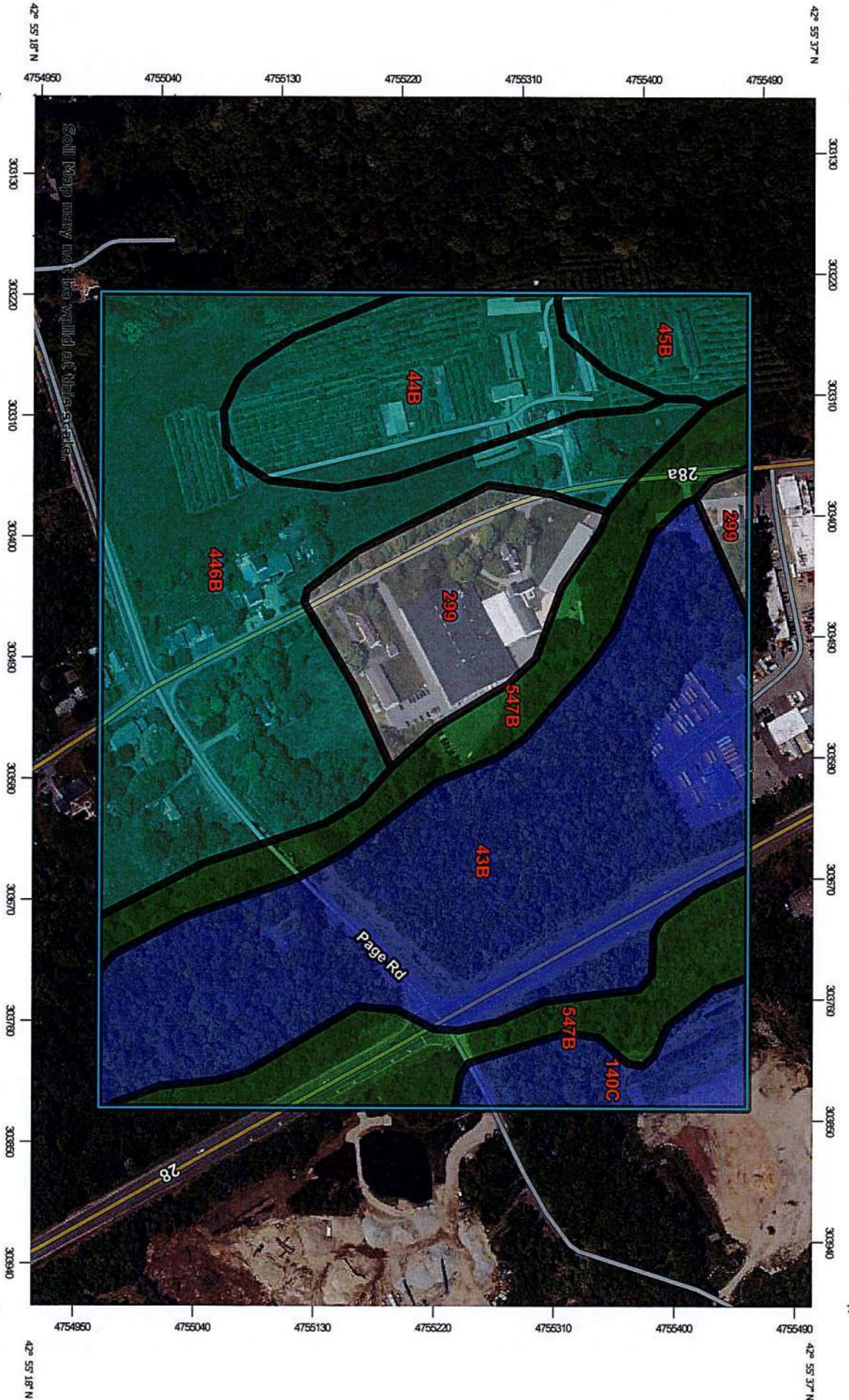
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JOB. NO. 21-0113-1

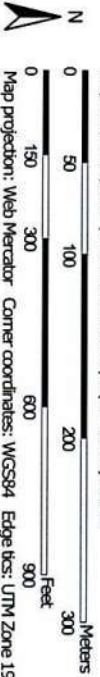
SCALE: 1" = 2000'

SHEET 1 OF 1

Hydrologic Soil Group—Rockingham County, New Hampshire











































Map Scale: 1:4,110 if printed on A landscape (11" x 8.5") sheet.



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

Soil Map may not be valid at this scale.

## MAP LEGEND

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

## 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 24, Aug 31, 2021

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

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

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
43B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	B	21.9	29.9%
44B	Montauk fine sandy loam, 3 to 8 percent slopes	C	7.5	10.3%
45B	Montauk fine sandy loam, 0 to 8 percent slopes, very stony	C	2.4	3.2%
140C	Chatfield-Hollis-Canton complex, 8 to 15 percent slopes, rocky	B	3.0	4.0%
299	Udorthents, smoothed		7.0	9.5%
446B	Scituate-Newfields complex, 3 to 8 percent slopes	C	20.3	27.8%
547B	Walpole very fine sandy loam, 3 to 8 percent slopes, very stony	A/D	11.1	15.2%
<b>Totals for Area of Interest</b>			<b>73.1</b>	<b>100.0%</b>

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

# Extreme Precipitation Tables

## Northeast Regional Climate Center

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

<b>Smoothing</b>	Yes
<b>State</b>	New Hampshire
<b>Location</b>	
<b>Longitude</b>	71.406 degrees West
<b>Latitude</b>	42.925 degrees North
<b>Elevation</b>	0 feet
<b>Date/Time</b>	Thu, 01 Sep 2022 15:46:37 -0400

### Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
<b>1yr</b>	0.27	0.41	0.51	0.67	0.83	1.05	<b>1yr</b>	0.72	1.00	1.21	1.53	1.93	2.44	2.66	<b>1yr</b>	2.16	2.56	2.97	3.64	4.23	<b>1yr</b>
<b>2yr</b>	0.32	0.50	0.62	0.82	1.03	1.29	<b>2yr</b>	0.89	1.19	1.49	1.87	2.33	2.90	3.22	<b>2yr</b>	2.57	3.10	3.59	4.29	4.88	<b>2yr</b>
<b>5yr</b>	0.38	0.60	0.75	1.00	1.28	1.63	<b>5yr</b>	1.11	1.48	1.89	2.37	2.95	3.67	4.11	<b>5yr</b>	3.25	3.95	4.57	5.39	6.08	<b>5yr</b>
<b>10yr</b>	0.43	0.68	0.86	1.17	1.52	1.94	<b>10yr</b>	1.31	1.75	2.26	2.84	3.53	4.38	4.94	<b>10yr</b>	3.88	4.75	5.48	6.40	7.18	<b>10yr</b>
<b>25yr</b>	0.51	0.81	1.03	1.43	1.89	2.45	<b>25yr</b>	1.63	2.19	2.86	3.60	4.48	5.54	6.31	<b>25yr</b>	4.90	6.07	6.98	8.05	8.95	<b>25yr</b>
<b>50yr</b>	0.58	0.93	1.19	1.67	2.24	2.92	<b>50yr</b>	1.94	2.60	3.42	4.31	5.37	6.62	7.60	<b>50yr</b>	5.85	7.30	8.38	9.57	10.59	<b>50yr</b>
<b>100yr</b>	0.66	1.07	1.38	1.95	2.66	3.49	<b>100yr</b>	2.29	3.08	4.10	5.17	6.43	7.91	9.15	<b>100yr</b>	7.00	8.80	10.07	11.39	12.52	<b>100yr</b>
<b>200yr</b>	0.75	1.22	1.59	2.28	3.15	4.17	<b>200yr</b>	2.72	3.65	4.91	6.20	7.71	9.46	11.03	<b>200yr</b>	8.37	10.60	12.11	13.56	14.81	<b>200yr</b>
<b>500yr</b>	0.91	1.49	1.95	2.82	3.95	5.26	<b>500yr</b>	3.41	4.58	6.21	7.86	9.77	11.99	14.12	<b>500yr</b>	10.61	13.57	15.45	17.09	18.52	<b>500yr</b>

### Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
<b>1yr</b>	0.22	0.34	0.42	0.56	0.69	0.84	<b>1yr</b>	0.60	0.83	1.07	1.34	1.64	2.26	2.53	<b>1yr</b>	2.00	2.43	2.73	3.27	3.74	<b>1yr</b>
<b>2yr</b>	0.31	0.48	0.59	0.80	0.98	1.17	<b>2yr</b>	0.85	1.15	1.34	1.76	2.25	2.81	3.12	<b>2yr</b>	2.49	3.00	3.48	4.16	4.75	<b>2yr</b>
<b>5yr</b>	0.35	0.54	0.68	0.93	1.18	1.40	<b>5yr</b>	1.02	1.37	1.58	2.06	2.62	3.39	3.76	<b>5yr</b>	3.00	3.62	4.20	4.99	5.65	<b>5yr</b>
<b>10yr</b>	0.39	0.60	0.74	1.04	1.34	1.58	<b>10yr</b>	1.15	1.55	1.80	2.32	2.95	3.89	4.34	<b>10yr</b>	3.45	4.17	4.84	5.74	6.42	<b>10yr</b>
<b>25yr</b>	0.44	0.68	0.84	1.20	1.58	1.85	<b>25yr</b>	1.36	1.81	2.11	2.71	3.42	4.66	5.20	<b>25yr</b>	4.12	5.00	5.82	6.89	7.56	<b>25yr</b>
<b>50yr</b>	0.49	0.74	0.92	1.33	1.78	2.09	<b>50yr</b>	1.54	2.05	2.40	3.06	3.84	5.33	5.98	<b>50yr</b>	4.72	5.75	6.69	7.91	8.54	<b>50yr</b>
<b>100yr</b>	0.54	0.82	1.02	1.48	2.02	2.36	<b>100yr</b>	1.75	2.31	2.73	3.46	4.31	5.95	6.86	<b>100yr</b>	5.26	6.60	7.67	9.08	9.63	<b>100yr</b>
<b>200yr</b>	0.60	0.90	1.14	1.65	2.30	2.66	<b>200yr</b>	1.98	2.61	3.08	3.92	4.87	6.76	7.87	<b>200yr</b>	5.98	7.57	8.80	10.43	10.83	<b>200yr</b>
<b>500yr</b>	0.69	1.02	1.31	1.91	2.71	3.14	<b>500yr</b>	2.34	3.07	3.64	4.62	5.71	7.98	9.43	<b>500yr</b>	7.06	9.06	10.52	12.54	12.63	<b>500yr</b>

### Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
<b>1yr</b>	0.30	0.46	0.57	0.76	0.94	1.10	<b>1yr</b>	0.81	1.07	1.22	1.62	2.05	2.61	2.81	<b>1yr</b>	2.31	2.71	3.30	4.11	4.63	<b>1yr</b>
<b>2yr</b>	0.34	0.52	0.64	0.87	1.08	1.28	<b>2yr</b>	0.93	1.25	1.44	1.88	2.40	3.02	3.36	<b>2yr</b>	2.68	3.23	3.74	4.43	5.08	<b>2yr</b>
<b>5yr</b>	0.42	0.65	0.81	1.11	1.41	1.62	<b>5yr</b>	1.22	1.58	1.85	2.37	2.99	3.99	4.49	<b>5yr</b>	3.53	4.32	4.93	5.81	6.55	<b>5yr</b>
<b>10yr</b>	0.51	0.78	0.97	1.35	1.75	1.97	<b>10yr</b>	1.51	1.93	2.23	2.83	3.56	4.96	5.61	<b>10yr</b>	4.39	5.40	6.12	7.14	7.97	<b>10yr</b>
<b>25yr</b>	0.65	1.00	1.24	1.77	2.33	2.55	<b>25yr</b>	2.01	2.49	2.87	3.58	4.46	6.62	7.55	<b>25yr</b>	5.86	7.26	8.16	9.37	10.40	<b>25yr</b>
<b>50yr</b>	0.79	1.20	1.49	2.15	2.89	3.11	<b>50yr</b>	2.49	3.04	3.48	4.29	5.29	8.24	9.47	<b>50yr</b>	7.29	9.11	10.15	11.51	12.71	<b>50yr</b>
<b>100yr</b>	0.96	1.45	1.82	2.63	3.60	3.79	<b>100yr</b>	3.11	3.71	4.22	5.13	6.28	10.34	11.86	<b>100yr</b>	9.15	11.41	12.61	14.16	15.58	<b>100yr</b>
<b>200yr</b>	1.16	1.75	2.22	3.21	4.48	4.62	<b>200yr</b>	3.87	4.52	5.11	6.13	7.46	12.91	14.91	<b>200yr</b>	11.42	14.34	15.71	17.44	19.12	<b>200yr</b>
<b>500yr</b>	1.51	2.25	2.90	4.21	5.98	6.01	<b>500yr</b>	5.16	5.88	6.60	7.77	9.38	17.33	20.17	<b>500yr</b>	15.33	19.39	20.99	22.97	25.10	<b>500yr</b>





KEACH-NORSTROM ASSOCIATES, INC.

## RIP RAP OUTLET PROTECTION APRON CALCULATIONS

Project: 295 Rockingham Road Date: 2/20/2026  
 KMA #: 21-0113-1

The purpose of this spreadsheet is to calculate the dimensions of Inlet/Outlet Protection apron (riprap) required during the SCS/NRCS 25-year type III 24-hr storm event. The spillway weir(s) inlet/outlet apron protection will be sized for the SCS/NRCS 25-year type III 24-hr storm event.

Required Input: Q peak flow in CFS  
 Do diameter in feet of outlet or width of channel  
 Tw tail water at end of apron

Depending on the tail water conditions, either column 1 or column 2 is used for calculations

Column One where  $Tw < 1/2 Do$  Column Two where  $Tw > 1/2 Do$

Length of Apron  $La = (1.8Q/Do^{0.3/2}) + 7Do$   $La = 3 * Q / Do^{0.3/2} + 7Do$

Width of Apron at outfall  
 $W1 = 3 * Do$   
 $W2 = 3 * Do + La$

If defined channel, then use channel width for W1 and W2

Rock Rip Rap Size  
 $d50 = (0.02 * Q^{0.4/3}) / (Tw * Do)$

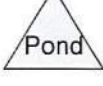
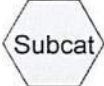
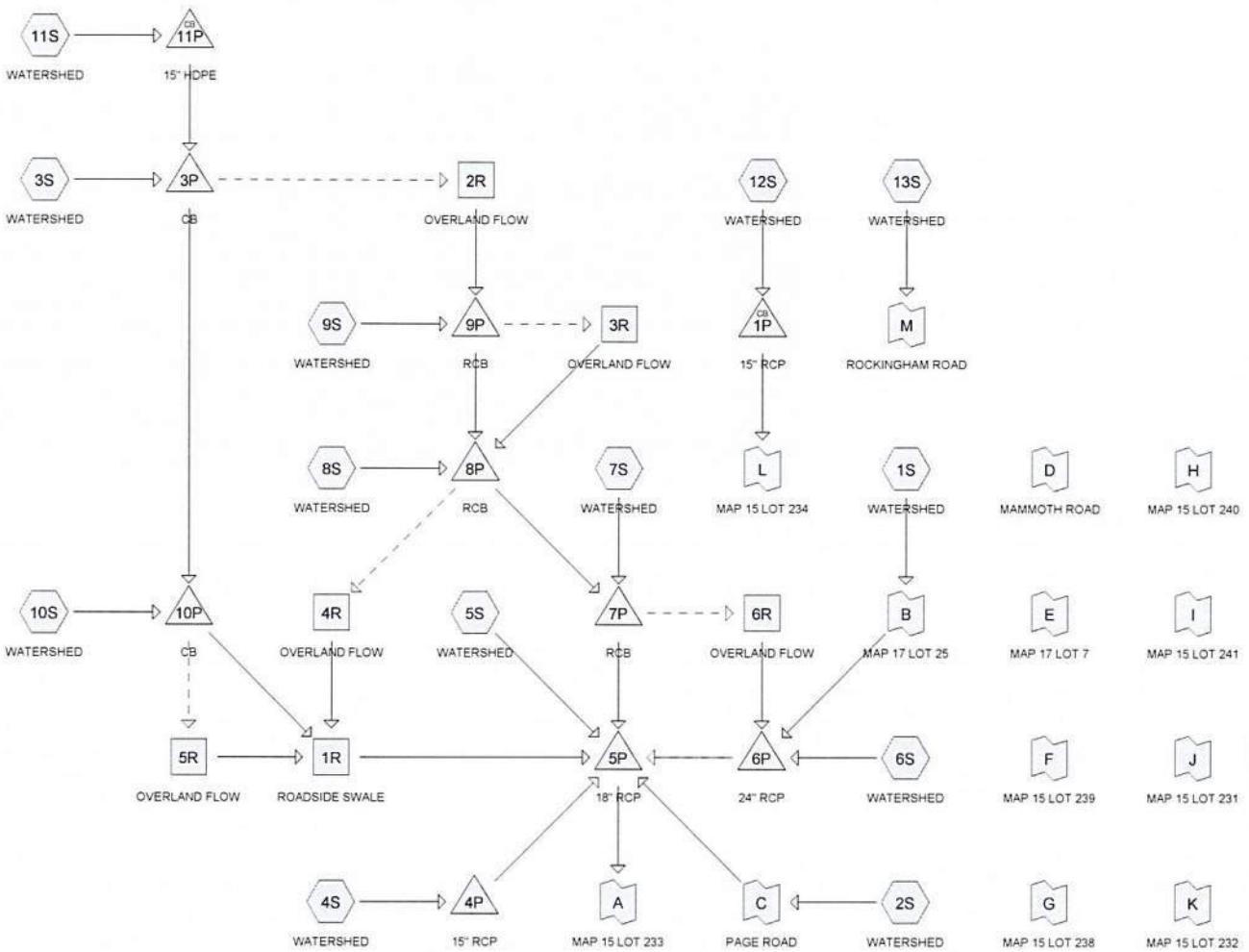
Calculation Summary Table:

Input to Chart Description (Optional)	HW#2	Detention Pond #2 Outlet	Q <sub>25</sub> ** (cfs)	Do (ft)	Tw (ft)	Calculated Output La	W1	W2	d50, ft	d50 in	USE d50 in	d100		d85		d50		d15		USE		
												FROM in	TO in	FROM in	TO in	FROM in	TO in	FROM in	TO in	Length ft.	Depth in.	Length ft.
			0.50	1.25	0.28	9	4	13	0.0	0.27	3	5	6	4	5	3	5	1	2	9	4	13

\*\* Center Apron with Headwall and Outlet Pipe (All Cases)  
 \* Line Apron with 6.0 oz. Geotextile Fabric (All Cases)

## **HYDROCAD DRAINAGE ANALYSIS**

- I. 25-YR, PRE-DEVELOPMENT
- II. 25-YR, POST-DEVELOPMENT
- III. 50-YR POND SUMMARIES



Routing Diagram for 2101131-PRE-DEVELOPMENT\_REV2, Revised November 25, 2025  
 Prepared by Keach-Nordstrom Associates, Inc. Printed 2/18/2026  
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## 2101131-PRE-DEVELOPMENT\_REV2

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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.13	61	>75% Grass cover, Good, HSG B (4S, 5S, 6S, 12S, 13S)
5.51	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S, 6S, 7S, 8S, 9S, 10S, 11S)
0.40	80	>75% Grass cover, Good, HSG D (6S)
2.81	98	Paved parking (2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 13S)
0.31	98	Paved parking, HSG C (12S)
2.14	98	Roofs (2S, 3S, 6S, 8S, 9S, 11S)
2.38	55	Woods, Good, HSG B (4S, 5S, 6S, 12S, 13S)
8.47	70	Woods, Good, HSG C (1S, 2S, 3S, 4S, 6S, 7S, 8S, 9S, 10S, 12S, 13S)
2.09	77	Woods, Good, HSG D (1S, 2S, 5S, 6S)
<b>25.23</b>	<b>76</b>	<b>TOTAL AREA</b>

**2101131-PRE-DEVELOPMENT\_REV2**

**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.00	HSG A	
3.51	HSG B	4S, 5S, 6S, 12S, 13S
14.29	HSG C	1S, 2S, 3S, 4S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S
2.49	HSG D	1S, 2S, 5S, 6S
4.94	Other	2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 13S
<b>25.23</b>		<b>TOTAL AREA</b>

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>Subcatchment1S: WATERSHED</b>	Runoff Area=37,990 sf 0.00% Impervious Runoff Depth>2.53" Flow Length=238' Tc=10.5 min CN=71 Runoff=2.19 cfs 0.184 af
<b>Subcatchment2S: WATERSHED</b>	Runoff Area=30,122 sf 8.90% Impervious Runoff Depth>2.79" Flow Length=200' Tc=14.2 min CN=74 Runoff=1.74 cfs 0.161 af
<b>Subcatchment3S: WATERSHED</b>	Runoff Area=36,571 sf 28.26% Impervious Runoff Depth>3.36" Flow Length=317' Tc=11.9 min CN=80 Runoff=2.71 cfs 0.235 af
<b>Subcatchment4S: WATERSHED</b>	Runoff Area=11,669 sf 34.32% Impervious Runoff Depth>2.80" Tc=6.0 min CN=74 Runoff=0.86 cfs 0.062 af
<b>Subcatchment5S: WATERSHED</b>	Runoff Area=43,638 sf 26.04% Impervious Runoff Depth>2.44" Flow Length=150' Tc=9.7 min CN=70 Runoff=2.47 cfs 0.204 af
<b>Subcatchment6S: WATERSHED</b>	Runoff Area=639,175 sf 25.40% Impervious Runoff Depth>3.05" Flow Length=1,316' Tc=48.0 min CN=77 Runoff=23.71 cfs 3.730 af
<b>Subcatchment7S: WATERSHED</b>	Runoff Area=18,012 sf 7.36% Impervious Runoff Depth>2.71" Flow Length=447' Tc=10.7 min CN=73 Runoff=1.11 cfs 0.093 af
<b>Subcatchment8S: WATERSHED</b>	Runoff Area=30,349 sf 3.67% Impervious Runoff Depth>2.89" Flow Length=322' Tc=8.0 min CN=75 Runoff=2.18 cfs 0.168 af
<b>Subcatchment9S: WATERSHED</b>	Runoff Area=47,516 sf 12.13% Impervious Runoff Depth>3.08" Flow Length=275' Tc=8.4 min CN=77 Runoff=3.58 cfs 0.280 af
<b>Subcatchment10S: WATERSHED</b>	Runoff Area=36,443 sf 15.15% Impervious Runoff Depth>2.98" Flow Length=233' Tc=12.0 min CN=76 Runoff=2.39 cfs 0.208 af
<b>Subcatchment11S: WATERSHED</b>	Runoff Area=34,434 sf 30.64% Impervious Runoff Depth>3.46" Tc=6.0 min CN=81 Runoff=3.14 cfs 0.228 af
<b>Subcatchment12S: WATERSHED</b>	Runoff Area=108,318 sf 12.62% Impervious Runoff Depth>2.61" Flow Length=505' Tc=23.1 min CN=72 Runoff=4.80 cfs 0.541 af
<b>Subcatchment13S: WATERSHED</b>	Runoff Area=24,832 sf 1.08% Impervious Runoff Depth>2.02" Flow Length=150' Tc=9.7 min CN=65 Runoff=1.14 cfs 0.096 af
<b>Reach 1R: ROADSIDEWALE</b>	Avg. Flow Depth=0.24' Max Vel=2.88 fps Inflow=7.80 cfs 0.645 af n=0.025 L=363.0' S=0.0183 '/ Capacity=89.79 cfs Outflow=7.41 cfs 0.644 af
<b>Reach 2R: OVERLANDFLOW</b>	Avg. Flow Depth=0.17' Max Vel=1.95 fps Inflow=3.82 cfs 0.082 af n=0.025 L=160.0' S=0.0122 '/ Capacity=73.48 cfs Outflow=3.54 cfs 0.082 af
<b>Reach 3R: OVERLANDFLOW</b>	Avg. Flow Depth=0.28' Max Vel=3.68 fps Inflow=6.02 cfs 0.132 af n=0.025 L=150.0' S=0.0257 '/ Capacity=60.51 cfs Outflow=6.01 cfs 0.132 af

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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<b>Reach 4R: OVERLANDFLOW</b>	Avg. Flow Depth=0.16' Max Vel=2.80 fps Inflow=4.69 cfs 0.058 af n=0.025 L=90.0' S=0.0270 '/' Capacity=109.09 cfs Outflow=4.75 cfs 0.058 af
<b>Reach 5R: OVERLANDFLOW</b>	Avg. Flow Depth=0.04' Max Vel=1.43 fps Inflow=0.64 cfs 0.009 af n=0.025 L=100.0' S=0.0416 '/' Capacity=135.41 cfs Outflow=0.60 cfs 0.009 af
<b>Reach 6R: OVERLANDFLOW</b>	Avg. Flow Depth=0.13' Max Vel=3.01 fps Inflow=2.02 cfs 0.176 af n=0.025 L=100.0' S=0.0450 '/' Capacity=80.01 cfs Outflow=2.04 cfs 0.176 af
<b>Pond 1P: 15" RCP</b>	Peak Elev=309.60' Inflow=4.80 cfs 0.541 af 15.0" Round Culvert n=0.011 L=111.0' S=0.0317 '/' Outflow=4.80 cfs 0.541 af
<b>Pond 3P: CB</b>	Peak Elev=321.11' Storage=167 cf Inflow=5.49 cfs 0.463 af Primary=1.92 cfs 0.380 af Secondary=3.82 cfs 0.082 af Outflow=5.68 cfs 0.462 af
<b>Pond 4P: 15" RCP</b>	Peak Elev=309.08' Storage=6 cf Inflow=0.86 cfs 0.062 af Primary=0.86 cfs 0.062 af Secondary=0.00 cfs 0.000 af Outflow=0.86 cfs 0.062 af
<b>Pond 5P: 18" RCP</b>	Peak Elev=308.51' Storage=2,360 cf Inflow=15.91 cfs 5.514 af 18.0" Round Culvert n=0.011 L=112.5' S=0.0096 '/' Outflow=13.14 cfs 5.514 af
<b>Pond 6P: 24" RCP</b>	Peak Elev=308.74' Storage=65,210 cf Inflow=24.71 cfs 4.089 af Primary=10.62 cfs 4.056 af Secondary=0.00 cfs 0.000 af Outflow=10.62 cfs 4.028 af
<b>Pond 7P: RCB</b>	Peak Elev=311.06' Storage=123 cf Inflow=5.82 cfs 0.565 af Primary=3.79 cfs 0.387 af Secondary=2.02 cfs 0.176 af Outflow=5.81 cfs 0.563 af
<b>Pond 8P: RCB</b>	Peak Elev=315.86' Storage=204 cf Inflow=9.23 cfs 0.529 af Primary=4.71 cfs 0.471 af Secondary=4.69 cfs 0.058 af Outflow=9.40 cfs 0.528 af
<b>Pond 9P: RCB</b>	Peak Elev=319.89' Storage=123 cf Inflow=7.07 cfs 0.362 af Primary=1.14 cfs 0.230 af Secondary=6.02 cfs 0.132 af Outflow=7.13 cfs 0.361 af
<b>Pond 10P: CB</b>	Peak Elev=317.50' Storage=671 cf Inflow=4.20 cfs 0.588 af Primary=3.12 cfs 0.579 af Secondary=0.64 cfs 0.009 af Outflow=3.75 cfs 0.588 af
<b>Pond 11P: 15" HDPE</b>	Peak Elev=325.57' Inflow=3.14 cfs 0.228 af 15.0" Round Culvert n=0.011 L=41.0' S=0.0707 '/' Outflow=3.14 cfs 0.228 af
<b>Link A: MAP 15 LOT 233</b>	Inflow=13.14 cfs 5.514 af Primary=13.14 cfs 5.514 af
<b>Link B: MAP 17 LOT 25</b>	Inflow=2.19 cfs 0.184 af Primary=2.19 cfs 0.184 af
<b>Link C: PAGE ROAD</b>	Inflow=1.74 cfs 0.161 af Primary=1.74 cfs 0.161 af
<b>Link D: MAMMOTHROAD</b>	Primary=0.00 cfs 0.000 af

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Link E: MAP 17 LOT 7

Primary=0.00 cfs 0.000 af

Link F: MAP 15 LOT 239

Primary=0.00 cfs 0.000 af

Link G: MAP 15 LOT 238

Primary=0.00 cfs 0.000 af

Link H: MAP 15 LOT 240

Primary=0.00 cfs 0.000 af

Link I: MAP 15 LOT 241

Primary=0.00 cfs 0.000 af

Link J: MAP 15 LOT 231

Primary=0.00 cfs 0.000 af

Link K: MAP 15 LOT 232

Primary=0.00 cfs 0.000 af

Link L: MAP 15 LOT 234

Inflow=4.80 cfs 0.541 af  
Primary=4.80 cfs 0.541 af

Link M: ROCKINGHAMROAD

Inflow=1.14 cfs 0.096 af  
Primary=1.14 cfs 0.096 af

Total Runoff Area = 25.23 ac Runoff Volume = 6.189 af Average Runoff Depth = 2.94"  
79.17% Pervious = 19.97 ac 20.83% Impervious = 5.26 ac

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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**Summary for Subcatchment 1S: WATERSHED**

Runoff = 2.19 cfs @ 12.15 hrs, Volume= 0.184 af, Depth> 2.53"  
 Routed to Link B : MAP 17 LOT 25

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
33,555	70	Woods, Good, HSG C
2,152	77	Woods, Good, HSG D
2,283	74	>75% Grass cover, Good, HSG C
37,990	71	Weighted Average
37,990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0600	0.10		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
2.1	188	0.0850	1.46		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.5	238	Total			

**Summary for Subcatchment 2S: WATERSHED**

Runoff = 1.74 cfs @ 12.20 hrs, Volume= 0.161 af, Depth> 2.79"  
 Routed to Link C : PAGE ROAD

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
16,741	70	Woods, Good, HSG C
290	77	Woods, Good, HSG D
10,410	74	>75% Grass cover, Good, HSG C
* 1,878	98	Paved parking
* 803	98	Roofs
30,122	74	Weighted Average
27,441		91.10% Pervious Area
2,681		8.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0250	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
2.3	150	0.0490	1.11		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
14.2	200	Total			

**Summary for Subcatchment 3S: WATERSHED**

Runoff = 2.71 cfs @ 12.17 hrs, Volume= 0.235 af, Depth> 3.36"  
 Routed to Pond 3P : CB

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
8,219	70	Woods, Good, HSG C
18,018	74	>75% Grass cover, Good, HSG C
* 9,019	98	Paved parking
* 1,315	98	Roofs
36,571	80	Weighted Average
26,237		71.74% Pervious Area
10,334		28.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.0100	0.11		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.89"
1.2	50	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.1	20	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.4	37	0.0400	1.40		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
2.4	160	0.0500	1.12		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.9	317	Total			

**Summary for Subcatchment 4S: WATERSHED**

Runoff = 0.86 cfs @ 12.09 hrs, Volume= 0.062 af, Depth> 2.80"  
 Routed to Pond 4P : 15" RCP

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
569	55	Woods, Good, HSG B
195	70	Woods, Good, HSG C
6,900	61	>75% Grass cover, Good, HSG B
* 4,005	98	Paved parking
11,669	74	Weighted Average
7,664		65.68% Pervious Area
4,005		34.32% Impervious Area

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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

**Summary for Subcatchment 5S: WATERSHED**

Runoff = 2.47 cfs @ 12.14 hrs, Volume= 0.204 af, Depth> 2.44"  
Routed to Pond 5P : 18" RCP

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
9,648	55	Woods, Good, HSG B
851	77	Woods, Good, HSG D
21,775	61	>75% Grass cover, Good, HSG B
* 11,364	98	Paved parking
43,638	70	Weighted Average
32,274		73.96% Pervious Area
11,364		26.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0600	0.10		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
1.3	100	0.0700	1.32		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
9.7	150	Total			

**Summary for Subcatchment 6S: WATERSHED**

Runoff = 23.71 cfs @ 12.66 hrs, Volume= 3.730 af, Depth> 3.05"  
Routed to Pond 6P : 24" RCP

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
79,545	55	Woods, Good, HSG B
189,214	70	Woods, Good, HSG C
87,572	77	Woods, Good, HSG D
7,600	61	>75% Grass cover, Good, HSG B
95,398	74	>75% Grass cover, Good, HSG C
17,469	80	>75% Grass cover, Good, HSG D
* 78,900	98	Paved parking
* 83,477	98	Roofs
639,175	77	Weighted Average
476,798		74.60% Pervious Area
162,377		25.40% Impervious Area

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0300	0.08		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
37.0	1,266	0.0130	0.57		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
48.0	1,316	Total			

**Summary for Subcatchment 7S: WATERSHED**

Runoff = 1.11 cfs @ 12.16 hrs, Volume= 0.093 af, Depth> 2.71"  
Routed to Pond 7P : RCB

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
12,181	70	Woods, Good, HSG C
4,506	74	>75% Grass cover, Good, HSG C
* 1,325	98	Paved parking
18,012	73	Weighted Average
16,687		92.64% Pervious Area
1,325		7.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0400	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.89"
1.8	130	0.0310	1.23		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
4.4	267	0.0410	1.01		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.7	447	Total			

**Summary for Subcatchment 8S: WATERSHED**

Runoff = 2.18 cfs @ 12.12 hrs, Volume= 0.168 af, Depth> 2.89"  
Routed to Pond 8P : RCB

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
684	70	Woods, Good, HSG C
28,552	74	>75% Grass cover, Good, HSG C
* 187	98	Paved parking
* 926	98	Roofs
30,349	75	Weighted Average
29,236		96.33% Pervious Area
1,113		3.67% Impervious Area

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Type III 24-hr 25-yr Rainfall=5.54"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0400	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.89"
3.5	272	0.0350	1.31		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
8.0	322	Total			

**Summary for Subcatchment 9S: WATERSHED**

Runoff = 3.58 cfs @ 12.12 hrs, Volume= 0.280 af, Depth> 3.08"  
Routed to Pond 9P : RCB

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
2,126	70	Woods, Good, HSG C
39,624	74	>75% Grass cover, Good, HSG C
* 1,971	98	Paved parking
* 3,795	98	Roofs
47,516	77	Weighted Average
41,750		87.87% Pervious Area
5,766		12.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.0200	0.14		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.89"
0.1	20	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.4	205	0.0400	1.40		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
8.4	275	Total			

**Summary for Subcatchment 10S: WATERSHED**

Runoff = 2.39 cfs @ 12.17 hrs, Volume= 0.208 af, Depth> 2.98"  
Routed to Pond 10P : CB

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 25-yr Rainfall=5.54"

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Type III 24-hr 25-yr Rainfall=5.54"

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Area (sf)	CN	Description
13,784	70	Woods, Good, HSG C
17,139	74	>75% Grass cover, Good, HSG C
* 5,520	98	Paved parking
36,443	76	Weighted Average
30,923		84.85% Pervious Area
5,520		15.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0630	0.10		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
3.8	183	0.0260	0.81		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
12.0	233	Total			

**Summary for Subcatchment 11S: WATERSHED**

Runoff = 3.14 cfs @ 12.09 hrs, Volume= 0.228 af, Depth> 3.46"  
Routed to Pond 11P : 15" HDPE

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
23,883	74	>75% Grass cover, Good, HSG C
* 7,832	98	Paved parking
* 2,719	98	Roofs
34,434	81	Weighted Average
23,883		69.36% Pervious Area
10,551		30.64% Impervious Area

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

**Summary for Subcatchment 12S: WATERSHED**

Runoff = 4.80 cfs @ 12.33 hrs, Volume= 0.541 af, Depth> 2.61"  
Routed to Pond 1P : 15" RCP

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 25-yr Rainfall=5.54"

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Type III 24-hr 25-yr Rainfall=5.54"

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Area (sf)	CN	Description
5,672	55	Woods, Good, HSG B
76,778	70	Woods, Good, HSG C
12,194	61	>75% Grass cover, Good, HSG B
13,674	98	Paved parking, HSG C
108,318	72	Weighted Average
94,644		87.38% Pervious Area
13,674		12.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0400	0.08		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
13.3	455	0.0130	0.57		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
23.1	505	Total			

**Summary for Subcatchment 13S: WATERSHED**

Runoff = 1.14 cfs @ 12.15 hrs, Volume= 0.096 af, Depth> 2.02"  
Routed to Link M : ROCKINGHAM ROAD

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
8,416	55	Woods, Good, HSG B
15,374	70	Woods, Good, HSG C
774	61	>75% Grass cover, Good, HSG B
* 268	98	Paved parking
24,832	65	Weighted Average
24,564		98.92% Pervious Area
268		1.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0600	0.10		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
1.3	100	0.0700	1.32		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
9.7	150	Total			

**Summary for Reach 1R: ROADSIDE SWALE**

Inflow Area = 2.47 ac, 24.57% Impervious, Inflow Depth > 3.14" for 25-yr event  
Inflow = 7.80 cfs @ 12.15 hrs, Volume= 0.645 af  
Outflow = 7.41 cfs @ 12.17 hrs, Volume= 0.644 af, Atten= 5%, Lag= 1.4 min  
Routed to Pond 5P : 18" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3

Max. Velocity= 2.88 fps, Min. Travel Time= 2.1 min

Avg. Velocity = 0.88 fps, Avg. Travel Time= 6.9 min

Peak Storage= 920 cf @ 12.17 hrs

Average Depth at Peak Storage= 0.24' , Surface Width= 11.42'

Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 89.79 cfs

10.00' x 1.00' deep channel, n= 0.025

Side Slope Z-value= 3.0 ' / ' Top Width= 16.00'

Length= 363.0' Slope= 0.0183 ' / '

Inlet Invert= 313.24', Outlet Invert= 306.60'



**Summary for Reach 2R: OVERLAND FLOW**

Inflow = 3.82 cfs @ 12.11 hrs, Volume= 0.082 af

Outflow = 3.54 cfs @ 12.13 hrs, Volume= 0.082 af, Atten= 7%, Lag= 1.4 min

Routed to Pond 9P : RCB

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3

Max. Velocity= 1.95 fps, Min. Travel Time= 1.4 min

Avg. Velocity = 0.68 fps, Avg. Travel Time= 3.9 min

Peak Storage= 289 cf @ 12.13 hrs

Average Depth at Peak Storage= 0.17' , Surface Width= 11.03'

Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 73.48 cfs

10.00' x 1.00' deep channel, n= 0.025

Side Slope Z-value= 3.0 ' / ' Top Width= 16.00'

Length= 160.0' Slope= 0.0122 ' / '

Inlet Invert= 320.75', Outlet Invert= 318.79'



**Summary for Reach 3R: OVERLAND FLOW**

Inflow = 6.02 cfs @ 12.13 hrs, Volume= 0.132 af  
Outflow = 6.01 cfs @ 12.14 hrs, Volume= 0.132 af, Atten= 0%, Lag= 0.5 min  
Routed to Pond 8P : RCB

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
Max. Velocity= 3.68 fps, Min. Travel Time= 0.7 min  
Avg. Velocity = 1.43 fps, Avg. Travel Time= 1.7 min

Peak Storage= 244 cf @ 12.14 hrs  
Average Depth at Peak Storage= 0.28' , Surface Width= 6.67'  
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 60.51 cfs

5.00' x 1.00' deep channel, n= 0.025  
Side Slope Z-value= 3.0 ' ' Top Width= 11.00'  
Length= 150.0' Slope= 0.0257 ' '  
Inlet Invert= 319.25', Outlet Invert= 315.39'



**Summary for Reach 4R: OVERLAND FLOW**

Inflow = 4.69 cfs @ 12.12 hrs, Volume= 0.058 af  
Outflow = 4.75 cfs @ 12.15 hrs, Volume= 0.058 af, Atten= 0%, Lag= 1.5 min  
Routed to Reach 1R : ROADSIDE SWALE

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
Max. Velocity= 2.80 fps, Min. Travel Time= 0.5 min  
Avg. Velocity = 1.17 fps, Avg. Travel Time= 1.3 min

Peak Storage= 153 cf @ 12.15 hrs  
Average Depth at Peak Storage= 0.16' , Surface Width= 10.97'  
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 109.09 cfs

10.00' x 1.00' deep channel, n= 0.025  
Side Slope Z-value= 3.0 ' ' Top Width= 16.00'  
Length= 90.0' Slope= 0.0270 ' '  
Inlet Invert= 315.67', Outlet Invert= 313.24'



Summary for Reach 5R: OVERLAND FLOW

Inflow = 0.64 cfs @ 12.27 hrs, Volume= 0.009 af  
Outflow = 0.60 cfs @ 12.29 hrs, Volume= 0.009 af, Atten= 5%, Lag= 1.2 min  
Routed to Reach 1R : ROADSIDE SWALE

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
Max. Velocity= 1.43 fps, Min. Travel Time= 1.2 min  
Avg. Velocity = 0.84 fps, Avg. Travel Time= 2.0 min

Peak Storage= 42 cf @ 12.29 hrs  
Average Depth at Peak Storage= 0.04' , Surface Width= 10.25'  
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 135.41 cfs

10.00' x 1.00' deep channel, n= 0.025  
Side Slope Z-value= 3.0 ' / ' Top Width= 16.00'  
Length= 100.0' Slope= 0.0416 ' / '  
Inlet Invert= 317.40', Outlet Invert= 313.24'



Summary for Reach 6R: OVERLAND FLOW

Inflow = 2.02 cfs @ 12.18 hrs, Volume= 0.176 af  
Outflow = 2.04 cfs @ 12.10 hrs, Volume= 0.176 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond 6P : 24" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
Max. Velocity= 3.01 fps, Min. Travel Time= 0.6 min  
Avg. Velocity = 0.89 fps, Avg. Travel Time= 1.9 min

Peak Storage= 68 cf @ 12.10 hrs  
Average Depth at Peak Storage= 0.13' , Surface Width= 5.75'  
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 80.01 cfs

5.00' x 1.00' deep channel, n= 0.025  
Side Slope Z-value= 3.0 ' / ' Top Width= 11.00'  
Length= 100.0' Slope= 0.0450 ' / '  
Inlet Invert= 310.74', Outlet Invert= 306.24'



**Summary for Pond 1P: 15" RCP**

Inflow Area = 2.49 ac, 12.62% Impervious, Inflow Depth > 2.61" for 25-yr event  
 Inflow = 4.80 cfs @ 12.33 hrs, Volume= 0.541 af  
 Outflow = 4.80 cfs @ 12.33 hrs, Volume= 0.541 af, Atten= 0%, Lag= 0.0 min  
 Primary = 4.80 cfs @ 12.33 hrs, Volume= 0.541 af  
 Routed to Link L : MAP 15 LOT 234

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 309.60' @ 12.33 hrs  
 Flood Elev= 312.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	308.31'	<b>15.0" Round Culvert</b> L= 111.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 308.31' / 304.79' S= 0.0317 ' / Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf

Primary OutFlow Max=4.77 cfs @ 12.33 hrs HW=309.59' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 4.77 cfs @ 3.89 fps)

**Summary for Pond 3P: CB**

Inflow Area = 1.63 ac, 29.41% Impervious, Inflow Depth > 3.41" for 25-yr event  
 Inflow = 5.49 cfs @ 12.11 hrs, Volume= 0.463 af  
 Outflow = 5.68 cfs @ 12.11 hrs, Volume= 0.462 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.92 cfs @ 11.97 hrs, Volume= 0.380 af  
 Routed to Pond 10P : CB  
 Secondary = 3.82 cfs @ 12.11 hrs, Volume= 0.082 af  
 Routed to Reach 2R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 321.11' @ 12.11 hrs Surf.Area= 356 sf Storage= 167 cf  
 Flood Elev= 321.00' Surf.Area= 356 sf Storage= 167 cf

Plug-Flow detention time=2.6 min calculated for 0.461 af (100% of inflow)  
 Center-of-Mass det. time= 1.1 min ( 819.1 - 818.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	319.10'	16 cf	<b>4.00'D x 1.25'H Vertical Cone/Cylinder</b>
#2	319.10'	151 cf	<b>Custom Stage Data (Prismatic) Listed below (Recalc)</b>
		167 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
319.10	5	0	0
320.50	65	49	49
321.00	343	102	151

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Type III 24-hr 25-yr Rainfall=5.54"

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Device	Routing	Invert	Outlet Devices
#1	Primary	319.10'	<b>8.0" Round Culvert</b> L= 228.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 319.10' / 314.83' S= 0.0187 '/ Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	320.27'	<b>24.0" x 24.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Secondary	320.75'	<b>8.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=1.91 cfs @ 11.97 hrs HW=320.85' TW=316.76' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 1.91 cfs @ 5.47 fps)

↑2=Grate (Passes 1.91 cfs of 11.56 cfs potential flow)

Secondary OutFlow Max=3.67 cfs @ 12.11 hrs HW=321.10' TW=320.92' (Dynamic Tailwater)

↑3=Broad-Crested Rectangular Weir(Weir Controls 3.67 cfs @ 1.30 fps)

**Summary for Pond 4P: 15" RCP**

Inflow Area = 0.27 ac, 34.32% Impervious, Inflow Depth > 2.80" for 25-yr event  
 Inflow = 0.86 cfs @ 12.09 hrs, Volume= 0.062 af  
 Outflow = 0.86 cfs @ 12.10 hrs, Volume= 0.062 af, Atten= 0%, Lag= 0.1 min  
 Primary = 0.86 cfs @ 12.10 hrs, Volume= 0.062 af  
 Routed to Pond 5P : 18" RCP  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Pond 5P : 18" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3

Peak Elev= 309.08' @ 12.10 hrs Surf.Area= 31 sf Storage= 6 cf

Flood Elev= 311.00' Surf.Area= 730 sf Storage= 593 cf

Plug-Flow detention time= 0.2 min calculated for 0.062 af (100% of inflow)

Center-of-Mass det. time= 0.2 min ( 832.1 - 831.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	308.62'	593 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
308.62	5	0	0
309.00	16	4	4
310.00	216	116	120
311.00	730	473	593

Device	Routing	Invert	Outlet Devices
#1	Primary	308.64'	<b>15.0" Round Culvert</b> L= 24.6' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 308.64' / 306.60' S= 0.0829 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#2	Secondary	310.96'	<b>2.0' long x 25.0' breadth Broad-Crested Rectangular Weir</b>

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60  
 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.85 cfs @ 12.10 hrs HW=309.07' TW=307.61' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.85 cfs @ 2.25 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=308.62' TW=305.37' (Dynamic Tailwater)  
 ↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

**Summary for Pond 5P: 18" RCP**

Inflow Area = 22.17 ac, 22.26% Impervious, Inflow Depth > 2.98" for 25-yr event  
 Inflow = 15.91 cfs @ 12.17 hrs, Volume= 5.514 af  
 Outflow = 13.14 cfs @ 12.26 hrs, Volume= 5.514 af, Atten= 17%, Lag= 5.6 min  
 Primary = 13.14 cfs @ 12.26 hrs, Volume= 5.514 af  
 Routed to Link A : MAP 15 LOT 233

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 308.51' @ 12.26 hrs Surf.Area= 2,081 sf Storage= 2,360 cf  
 Flood Elev= 310.88' Surf.Area= 7,537 sf Storage= 12,203 cf

Plug-Flow detention time= 1.4 min calculated for 5.514 af (100% of inflow)  
 Center-of-Mass det. time= 1.4 min ( 899.7 - 898.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	305.37'	13,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
305.37	10	0	0
306.00	92	32	32
307.00	641	367	399
308.00	1,481	1,061	1,460
309.00	2,668	2,075	3,534
310.00	4,275	3,472	7,006
311.00	7,982	6,129	13,134

Device	Routing	Invert	Outlet Devices
#1	Primary	305.37'	<b>18.0" Round Culvert</b> L= 112.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 305.37' / 304.29' S= 0.0096 ' / Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

Primary OutFlow Max=13.10 cfs @ 12.26 hrs HW=308.49' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 13.10 cfs @ 7.41 fps)

**Summary for Pond 6P: 24" RCP**

Inflow Area = 15.55 ac, 23.98% Impervious, Inflow Depth > 3.16" for 25-yr event  
 Inflow = 24.71 cfs @ 12.64 hrs, Volume= 4.089 af  
 Outflow = 10.62 cfs @ 13.39 hrs, Volume= 4.028 af, Atten= 57%, Lag= 45.1 min  
 Primary = 10.62 cfs @ 13.39 hrs, Volume= 4.056 af  
     Routed to Pond 5P : 18" RCP  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
     Routed to Pond 5P : 18" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 308.74' @ 13.34 hrs Surf.Area= 44,481 sf Storage= 65,210 cf  
 Flood Elev= 311.00' Surf.Area= 73,507 sf Storage= 196,526 cf

Plug-Flow detention time= 75.5 min calculated for 4.020 af (98% of inflow)  
 Center-of-Mass det. time= 67.1 min ( 922.4 - 855.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	306.24'	196,526 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.24	4,300	0	0
308.00	35,858	35,339	35,339
310.00	59,050	94,908	130,247
311.00	73,507	66,279	196,526

Device	Routing	Invert	Outlet Devices
#1	Primary	306.24'	<b>24.0" Round Culvert</b> L= 43.9' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 306.24' / 305.70' S= 0.0123 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Secondary	310.88'	<b>6.0' long x 30.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Primary OutFlow** Max=10.63 cfs @ 13.39 hrs HW=308.74' TW=308.25' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 10.63 cfs @ 3.38 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=306.24' TW=305.37' (Dynamic Tailwater)  
 ↑2=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Summary for Pond 7P: RCB**

Inflow Area = 2.20 ac, 8.56% Impervious, Inflow Depth > 3.08" for 25-yr event  
 Inflow = 5.82 cfs @ 12.15 hrs, Volume= 0.565 af  
 Outflow = 5.81 cfs @ 12.18 hrs, Volume= 0.563 af, Atten= 0%, Lag= 1.4 min  
 Primary = 3.79 cfs @ 12.18 hrs, Volume= 0.387 af  
     Routed to Pond 5P : 18" RCP  
 Secondary = 2.02 cfs @ 12.18 hrs, Volume= 0.176 af  
     Routed to Reach 6R : OVERLAND FLOW

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 311.06' @ 12.18 hrs Surf.Area= 521 sf Storage= 123 cf  
 Flood Elev= 311.00' Surf.Area= 521 sf Storage= 123 cf

Plug-Flow detention time=2.2 min calculated for 0.562 af (100% of inflow)  
 Center-of-Mass det. time= 0.8 min ( 827.6 - 826.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	306.24'	57 cf	<b>4.00'D x 4.50'H Vertical Cone/Cylinder</b>
#2	310.74'	67 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
		123 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
310.74	5	0	0
311.00	508	67	67

Device	Routing	Invert	Outlet Devices
#1	Primary	306.24'	<b>12.0" Round Culvert</b> L= 44.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 306.24' / 305.82' S= 0.0095 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	310.74'	<b>24.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Secondary	310.75'	<b>5.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=3.76 cfs @ 12.18 hrs HW=311.06' TW=308.23' (Dynamic Tailwater)

↑1=Culvert (Passes 3.76 cfs of 6.37 cfs potential flow)

↑2=Grate (Weir Controls 3.76 cfs @ 1.86 fps)

**Secondary OutFlow** Max=2.01 cfs @ 12.18 hrs HW=311.06' TW=310.86' (Dynamic Tailwater)

↑3=Broad-Crested Rectangular Weir(Weir Controls 2.01 cfs @ 1.28 fps)

**Summary for Pond 8P: RCB**

Inflow Area = 1.79 ac, 8.83% Impervious, Inflow Depth > 3.55" for 25-yr event  
 Inflow = 9.23 cfs @ 12.14 hrs, Volume= 0.529 af  
 Outflow = 9.40 cfs @ 12.12 hrs, Volume= 0.528 af, Atten= 0%, Lag= 0.0 min  
 Primary = 4.71 cfs @ 12.14 hrs, Volume= 0.471 af  
     Routed to Pond 7P : RCB  
 Secondary = 4.69 cfs @ 12.12 hrs, Volume= 0.058 af  
     Routed to Reach 4R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 315.86' @ 12.14 hrs Surf.Area= 480 sf Storage= 204 cf  
 Flood Elev= 316.00' Surf.Area= 614 sf Storage= 278 cf

Plug-Flow detention time=1.4 min calculated for 0.527 af (100% of inflow)  
 Center-of-Mass det. time= 0.6 min ( 814.5 - 813.9 )

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

Volume	Invert	Avail.Storage	Storage Description
#1	315.39'	186 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
#2	308.11'	91 cf	<b>4.00'D x 7.28'H Vertical Cone/Cylinder</b>
		278 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
315.39	10	0	0
316.00	601	186	186

Device	Routing	Invert	Outlet Devices
#1	Primary	308.11'	<b>12.0" Round Culvert</b> L= 315.8' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 308.11' / 306.28' S= 0.0058 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Secondary	315.67'	<b>35.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Primary OutFlow** Max=4.71 cfs @ 12.14 hrs HW=315.86' TW=311.06' (Dynamic Tailwater)  
 ↑1=Culvert (Outlet Controls 4.71 cfs @ 5.99 fps)

**Secondary OutFlow** Max=4.22 cfs @ 12.12 hrs HW=315.85' TW=315.81' (Dynamic Tailwater)  
 ↑2=Broad-Crested Rectangular Weir(Weir Controls 4.22 cfs @ 0.66 fps)

**Summary for Pond 9P: RCB**

Inflow Area = 1.09 ac, 12.13% Impervious, Inflow Depth > 3.98" for 25-yr event  
 Inflow = 7.07 cfs @ 12.13 hrs, Volume= 0.362 af  
 Outflow = 7.13 cfs @ 12.13 hrs, Volume= 0.361 af, Atten= 0%, Lag= 0.3 min  
 Primary = 1.14 cfs @ 12.36 hrs, Volume= 0.230 af  
 Routed to Pond 8P : RCB  
 Secondary = 6.02 cfs @ 12.13 hrs, Volume= 0.132 af  
 Routed to Reach 3R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 319.89' @ 12.13 hrs Surf.Area= 213 sf Storage= 123 cf  
 Flood Elev= 319.50' Surf.Area= 213 sf Storage= 123 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 0.5 min ( 805.7 - 805.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	318.78'	111 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
#2	317.84'	12 cf	<b>4.00'D x 0.95'H Vertical Cone/Cylinder</b>
		123 cf	Total Available Storage

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
318.78	5	0	0
319.00	168	19	19
319.50	200	92	111

Device	Routing	Invert	Outlet Devices
#1	Primary	317.84'	<b>6.0" Round Culvert</b> L= 141.2' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 317.84' / 314.02' S= 0.0271 ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	318.79'	<b>24.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Secondary	319.25'	<b>5.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=1.14 cfs @ 12.36 hrs HW=319.55' TW=314.96' (Dynamic Tailwater)

- ↑1=Culvert (Inlet Controls 1.14 cfs @ 5.82 fps)
- ↑2=Orifice/Grate (Passes 1.14 cfs of 13.22 cfs potential flow)

Secondary OutFlow Max=5.83 cfs @ 12.13 hrs HW=319.87' TW=319.52' (Dynamic Tailwater)

- ↑3=Broad-Crested Rectangular Weir (Weir Controls 5.83 cfs @ 1.87 fps)

**Summary for Pond 10P: CB**

Inflow Area = 2.47 ac, 24.57% Impervious, Inflow Depth > 2.86" for 25-yr event  
 Inflow = 4.20 cfs @ 12.16 hrs, Volume= 0.588 af  
 Outflow = 3.75 cfs @ 12.27 hrs, Volume= 0.588 af, Atten= 11%, Lag= 6.1 min  
 Primary = 3.12 cfs @ 12.27 hrs, Volume= 0.579 af  
 Routed to Reach 1R : ROADSIDE SWALE  
 Secondary = 0.64 cfs @ 12.27 hrs, Volume= 0.009 af  
 Routed to Reach 5R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 317.50' @ 12.27 hrs Surf.Area= 1,955 sf Storage= 671 cf  
 Flood Elev= 317.50' Surf.Area= 1,972 sf Storage= 681 cf

Plug-Flow detention time=(not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 1.0 min ( 836.9 - 836.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	314.53'	24 cf	<b>4.00'D x 1.91'H Vertical Cone/Cylinder</b>
#2	316.44'	657 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
		681 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
316.44	5	0	0
317.00	312	89	89
317.50	1,959	568	657

**2101131-PRE-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Device	Routing	Invert	Outlet Devices
#1	Primary	314.53'	<b>12.0" Round Culvert</b> L= 101.8' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 314.53' / 313.24' S= 0.0127 '/ Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Device 1	316.44'	<b>24.0" x 24.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Secondary	317.40'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=3.11 cfs @ 12.27 hrs HW=317.49' TW=313.44' (Dynamic Tailwater)

↑1=Culvert (Barrel Controls 3.11 cfs @ 3.96 fps)

↑2=Grate (Passes 3.11 cfs of 19.74 cfs potential flow)

Secondary OutFlow Max=0.60 cfs @ 12.27 hrs HW=317.49' TW=317.44' (Dynamic Tailwater)

↑3=Broad-Crested Rectangular Weir(Weir Controls 0.60 cfs @ 0.66 fps)

**Summary for Pond 11P: 15" HDPE**

Inflow Area = 0.79 ac, 30.64% Impervious, Inflow Depth > 3.46" for 25-yr event  
 Inflow = 3.14 cfs @ 12.09 hrs, Volume= 0.228 af  
 Outflow = 3.14 cfs @ 12.09 hrs, Volume= 0.228 af, Atten= 0%, Lag= 0.0 min  
 Primary = 3.14 cfs @ 12.09 hrs, Volume= 0.228 af  
 Routed to Pond 3P : CB

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 325.57' @ 12.09 hrs  
 Flood Elev= 326.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	324.65'	<b>15.0" Round Culvert</b> L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 324.65' / 321.75' S= 0.0707 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf

Primary OutFlow Max=3.07 cfs @ 12.09 hrs HW=325.55' TW=321.09' (Dynamic Tailwater)

↑1=Culvert (Inlet Controls 3.07 cfs @ 3.24 fps)

**Summary for Link A: MAP 15 LOT 233**

Inflow Area = 22.17 ac, 22.26% Impervious, Inflow Depth > 2.98" for 25-yr event  
 Inflow = 13.14 cfs @ 12.26 hrs, Volume= 5.514 af  
 Primary = 13.14 cfs @ 12.26 hrs, Volume= 5.514 af, Atten= 0%, Lag= 0.0 min

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

**Summary for Link B: MAP 17 LOT 25**

Inflow Area = 0.87 ac, 0.00% Impervious, Inflow Depth > 2.53" for 25-yr event  
Inflow = 2.19 cfs @ 12.15 hrs, Volume= 0.184 af  
Primary = 2.19 cfs @ 12.15 hrs, Volume= 0.184 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond 6P : 24" RCP

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

**Summary for Link C: PAGE ROAD**

Inflow Area = 0.69 ac, 8.90% Impervious, Inflow Depth > 2.79" for 25-yr event  
Inflow = 1.74 cfs @ 12.20 hrs, Volume= 0.161 af  
Primary = 1.74 cfs @ 12.20 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond 5P : 18" RCP

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

**Summary for Link D: MAMMOTH ROAD**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link E: MAP 17 LOT 7**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link F: MAP 15 LOT 239**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link G: MAP 15 LOT 238**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link H: MAP 15 LOT 240**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link I: MAP 15 LOT 241**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link J: MAP 15 LOT 231**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link K: MAP 15 LOT 232**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link L: MAP 15 LOT 234**

Inflow Area = 2.49 ac, 12.62% Impervious, Inflow Depth > 2.61" for 25-yr event

Inflow = 4.80 cfs @ 12.33 hrs, Volume= 0.541 af

Primary = 4.80 cfs @ 12.33 hrs, Volume= 0.541 af, Atten= 0%, Lag= 0.0 min

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

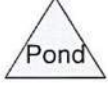
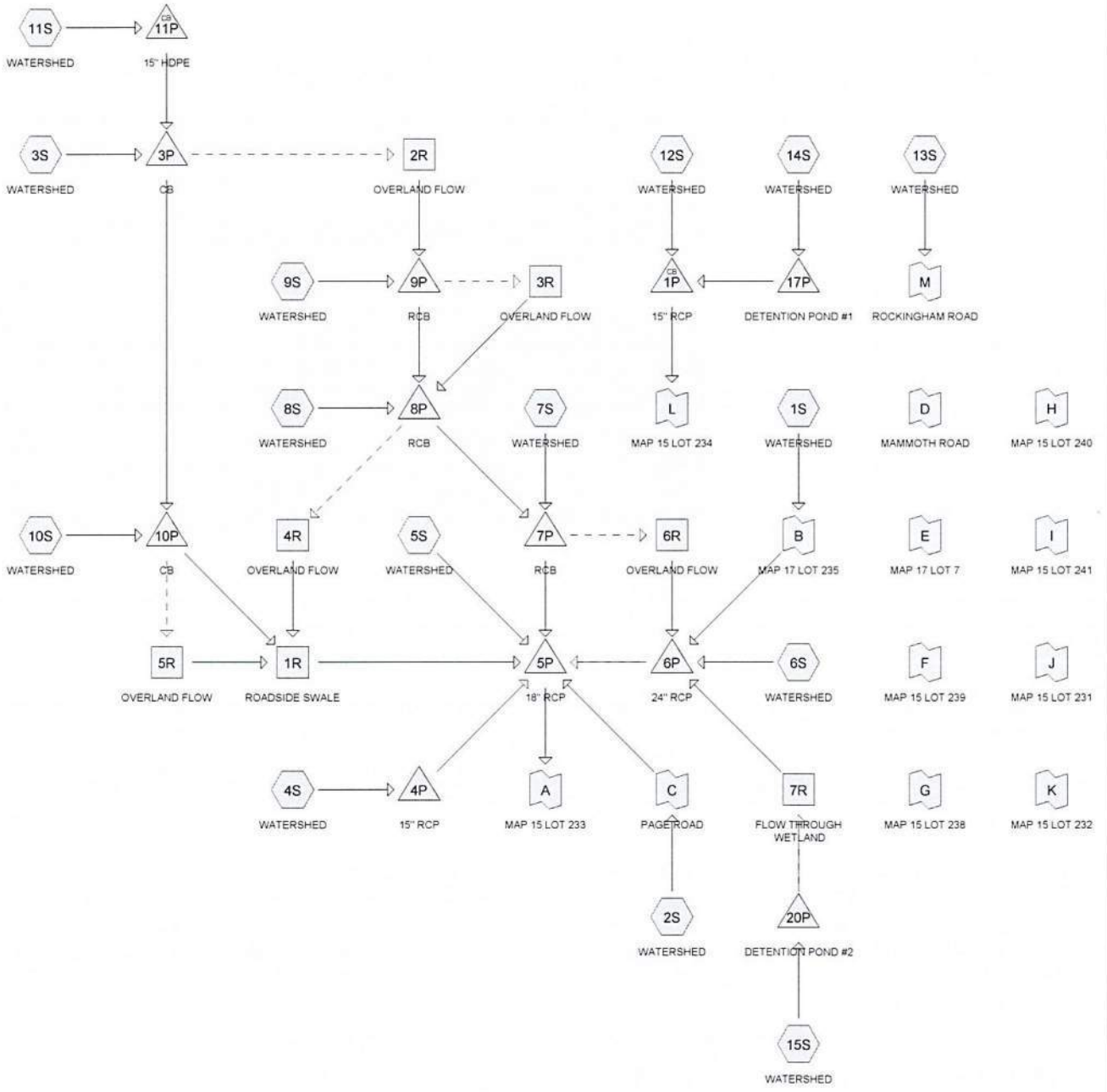
**Summary for Link M: ROCKINGHAM ROAD**

Inflow Area = 0.57 ac, 1.08% Impervious, Inflow Depth > 2.02" for 25-yr event

Inflow = 1.14 cfs @ 12.15 hrs, Volume= 0.096 af

Primary = 1.14 cfs @ 12.15 hrs, Volume= 0.096 af, Atten= 0%, Lag= 0.0 min

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



Routing Diagram for 2101131-POST-DEVELOPMENT\_REV2, Revised November 25, 2025  
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### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.113	61	>75% Grass cover, Good, HSG B (4S, 5S, 6S, 12S, 13S, 14S)
6.169	74	>75% Grass cover, Good, HSG C (1S, 2S, 3S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 14S, 15S)
0.401	80	>75% Grass cover, Good, HSG D (6S)
0.119	100	Open water (14S, 15S)
3.520	98	Paved parking (2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S)
0.033	98	Rip rap (14S)
0.033	98	Riprap (15S)
2.478	98	Roofs (2S, 3S, 6S, 8S, 9S, 11S, 12S, 14S, 15S)
2.332	55	Woods, Good, HSG B (4S, 5S, 6S, 12S, 13S, 14S)
6.950	70	Woods, Good, HSG C (1S, 2S, 3S, 6S, 7S, 8S, 9S, 10S, 12S, 13S, 14S)
2.086	77	Woods, Good, HSG D (1S, 2S, 5S, 6S)
<b>25.232</b>	<b>77</b>	<b>TOTAL AREA</b>

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**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.445	HSG B	4S, 5S, 6S, 12S, 13S, 14S
13.119	HSG C	1S, 2S, 3S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S
2.487	HSG D	1S, 2S, 5S, 6S
6.182	Other	2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 13S, 14S, 15S
<b>25.232</b>		<b>TOTAL AREA</b>

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points x 3  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>Subcatchment1S: WATERSHED</b>	Runoff Area=37,990 sf 0.00% Impervious Runoff Depth>2.53" Flow Length=238' Tc=10.5 min CN=71 Runoff=2.19 cfs 0.184 af
<b>Subcatchment2S: WATERSHED</b>	Runoff Area=30,122 sf 8.90% Impervious Runoff Depth>2.79" Flow Length=200' Tc=14.2 min CN=74 Runoff=1.74 cfs 0.161 af
<b>Subcatchment3S: WATERSHED</b>	Runoff Area=36,571 sf 28.26% Impervious Runoff Depth>3.36" Flow Length=317' Tc=11.9 min CN=80 Runoff=2.71 cfs 0.235 af
<b>Subcatchment4S: WATERSHED</b>	Runoff Area=6,682 sf 33.73% Impervious Runoff Depth>2.71" Tc=6.0 min CN=73 Runoff=0.48 cfs 0.035 af
<b>Subcatchment5S: WATERSHED</b>	Runoff Area=43,638 sf 26.04% Impervious Runoff Depth>2.44" Flow Length=150' Tc=9.7 min CN=70 Runoff=2.47 cfs 0.204 af
<b>Subcatchment6S: WATERSHED</b>	Runoff Area=625,621 sf 26.82% Impervious Runoff Depth>3.05" Flow Length=1,316' Tc=48.0 min CN=77 Runoff=23.20 cfs 3.651 af
<b>Subcatchment7S: WATERSHED</b>	Runoff Area=18,012 sf 7.36% Impervious Runoff Depth>2.71" Flow Length=447' Tc=10.7 min CN=73 Runoff=1.11 cfs 0.093 af
<b>Subcatchment8S: WATERSHED</b>	Runoff Area=30,349 sf 3.67% Impervious Runoff Depth>2.89" Flow Length=322' Tc=8.0 min CN=75 Runoff=2.18 cfs 0.168 af
<b>Subcatchment9S: WATERSHED</b>	Runoff Area=47,516 sf 12.13% Impervious Runoff Depth>3.08" Flow Length=275' Tc=8.4 min CN=77 Runoff=3.58 cfs 0.280 af
<b>Subcatchment10S: WATERSHED</b>	Runoff Area=36,443 sf 15.15% Impervious Runoff Depth>2.98" Flow Length=233' Tc=12.0 min CN=76 Runoff=2.39 cfs 0.208 af
<b>Subcatchment11S: WATERSHED</b>	Runoff Area=34,434 sf 30.64% Impervious Runoff Depth>3.46" Tc=6.0 min CN=81 Runoff=3.14 cfs 0.228 af
<b>Subcatchment12S: WATERSHED</b>	Runoff Area=76,641 sf 22.72% Impervious Runoff Depth>2.88" Flow Length=505' Tc=23.1 min CN=75 Runoff=3.78 cfs 0.422 af
<b>Subcatchment13S: WATERSHED</b>	Runoff Area=24,832 sf 1.08% Impervious Runoff Depth>2.02" Flow Length=150' Tc=9.7 min CN=65 Runoff=1.14 cfs 0.096 af
<b>Subcatchment14S: WATERSHED</b>	Runoff Area=23,299 sf 59.41% Impervious Runoff Depth>4.08" Tc=6.0 min CN=87 Runoff=2.44 cfs 0.182 af
<b>Subcatchment15S: WATERSHED</b>	Runoff Area=26,967 sf 70.56% Impervious Runoff Depth>4.50" Tc=6.0 min CN=91 Runoff=3.04 cfs 0.232 af
<b>Reach 1R: ROADSIDESWALE</b>	Avg. Flow Depth=0.24' Max Vel=2.88 fps Inflow=7.80 cfs 0.645 af n=0.025 L=363.0' S=0.0183 '/ Capacity=89.79 cfs Outflow=7.41 cfs 0.644 af

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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<b>Reach 2R: OVERLANDFLOW</b>	Avg. Flow Depth=0.17' Max Vel=1.95 fps Inflow=3.82 cfs 0.082 af n=0.025 L=160.0' S=0.0122 '/' Capacity=73.48 cfs Outflow=3.54 cfs 0.082 af
<b>Reach 3R: OVERLANDFLOW</b>	Avg. Flow Depth=0.28' Max Vel=3.68 fps Inflow=6.02 cfs 0.132 af n=0.025 L=150.0' S=0.0257 '/' Capacity=60.51 cfs Outflow=6.01 cfs 0.132 af
<b>Reach 4R: OVERLANDFLOW</b>	Avg. Flow Depth=0.16' Max Vel=2.80 fps Inflow=4.69 cfs 0.058 af n=0.025 L=90.0' S=0.0270 '/' Capacity=109.09 cfs Outflow=4.75 cfs 0.058 af
<b>Reach 5R: OVERLANDFLOW</b>	Avg. Flow Depth=0.04' Max Vel=1.43 fps Inflow=0.64 cfs 0.009 af n=0.025 L=100.0' S=0.0416 '/' Capacity=135.41 cfs Outflow=0.60 cfs 0.009 af
<b>Reach 6R: OVERLANDFLOW</b>	Avg. Flow Depth=0.13' Max Vel=3.01 fps Inflow=2.02 cfs 0.176 af n=0.025 L=100.0' S=0.0450 '/' Capacity=80.01 cfs Outflow=2.04 cfs 0.176 af
<b>Reach 7R: FLOW THROUGH WETLAND</b>	Avg. Flow Depth=0.06' Max Vel=0.83 fps Inflow=0.50 cfs 0.210 af n=0.025 L=382.0' S=0.0088 '/' Capacity=62.45 cfs Outflow=0.49 cfs 0.209 af
<b>Pond 1P: 15" RCP</b>	Peak Elev=309.59' Inflow=4.79 cfs 0.600 af 15.0" Round Culvert n=0.011 L=111.0' S=0.0317 '/' Outflow=4.79 cfs 0.600 af
<b>Pond 3P: CB</b>	Peak Elev=321.11' Storage=167 cf Inflow=5.49 cfs 0.463 af Primary=1.92 cfs 0.380 af Secondary=3.82 cfs 0.082 af Outflow=5.68 cfs 0.462 af
<b>Pond 4P: 15" RCP</b>	Peak Elev=308.96' Storage=3 cf Inflow=0.48 cfs 0.035 af Primary=0.48 cfs 0.035 af Secondary=0.00 cfs 0.000 af Outflow=0.48 cfs 0.035 af
<b>Pond 5P: 18" RCP</b>	Peak Elev=308.45' Storage=2,244 cf Inflow=15.62 cfs 5.618 af 18.0" Round Culvert n=0.011 L=112.5' S=0.0096 '/' Outflow=12.99 cfs 5.618 af
<b>Pond 6P: 24" RCP</b>	Peak Elev=308.75' Storage=65,566 cf Inflow=24.70 cfs 4.219 af Primary=10.67 cfs 4.188 af Secondary=0.00 cfs 0.000 af Outflow=10.67 cfs 4.155 af
<b>Pond 7P: RCB</b>	Peak Elev=311.06' Storage=123 cf Inflow=5.82 cfs 0.565 af Primary=3.79 cfs 0.387 af Secondary=2.02 cfs 0.176 af Outflow=5.81 cfs 0.563 af
<b>Pond 8P: RCB</b>	Peak Elev=315.86' Storage=204 cf Inflow=9.23 cfs 0.529 af Primary=4.71 cfs 0.471 af Secondary=4.69 cfs 0.058 af Outflow=9.40 cfs 0.528 af
<b>Pond 9P: RCB</b>	Peak Elev=319.89' Storage=123 cf Inflow=7.07 cfs 0.362 af Primary=1.14 cfs 0.230 af Secondary=6.02 cfs 0.132 af Outflow=7.13 cfs 0.361 af
<b>Pond 10P: CB</b>	Peak Elev=317.50' Storage=671 cf Inflow=4.20 cfs 0.588 af Primary=3.12 cfs 0.579 af Secondary=0.64 cfs 0.009 af Outflow=3.75 cfs 0.588 af
<b>Pond 11P: 15" HDPE</b>	Peak Elev=325.57' Inflow=3.14 cfs 0.228 af 15.0" Round Culvert n=0.011 L=41.0' S=0.0707 '/' Outflow=3.14 cfs 0.228 af
<b>Pond 17P: DETENTION POND #1</b>	Peak Elev=310.83' Storage=2,284 cf Inflow=2.44 cfs 0.182 af Outflow=1.01 cfs 0.177 af

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**Pond 20P: DETENTIONPOND #2** Peak Elev=311.52' Storage=4,975 cf Inflow=3.04 cfs 0.232 af  
 Primary=0.50 cfs 0.210 af Secondary=0.00 cfs 0.000 af Outflow=0.50 cfs 0.210 af

**Link A: MAP 15 LOT 233** Inflow=12.99 cfs 5.618 af  
 Primary=12.99 cfs 5.618 af

**Link B: MAP 17 LOT 235** Inflow=2.19 cfs 0.184 af  
 Primary=2.19 cfs 0.184 af

**Link C: PAGE ROAD** Inflow=1.74 cfs 0.161 af  
 Primary=1.74 cfs 0.161 af

**Link D: MAMMOTH ROAD** Primary=0.00 cfs 0.000 af

**Link E: MAP 17 LOT 7** Primary=0.00 cfs 0.000 af

**Link F: MAP 15 LOT 239** Primary=0.00 cfs 0.000 af

**Link G: MAP 15 LOT 238** Primary=0.00 cfs 0.000 af

**Link H: MAP 15 LOT 240** Primary=0.00 cfs 0.000 af

**Link I: MAP 15 LOT 241** Primary=0.00 cfs 0.000 af

**Link J: MAP 15 LOT 231** Primary=0.00 cfs 0.000 af

**Link K: MAP 15 LOT 232** Primary=0.00 cfs 0.000 af

**Link L: MAP 15 LOT 234** Inflow=4.79 cfs 0.600 af  
 Primary=4.79 cfs 0.600 af

**Link M: ROCKINGHAM ROAD** Inflow=1.14 cfs 0.096 af  
 Primary=1.14 cfs 0.096 af

**Total Runoff Area = 25.232 ac Runoff Volume = 6.378 af Average Runoff Depth = 3.03"**  
**75.50% Pervious = 19.050 ac 24.50% Impervious = 6.182 ac**

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**Summary for Subcatchment 1S: WATERSHED**

Runoff = 2.19 cfs @ 12.15 hrs, Volume= 0.184 af, Depth> 2.53"  
 Routed to Link B : MAP 17 LOT 235

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
33,555	70	Woods, Good, HSG C
2,152	77	Woods, Good, HSG D
2,283	74	>75% Grass cover, Good, HSG C
37,990	71	Weighted Average
37,990		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0600	0.10		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
2.1	188	0.0850	1.46		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.5	238	Total			

**Summary for Subcatchment 2S: WATERSHED**

Runoff = 1.74 cfs @ 12.20 hrs, Volume= 0.161 af, Depth> 2.79"  
 Routed to Link C : PAGE ROAD

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
16,741	70	Woods, Good, HSG C
290	77	Woods, Good, HSG D
10,410	74	>75% Grass cover, Good, HSG C
* 1,878	98	Paved parking
* 803	98	Roofs
30,122	74	Weighted Average
27,441		91.10% Pervious Area
2,681		8.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	50	0.0250	0.07		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
2.3	150	0.0490	1.11		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
14.2	200	Total			

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**Summary for Subcatchment 3S: WATERSHED**

Runoff = 2.71 cfs @ 12.17 hrs, Volume= 0.235 af, Depth> 3.36"  
 Routed to Pond 3P : CB

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
8,219	70	Woods, Good, HSG C
18,018	74	>75% Grass cover, Good, HSG C
* 9,019	98	Paved parking
* 1,315	98	Roofs
36,571	80	Weighted Average
26,237		71.74% Pervious Area
10,334		28.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	50	0.0100	0.11		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.89"
1.2	50	0.0100	0.70		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
0.1	20	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
0.4	37	0.0400	1.40		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
2.4	160	0.0500	1.12		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
11.9	317	Total			

**Summary for Subcatchment 4S: WATERSHED**

Runoff = 0.48 cfs @ 12.09 hrs, Volume= 0.035 af, Depth> 2.71"  
 Routed to Pond 4P : 15" RCP

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
102	55	Woods, Good, HSG B
4,326	61	>75% Grass cover, Good, HSG B
* 2,254	98	Paved parking
6,682	73	Weighted Average
4,428		66.27% Pervious Area
2,254		33.73% Impervious Area

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Type III 24-hr 25-yr Rainfall=5.54"

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

**Summary for Subcatchment 5S: WATERSHED**

Runoff = 2.47 cfs @ 12.14 hrs, Volume= 0.204 af, Depth> 2.44"  
 Routed to Pond 5P : 18" RCP

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
9,648	55	Woods, Good, HSG B
851	77	Woods, Good, HSG D
21,775	61	>75% Grass cover, Good, HSG B
* 11,364	98	Paved parking
43,638	70	Weighted Average
32,274		73.96% Pervious Area
11,364		26.04% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0600	0.10		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
1.3	100	0.0700	1.32		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
9.7	150	Total			

**Summary for Subcatchment 6S: WATERSHED**

Runoff = 23.20 cfs @ 12.66 hrs, Volume= 3.651 af, Depth> 3.05"  
 Routed to Pond 6P : 24" RCP

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
79,545	55	Woods, Good, HSG B
163,615	70	Woods, Good, HSG C
87,572	77	Woods, Good, HSG D
7,600	61	>75% Grass cover, Good, HSG B
102,000	74	>75% Grass cover, Good, HSG C
17,469	80	>75% Grass cover, Good, HSG D
* 79,810	98	Paved parking
* 88,010	98	Roofs
625,621	77	Weighted Average
457,801		73.18% Pervious Area
167,820		26.82% Impervious Area

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Type III 24-hr 25-yr Rainfall=5.54"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	50	0.0300	0.08		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
37.0	1,266	0.0130	0.57		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
48.0	1,316	Total			

**Summary for Subcatchment 7S: WATERSHED**

Runoff = 1.11 cfs @ 12.16 hrs, Volume= 0.093 af, Depth> 2.71"  
Routed to Pond 7P : RCB

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
12,181	70	Woods, Good, HSG C
4,506	74	>75% Grass cover, Good, HSG C
* 1,325	98	Paved parking
18,012	73	Weighted Average
16,687		92.64% Pervious Area
1,325		7.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0400	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.89"
1.8	130	0.0310	1.23		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
4.4	267	0.0410	1.01		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
10.7	447	Total			

**Summary for Subcatchment 8S: WATERSHED**

Runoff = 2.18 cfs @ 12.12 hrs, Volume= 0.168 af, Depth> 2.89"  
Routed to Pond 8P : RCB

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
684	70	Woods, Good, HSG C
28,552	74	>75% Grass cover, Good, HSG C
* 187	98	Paved parking
* 926	98	Roofs
30,349	75	Weighted Average
29,236		96.33% Pervious Area
1,113		3.67% Impervious Area

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Type III 24-hr 25-yr Rainfall=5.54"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0400	0.19		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.89"
3.5	272	0.0350	1.31		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
8.0	322	Total			

**Summary for Subcatchment 9S: WATERSHED**

Runoff = 3.58 cfs @ 12.12 hrs, Volume= 0.280 af, Depth> 3.08"  
Routed to Pond 9P : RCB

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
2,126	70	Woods, Good, HSG C
39,624	74	>75% Grass cover, Good, HSG C
* 1,971	98	Paved parking
* 3,795	98	Roofs
47,516	77	Weighted Average
41,750		87.87% Pervious Area
5,766		12.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.0200	0.14		<b>Sheet Flow,</b> Grass: Short n= 0.150 P2= 2.89"
0.1	20	0.0200	2.87		<b>Shallow Concentrated Flow,</b> Paved Kv= 20.3 fps
2.4	205	0.0400	1.40		<b>Shallow Concentrated Flow,</b> Short Grass Pasture Kv= 7.0 fps
8.4	275	Total			

**Summary for Subcatchment 10S: WATERSHED**

Runoff = 2.39 cfs @ 12.17 hrs, Volume= 0.208 af, Depth> 2.98"  
Routed to Pond 10P : CB

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 25-yr Rainfall=5.54"

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Area (sf)	CN	Description
13,784	70	Woods, Good, HSG C
17,139	74	>75% Grass cover, Good, HSG C
* 5,520	98	Paved parking
36,443	76	Weighted Average
30,923		84.85% Pervious Area
5,520		15.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0630	0.10		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
3.8	183	0.0260	0.81		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
12.0	233	Total			

**Summary for Subcatchment 11S: WATERSHED**

Runoff = 3.14 cfs @ 12.09 hrs, Volume= 0.228 af, Depth> 3.46"  
Routed to Pond 11P : 15" HDPE

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
23,883	74	>75% Grass cover, Good, HSG C
* 7,832	98	Paved parking
* 2,719	98	Roofs
34,434	81	Weighted Average
23,883		69.36% Pervious Area
10,551		30.64% Impervious Area

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

**Summary for Subcatchment 12S: WATERSHED**

Runoff = 3.78 cfs @ 12.32 hrs, Volume= 0.422 af, Depth> 2.88"  
Routed to Pond 1P : 15" RCP

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 25-yr Rainfall=5.54"

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Area (sf)	CN	Description
3,850	55	Woods, Good, HSG B
36,093	70	Woods, Good, HSG C
12,375	61	>75% Grass cover, Good, HSG B
6,910	74	>75% Grass cover, Good, HSG C
* 14,324	98	Paved parking
* 3,089	98	Roofs
76,641	75	Weighted Average
59,228		77.28% Pervious Area
17,413		22.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	50	0.0400	0.08		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
13.3	455	0.0130	0.57		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
23.1	505	Total			

**Summary for Subcatchment 13S: WATERSHED**

Runoff = 1.14 cfs @ 12.15 hrs, Volume= 0.096 af, Depth> 2.02"  
 Routed to Link M : ROCKINGHAM ROAD

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
8,416	55	Woods, Good, HSG B
15,374	70	Woods, Good, HSG C
774	61	>75% Grass cover, Good, HSG B
* 268	98	Paved parking
24,832	65	Weighted Average
24,564		98.92% Pervious Area
268		1.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	50	0.0600	0.10		<b>Sheet Flow,</b> Woods: Light underbrush n= 0.400 P2= 2.89"
1.3	100	0.0700	1.32		<b>Shallow Concentrated Flow,</b> Woodland Kv= 5.0 fps
9.7	150	Total			

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**Summary for Subcatchment 14S: WATERSHED**

Runoff = 2.44 cfs @ 12.09 hrs, Volume= 0.182 af, Depth> 4.08"  
Routed to Pond 17P : DETENTION POND #1

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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
17	55	Woods, Good, HSG B
373	70	Woods, Good, HSG C
1,629	61	>75% Grass cover, Good, HSG B
7,438	74	>75% Grass cover, Good, HSG C
* 7,818	98	Paved parking
* 1,425	98	Rip rap
* 2,112	98	Roofs
* 2,487	100	Open water
23,299	87	Weighted Average
9,457		40.59% Pervious Area
13,842		59.41% Impervious Area

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

**Summary for Subcatchment 15S: WATERSHED**

Runoff = 3.04 cfs @ 12.09 hrs, Volume= 0.232 af, Depth> 4.50"  
Routed to Pond 20P : DETENTION POND #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 25-yr Rainfall=5.54"

Area (sf)	CN	Description
7,940	74	>75% Grass cover, Good, HSG C
* 9,755	98	Paved parking
* 1,423	98	Riprap
* 5,154	98	Roofs
* 2,695	100	Open water
26,967	91	Weighted Average
7,940		29.44% Pervious Area
19,027		70.56% Impervious Area

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

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**Summary for Reach 1R: ROADSIDE SWALE**

Inflow Area = 2.467 ac, 24.57% Impervious, Inflow Depth > 3.14" for 25-yr event  
Inflow = 7.80 cfs @ 12.15 hrs, Volume= 0.645 af  
Outflow = 7.41 cfs @ 12.17 hrs, Volume= 0.644 af, Atten= 5%, Lag= 1.4 min  
Routed to Pond 5P : 18" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
Max. Velocity= 2.88 fps, Min. Travel Time= 2.1 min  
Avg. Velocity = 0.88 fps, Avg. Travel Time= 6.9 min

Peak Storage= 920 cf @ 12.17 hrs  
Average Depth at Peak Storage= 0.24' , Surface Width= 11.42'  
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 89.79 cfs

10.00' x 1.00' deep channel, n= 0.025  
Side Slope Z-value= 3.0 ' / Top Width= 16.00'  
Length= 363.0' Slope= 0.0183 ' /  
Inlet Invert= 313.24' , Outlet Invert= 306.60'



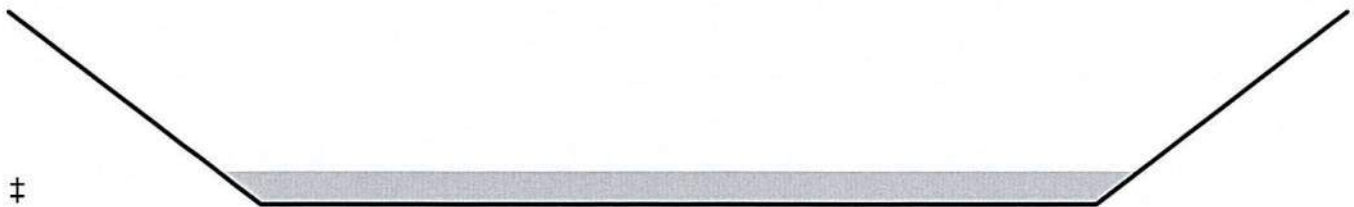
**Summary for Reach 2R: OVERLAND FLOW**

Inflow = 3.82 cfs @ 12.11 hrs, Volume= 0.082 af  
Outflow = 3.54 cfs @ 12.13 hrs, Volume= 0.082 af, Atten= 7%, Lag= 1.4 min  
Routed to Pond 9P : RCB

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
Max. Velocity= 1.95 fps, Min. Travel Time= 1.4 min  
Avg. Velocity = 0.68 fps, Avg. Travel Time= 3.9 min

Peak Storage= 289 cf @ 12.13 hrs  
Average Depth at Peak Storage= 0.17' , Surface Width= 11.03'  
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 73.48 cfs

10.00' x 1.00' deep channel, n= 0.025  
Side Slope Z-value= 3.0 ' / Top Width= 16.00'  
Length= 160.0' Slope= 0.0122 ' /  
Inlet Invert= 320.75' , Outlet Invert= 318.79'



Summary for Reach 3R: OVERLAND FLOW

Inflow = 6.02 cfs @ 12.13 hrs, Volume= 0.132 af
Outflow = 6.01 cfs @ 12.14 hrs, Volume= 0.132 af, Atten= 0%, Lag= 0.5 min
Routed to Pond 8P : RCB

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 3.68 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 1.7 min

Peak Storage= 244 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.28', Surface Width= 6.67'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 60.51 cfs

5.00' x 1.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/ Top Width= 11.00'
Length= 150.0' Slope= 0.0257 '/
Inlet Invert= 319.25', Outlet Invert= 315.39'



Summary for Reach 4R: OVERLAND FLOW

Inflow = 4.69 cfs @ 12.12 hrs, Volume= 0.058 af
Outflow = 4.75 cfs @ 12.15 hrs, Volume= 0.058 af, Atten= 0%, Lag= 1.5 min
Routed to Reach 1R : ROADSIDE SWALE

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 2.80 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.17 fps, Avg. Travel Time= 1.3 min

Peak Storage= 153 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.16', Surface Width= 10.97'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 109.09 cfs

10.00' x 1.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 '/ Top Width= 16.00'
Length= 90.0' Slope= 0.0270 '/
Inlet Invert= 315.67', Outlet Invert= 313.24'



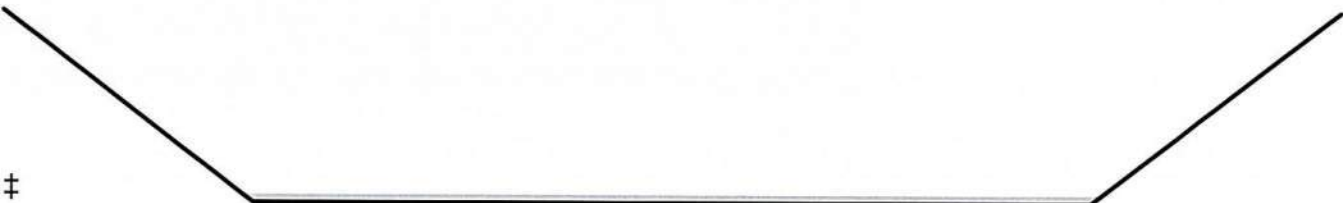
Summary for Reach 5R: OVERLAND FLOW

Inflow = 0.64 cfs @ 12.27 hrs, Volume= 0.009 af
Outflow = 0.60 cfs @ 12.29 hrs, Volume= 0.009 af, Atten= 5%, Lag= 1.2 min
Routed to Reach 1R : ROADSIDE SWALE

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 1.43 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 0.84 fps, Avg. Travel Time= 2.0 min

Peak Storage= 42 cf @ 12.29 hrs
Average Depth at Peak Storage= 0.04', Surface Width= 10.25'
Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 135.41 cfs

10.00' x 1.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 ' ' Top Width= 16.00'
Length= 100.0' Slope= 0.0416 ' '
Inlet Invert= 317.40', Outlet Invert= 313.24'



Summary for Reach 6R: OVERLAND FLOW

Inflow = 2.02 cfs @ 12.18 hrs, Volume= 0.176 af
Outflow = 2.04 cfs @ 12.10 hrs, Volume= 0.176 af, Atten= 0%, Lag= 0.0 min
Routed to Pond 6P : 24" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3
Max. Velocity= 3.01 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 1.9 min

Peak Storage= 68 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.13', Surface Width= 5.75'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 80.01 cfs

5.00' x 1.00' deep channel, n= 0.025
Side Slope Z-value= 3.0 ' ' Top Width= 11.00'
Length= 100.0' Slope= 0.0450 ' '
Inlet Invert= 310.74', Outlet Invert= 306.24'



**Summary for Reach 7R: FLOW THROUGH WETLAND**

Inflow Area = 0.619 ac, 70.56% Impervious, Inflow Depth > 4.07" for 25-yr event  
 Inflow = 0.50 cfs @ 12.57 hrs, Volume= 0.210 af  
 Outflow = 0.49 cfs @ 12.66 hrs, Volume= 0.209 af, Atten= 1%, Lag= 5.9 min  
 Routed to Pond 6P : 24" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Max. Velocity= 0.83 fps, Min. Travel Time= 7.7 min  
 Avg. Velocity = 0.45 fps, Avg. Travel Time= 14.1 min

Peak Storage= 226 cf @ 12.66 hrs  
 Average Depth at Peak Storage= 0.06' , Surface Width= 10.35'  
 Bank-Full Depth= 1.00' Flow Area= 13.0 sf, Capacity= 62.45 cfs

10.00' x 1.00' deep channel, n= 0.025  
 Side Slope Z-value= 3.0 ' / ' Top Width= 16.00'  
 Length= 382.0' Slope= 0.0088 ' / '  
 Inlet Invert= 309.62', Outlet Invert= 306.24'



**Summary for Pond 1P: 15" RCP**

Inflow Area = 2.294 ac, 31.27% Impervious, Inflow Depth > 3.14" for 25-yr event  
 Inflow = 4.79 cfs @ 12.32 hrs, Volume= 0.600 af  
 Outflow = 4.79 cfs @ 12.32 hrs, Volume= 0.600 af, Atten= 0%, Lag= 0.0 min  
 Primary = 4.79 cfs @ 12.32 hrs, Volume= 0.600 af  
 Routed to Link L : MAP 15 LOT 234

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 309.59' @ 12.32 hrs  
 Flood Elev= 312.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	308.31'	<b>15.0" Round Culvert</b> L= 111.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 308.31' / 304.79' S= 0.0317 ' / ' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf

**Primary OutFlow** Max=4.76 cfs @ 12.32 hrs HW=309.58' TW=0.00' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 4.76 cfs @ 3.88 fps)

**Summary for Pond 3P: CB**

Inflow Area = 1.630 ac, 29.41% Impervious, Inflow Depth > 3.41" for 25-yr event  
 Inflow = 5.49 cfs @ 12.11 hrs, Volume= 0.463 af  
 Outflow = 5.68 cfs @ 12.11 hrs, Volume= 0.462 af, Atten= 0%, Lag= 0.0 min  
 Primary = 1.92 cfs @ 11.97 hrs, Volume= 0.380 af  
 Routed to Pond 10P : CB  
 Secondary = 3.82 cfs @ 12.11 hrs, Volume= 0.082 af  
 Routed to Reach 2R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 321.11' @ 12.11 hrs Surf.Area= 356 sf Storage= 167 cf  
 Flood Elev= 321.00' Surf.Area= 356 sf Storage= 167 cf

Plug-Flow detention time= 2.6 min calculated for 0.461 af (100% of inflow)  
 Center-of-Mass det. time= 1.1 min ( 819.1 - 818.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	319.10'	16 cf	4.00'D x 1.25'H Vertical Cone/Cylinder
#2	319.10'	151 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		167 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
319.10	5	0	0
320.50	65	49	49
321.00	343	102	151

Device	Routing	Invert	Outlet Devices
#1	Primary	319.10'	<b>8.0" Round Culvert</b> L= 228.7' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 319.10' / 314.83' S= 0.0187 '/ Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	320.27'	<b>24.0" x 24.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Secondary	320.75'	<b>8.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=1.91 cfs @ 11.97 hrs HW=320.85' TW=316.76' (Dynamic Tailwater)

- ↑1=Culvert (Outlet Controls 1.91 cfs @ 5.47 fps)
- ↑2=Grate (Passes 1.91 cfs of 11.56 cfs potential flow)

Secondary OutFlow Max=3.67 cfs @ 12.11 hrs HW=321.10' TW=320.92' (Dynamic Tailwater)

- ↑3=Broad-Crested Rectangular Weir(Weir Controls 3.67 cfs @ 1.30 fps)

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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**Summary for Pond 4P: 15" RCP**

Inflow Area = 0.153 ac, 33.73% Impervious, Inflow Depth > 2.71" for 25-yr event  
 Inflow = 0.48 cfs @ 12.09 hrs, Volume= 0.035 af  
 Outflow = 0.48 cfs @ 12.10 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.1 min  
 Primary = 0.48 cfs @ 12.10 hrs, Volume= 0.035 af  
     Routed to Pond 5P : 18" RCP  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
     Routed to Pond 5P : 18" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 308.96' @ 12.10 hrs Surf.Area= 15 sf Storage= 3 cf  
 Flood Elev= 311.00' Surf.Area= 730 sf Storage= 593 cf

Plug-Flow detention time= 0.3 min calculated for 0.035 af (100% of inflow)  
 Center-of-Mass det. time= 0.2 min ( 834.6 - 834.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	308.62'	593 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
308.62	5	0	0
309.00	16	4	4
310.00	216	116	120
311.00	730	473	593

Device	Routing	Invert	Outlet Devices
#1	Primary	308.64'	<b>15.0" Round Culvert</b> L= 24.6' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 308.64' / 306.60' S= 0.0829' / Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf
#2	Secondary	310.96'	<b>2.0' long x 25.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Primary OutFlow** Max=0.47 cfs @ 12.10 hrs HW=308.96' TW=307.57' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 0.47 cfs @ 1.92 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=308.62' TW=305.37' (Dynamic Tailwater)  
 ↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

**Summary for Pond 5P: 18" RCP**

Inflow Area = 22.368 ac, 24.40% Impervious, Inflow Depth > 3.01" for 25-yr event  
 Inflow = 15.62 cfs @ 12.17 hrs, Volume= 5.618 af  
 Outflow = 12.99 cfs @ 12.26 hrs, Volume= 5.618 af, Atten= 17%, Lag= 5.4 min  
 Primary = 12.99 cfs @ 12.26 hrs, Volume= 5.618 af  
     Routed to Link A : MAP 15 LOT 233

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Peak Elev= 308.45' @ 12.26 hrs Surf.Area= 2,014 sf Storage= 2,244 cf  
 Flood Elev= 310.88' Surf.Area= 7,537 sf Storage= 12,203 cf

Plug-Flow detention time= 1.4 min calculated for 5.618 af (100% of inflow)  
 Center-of-Mass det. time= 1.4 min ( 903.0 - 901.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	305.37'	13,134 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
305.37	10	0	0
306.00	92	32	32
307.00	641	367	399
308.00	1,481	1,061	1,460
309.00	2,668	2,075	3,534
310.00	4,275	3,472	7,006
311.00	7,982	6,129	13,134

Device	Routing	Invert	Outlet Devices
#1	Primary	305.37'	<b>18.0" Round Culvert</b> L= 112.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 305.37' / 304.29' S= 0.0096 ' S= 0.0096 ' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.77 sf

**Primary OutFlow** Max=12.94 cfs @ 12.26 hrs HW=308.43' TW=0.00' (Dynamic Tailwater)  
 ←1=Culvert (Inlet Controls 12.94 cfs @ 7.32 fps)

**Summary for Pond 6P: 24" RCP**

Inflow Area = 15.853 ac, 27.06% Impervious, Inflow Depth > 3.19" for 25-yr event  
 Inflow = 24.70 cfs @ 12.64 hrs, Volume= 4.219 af  
 Outflow = 10.67 cfs @ 13.40 hrs, Volume= 4.155 af, Atten= 57%, Lag= 45.8 min  
 Primary = 10.67 cfs @ 13.40 hrs, Volume= 4.188 af  
     Routed to Pond 5P : 18" RCP  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
     Routed to Pond 5P : 18" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 308.75' @ 13.35 hrs Surf.Area= 44,574 sf Storage= 65,566 cf  
 Flood Elev= 311.00' Surf.Area= 73,507 sf Storage= 196,526 cf

Plug-Flow detention time= 75.2 min calculated for 4.155 af (98% of inflow)  
 Center-of-Mass det. time= 66.8 min ( 925.8 - 859.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	306.24'	196,526 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

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Type III 24-hr 25-yr Rainfall=5.54"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.24	4,300	0	0
308.00	35,858	35,339	35,339
310.00	59,050	94,908	130,247
311.00	73,507	66,279	196,526

Device	Routing	Invert	Outlet Devices
#1	Primary	306.24'	<b>24.0" Round Culvert</b> L= 43.9' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 306.24' / 305.70' S= 0.0123 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 3.14 sf
#2	Secondary	310.88'	<b>6.0' long x 30.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

**Primary OutFlow** Max=10.68 cfs @ 13.40 hrs HW=308.75' TW=308.25' (Dynamic Tailwater)  
 ↑1=Culvert (Inlet Controls 10.68 cfs @ 3.40 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=306.24' TW=305.37' (Dynamic Tailwater)  
 ↑2=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Summary for Pond 7P: RCB**

Inflow Area = 2.201 ac, 8.56% Impervious, Inflow Depth > 3.08" for 25-yr event  
 Inflow = 5.82 cfs @ 12.15 hrs, Volume= 0.565 af  
 Outflow = 5.81 cfs @ 12.18 hrs, Volume= 0.563 af, Atten= 0%, Lag= 1.4 min  
 Primary = 3.79 cfs @ 12.18 hrs, Volume= 0.387 af  
 Routed to Pond 5P : 18" RCP  
 Secondary = 2.02 cfs @ 12.18 hrs, Volume= 0.176 af  
 Routed to Reach 6R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 311.06' @ 12.18 hrs Surf.Area= 521 sf Storage= 123 cf  
 Flood Elev= 311.00' Surf.Area= 521 sf Storage= 123 cf

Plug-Flow detention time= 2.2 min calculated for 0.562 af (100% of inflow)  
 Center-of-Mass det. time= 0.8 min ( 827.6 - 826.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	306.24'	57 cf	<b>4.00'D x 4.50'H Vertical Cone/Cylinder</b>
#2	310.74'	67 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
		123 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
310.74	5	0	0
311.00	508	67	67

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Device	Routing	Invert	Outlet Devices
#1	Primary	306.24'	<b>12.0" Round Culvert</b> L= 44.4' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 306.24' / 305.82' S= 0.0095 ' / Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	310.74'	<b>24.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Secondary	310.75'	<b>5.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=3.76 cfs @ 12.18 hrs HW=311.06' TW=308.17' (Dynamic Tailwater)

↑1=Culvert (Passes 3.76 cfs of 6.43 cfs potential flow)

↑2=Grate (Weir Controls 3.76 cfs @ 1.86 fps)

Secondary OutFlow Max=2.01 cfs @ 12.18 hrs HW=311.06' TW=310.86' (Dynamic Tailwater)

↑3=Broad-Crested Rectangular Weir (Weir Controls 2.01 cfs @ 1.28 fps)

**Summary for Pond 8P: RCB**

Inflow Area = 1.788 ac, 8.83% Impervious, Inflow Depth > 3.55" for 25-yr event  
 Inflow = 9.23 cfs @ 12.14 hrs, Volume= 0.529 af  
 Outflow = 9.40 cfs @ 12.12 hrs, Volume= 0.528 af, Atten= 0%, Lag= 0.0 min  
 Primary = 4.71 cfs @ 12.14 hrs, Volume= 0.471 af  
 Routed to Pond 7P : RCB  
 Secondary = 4.69 cfs @ 12.12 hrs, Volume= 0.058 af  
 Routed to Reach 4R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3

Peak Elev= 315.86' @ 12.14 hrs Surf.Area= 480 sf Storage= 204 cf

Flood Elev= 316.00' Surf.Area= 614 sf Storage= 278 cf

Plug-Flow detention time= 1.4 min calculated for 0.527 af (100% of inflow)

Center-of-Mass det. time= 0.6 min ( 814.5 - 813.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	315.39'	186 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
#2	308.11'	91 cf	<b>4.00'D x 7.28'H Vertical Cone/Cylinder</b>
		278 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
315.39	10	0	0
316.00	601	186	186

Device	Routing	Invert	Outlet Devices
#1	Primary	308.11'	<b>12.0" Round Culvert</b> L= 315.8' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 308.11' / 306.28' S= 0.0058 ' / Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Secondary	315.67'	<b>35.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60

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Type III 24-hr 25-yr Rainfall=5.54"

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Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=4.71 cfs @ 12.14 hrs HW=315.86' TW=311.06' (Dynamic Tailwater)

↑1=Culvert (Outlet Controls 4.71 cfs @ 5.99 fps)

Secondary OutFlow Max=4.22 cfs @ 12.12 hrs HW=315.85' TW=315.81' (Dynamic Tailwater)

↑2=Broad-Crested Rectangular Weir(Weir Controls 4.22 cfs @ 0.66 fps)

**Summary for Pond 9P: RCB**

Inflow Area = 1.091 ac, 12.13% Impervious, Inflow Depth > 3.98" for 25-yr event  
 Inflow = 7.07 cfs @ 12.13 hrs, Volume= 0.362 af  
 Outflow = 7.13 cfs @ 12.13 hrs, Volume= 0.361 af, Atten= 0%, Lag= 0.3 min  
 Primary = 1.14 cfs @ 12.36 hrs, Volume= 0.230 af  
 Routed to Pond 8P : RCB  
 Secondary = 6.02 cfs @ 12.13 hrs, Volume= 0.132 af  
 Routed to Reach 3R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 319.89' @ 12.13 hrs Surf.Area= 213 sf Storage= 123 cf  
 Flood Elev= 319.50' Surf.Area= 213 sf Storage= 123 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 0.5 min ( 805.7 - 805.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	318.78'	111 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	317.84'	12 cf	4.00'D x 0.95'H Vertical Cone/Cylinder
		123 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
318.78	5	0	0
319.00	168	19	19
319.50	200	92	111

Device	Routing	Invert	Outlet Devices
#1	Primary	317.84'	<b>6.0" Round Culvert</b> L= 141.2' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 317.84' / 314.02' S= 0.0271 ' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
#2	Device 1	318.79'	<b>24.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Secondary	319.25'	<b>5.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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**Primary OutFlow** Max=1.14 cfs @ 12.36 hrs HW=319.55' TW=314.96' (Dynamic Tailwater)

↑1=Culvert (Inlet Controls 1.14 cfs @ 5.82 fps)

↑2=Orifice/Grate (Passes 1.14 cfs of 13.22 cfs potential flow)

**Secondary OutFlow** Max=5.83 cfs @ 12.13 hrs HW=319.87' TW=319.52' (Dynamic Tailwater)

↑3=Broad-Crested Rectangular Weir(Weir Controls 5.83 cfs @ 1.87 fps)

**Summary for Pond 10P: CB**

Inflow Area = 2.467 ac, 24.57% Impervious, Inflow Depth > 2.86" for 25-yr event  
 Inflow = 4.20 cfs @ 12.16 hrs, Volume= 0.588 af  
 Outflow = 3.75 cfs @ 12.27 hrs, Volume= 0.588 af, Atten= 11%, Lag= 6.1 min  
 Primary = 3.12 cfs @ 12.27 hrs, Volume= 0.579 af  
 Routed to Reach 1R : ROADSIDE SWALE  
 Secondary = 0.64 cfs @ 12.27 hrs, Volume= 0.009 af  
 Routed to Reach 5R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3

Peak Elev= 317.50' @ 12.27 hrs Surf.Area= 1,955 sf Storage= 671 cf

Flood Elev= 317.50' Surf.Area= 1,972 sf Storage= 681 cf

Plug-Flow detention time=(not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 1.0 min ( 836.9 - 836.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	314.53'	24 cf	<b>4.00'D x 1.91'H Vertical Cone/Cylinder</b>
#2	316.44'	657 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
		681 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
316.44	5	0	0
317.00	312	89	89
317.50	1,959	568	657

Device	Routing	Invert	Outlet Devices
#1	Primary	314.53'	<b>12.0" Round Culvert</b> L= 101.8' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 314.53' / 313.24' S= 0.0127 ' / Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf
#2	Device 1	316.44'	<b>24.0" x 24.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Secondary	317.40'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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**Primary OutFlow** Max=3.11 cfs @ 12.27 hrs HW=317.49' TW=313.44' (Dynamic Tailwater)

- ↳1=Culvert (Barrel Controls 3.11 cfs @ 3.96 fps)
- ↳2=Grate (Passes 3.11 cfs of 19.74 cfs potential flow)

**Secondary OutFlow** Max=0.60 cfs @ 12.27 hrs HW=317.49' TW=317.44' (Dynamic Tailwater)

- ↳3=Broad-Crested Rectangular Weir (Weir Controls 0.60 cfs @ 0.66 fps)

**Summary for Pond 11P: 15" HDPE**

Inflow Area = 0.790 ac, 30.64% Impervious, Inflow Depth > 3.46" for 25-yr event  
 Inflow = 3.14 cfs @ 12.09 hrs, Volume= 0.228 af  
 Outflow = 3.14 cfs @ 12.09 hrs, Volume= 0.228 af, Atten= 0%, Lag= 0.0 min  
 Primary = 3.14 cfs @ 12.09 hrs, Volume= 0.228 af  
 Routed to Pond 3P : CB

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 325.57' @ 12.09 hrs  
 Flood Elev= 326.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	324.65'	<b>15.0" Round Culvert</b> L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 324.65' / 321.75' S= 0.0707 '/ Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 1.23 sf

**Primary OutFlow** Max=3.07 cfs @ 12.09 hrs HW=325.55' TW=321.09' (Dynamic Tailwater)

- ↳1=Culvert (Inlet Controls 3.07 cfs @ 3.24 fps)

**Summary for Pond 17P: DETENTION POND #1**

Inflow Area = 0.535 ac, 59.41% Impervious, Inflow Depth > 4.08" for 25-yr event  
 Inflow = 2.44 cfs @ 12.09 hrs, Volume= 0.182 af  
 Outflow = 1.01 cfs @ 12.31 hrs, Volume= 0.177 af, Atten= 59%, Lag= 13.2 min  
 Primary = 1.01 cfs @ 12.31 hrs, Volume= 0.177 af  
 Routed to Pond 1P : 15" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 310.83' @ 12.31 hrs Surf.Area= 3,234 sf Storage= 2,284 cf  
 Flood Elev= 312.00' Surf.Area= 4,647 sf Storage= 6,431 cf

Plug-Flow detention time= 59.0 min calculated for 0.177 af (98% of inflow)  
 Center-of-Mass det. time= 44.6 min ( 841.6 - 797.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	310.00'	6,431 cf	<b>Custom Stage Data (Prismatic)</b> listed below (Recalc)
#2	309.50'	0 cf	<b>Sediment Forebay (No Storage) (Prismatic)</b> listed below (Recalc)
			313 cf Overall x 0.0% Voids
		6,431 cf	Total Available Storage

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
310.00	2,487	0	0
311.00	3,142	2,815	2,815
311.50	3,490	1,658	4,473
312.00	4,344	1,959	6,431

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
309.50	10	0	0
311.50	303	313	313

Device	Routing	Invert	Outlet Devices
#1	Primary	310.00'	<b>Weir, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 310.00 310.85 310.85 311.50 Width (feet) 0.41 0.41 1.00 1.00

Primary OutFlow Max=1.01 cfs @ 12.31 hrs HW=310.83' TW=309.58' (Dynamic Tailwater)  
 ↑1=Weir (Weir Controls 1.01 cfs @ 2.98 fps)

**Summary for Pond 20P: DETENTION POND #2**

Inflow Area = 0.619 ac, 70.56% Impervious, Inflow Depth > 4.50" for 25-yr event  
 Inflow = 3.04 cfs @ 12.09 hrs, Volume= 0.232 af  
 Outflow = 0.50 cfs @ 12.57 hrs, Volume= 0.210 af, Atten= 84%, Lag= 28.7 min  
 Primary = 0.50 cfs @ 12.57 hrs, Volume= 0.210 af  
 Routed to Reach 7R : FLOW THROUGH WETLAND  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 7R : FLOW THROUGH WETLAND

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 311.52' @ 12.57 hrs Surf.Area= 4,229 sf Storage= 4,975 cf  
 Flood Elev= 313.50' Surf.Area= 7,410 sf Storage= 14,430 cf

Plug-Flow detention time= 188.5 min calculated for 0.209 af (90% of inflow)  
 Center-of-Mass det. time= 141.6 min ( 924.7 - 783.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	310.00'	14,430 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
#2	311.00'	0 cf	<b>Sediment Forebay (No Storage) (Prismatic)</b> Listed below (Recalc)
		1,031 cf Overall x 0.0% Voids	
		14,430 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
310.00	2,696	0	0
312.00	4,200	6,896	6,896
313.00	5,036	4,618	11,514
313.50	6,629	2,916	14,430

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 25-yr Rainfall=5.54"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
311.00	250	0	0
313.00	781	1,031	1,031

Device	Routing	Invert	Outlet Devices
#1	Primary	309.75'	<b>15.0" Round Culvert</b> L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 309.75' / 309.60' S= 0.0050 ' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	310.00'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 310.00 311.50 311.50 313.00 Width (feet) 0.08 0.08 0.50 0.50
#3	Device 1	313.25'	<b>48.0" x 48.0" Horiz. Grate C= 0.600</b> Limited to weir flow at low heads
#4	Secondary	313.35'	<b>5.0' long x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.50 cfs @ 12.57 hrs HW=311.52' TW=309.68' (Dynamic Tailwater)

- ↑ 1=Culvert (Passes 0.50 cfs of 5.44 cfs potential flow)
- ↑ 2=Custom Weir/Orifice (Weir Controls 0.50 cfs @ 3.79 fps)
- ↑ 3=Grate ( Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=310.00' TW=309.62' (Dynamic Tailwater)

- ↑ 4=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

**Summary for Link A: MAP 15 LOT 233**

Inflow Area = 22.368 ac, 24.40% Impervious, Inflow Depth > 3.01" for 25-yr event  
 Inflow = 12.99 cfs @ 12.26 hrs, Volume= 5.618 af  
 Primary = 12.99 cfs @ 12.26 hrs, Volume= 5.618 af, Atten= 0%, Lag= 0.0 min

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

**Summary for Link B: MAP 17 LOT 235**

Inflow Area = 0.872 ac, 0.00% Impervious, Inflow Depth > 2.53" for 25-yr event  
 Inflow = 2.19 cfs @ 12.15 hrs, Volume= 0.184 af  
 Primary = 2.19 cfs @ 12.15 hrs, Volume= 0.184 af, Atten= 0%, Lag= 0.0 min  
 Routed to Pond 6P : 24" RCP

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

**Summary for Link C: PAGE ROAD**

Inflow Area = 0.692 ac, 8.90% Impervious, Inflow Depth > 2.79" for 25-yr event  
Inflow = 1.74 cfs @ 12.20 hrs, Volume= 0.161 af  
Primary = 1.74 cfs @ 12.20 hrs, Volume= 0.161 af, Atten= 0%, Lag= 0.0 min  
Routed to Pond 5P : 18" RCP

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

**Summary for Link D: MAMMOTH ROAD**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link E: MAP 17 LOT 7**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link F: MAP 15 LOT 239**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link G: MAP 15 LOT 238**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link H: MAP 15 LOT 240**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link I: MAP 15 LOT 241**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link J: MAP 15 LOT 231**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link K: MAP 15 LOT 232**

Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

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

**Summary for Link L: MAP 15 LOT 234**

Inflow Area = 2.294 ac, 31.27% Impervious, Inflow Depth > 3.14" for 25-yr event

Inflow = 4.79 cfs @ 12.32 hrs, Volume= 0.600 af

Primary = 4.79 cfs @ 12.32 hrs, Volume= 0.600 af, Atten= 0%, Lag= 0.0 min

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

**Summary for Link M: ROCKINGHAM ROAD**

Inflow Area = 0.570 ac, 1.08% Impervious, Inflow Depth > 2.02" for 25-yr event

Inflow = 1.14 cfs @ 12.15 hrs, Volume= 0.096 af

Primary = 1.14 cfs @ 12.15 hrs, Volume= 0.096 af, Atten= 0%, Lag= 0.0 min

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

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 50-yr Rainfall=6.62"

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**Summary for Pond 17P: DETENTION POND #1**

Inflow Area = 0.535 ac, 59.41% Impervious, Inflow Depth > 5.11" for 50-yr event  
 Inflow = 3.03 cfs @ 12.09 hrs, Volume= 0.228 af  
 Outflow = 1.37 cfs @ 12.27 hrs, Volume= 0.223 af, Atten= 55%, Lag= 11.0 min  
 Primary = 1.37 cfs @ 12.27 hrs, Volume= 0.223 af  
 Routed to Pond 1P : 15" RCP

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 310.97' @ 12.27 hrs Surf.Area= 3,349 sf Storage= 2,725 cf  
 Flood Elev= 312.00' Surf.Area= 4,647 sf Storage= 6,431 cf

Plug-Flow detention time=55.4 min calculated for 0.223 af (98% of inflow)  
 Center-of-Mass det. time= 42.2 min ( 832.9 - 790.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	310.00'	6,431 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
#2	309.50'	0 cf	<b>Sediment Forebay (No Storage) (Prismatic)</b> ,listed below (Recalc)
		313 cf Overall x 0.0% Voids	
		6,431 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
310.00	2,487	0	0
311.00	3,142	2,815	2,815
311.50	3,490	1,658	4,473
312.00	4,344	1,959	6,431

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
309.50	10	0	0
311.50	303	313	313

Device	Routing	Invert	Outlet Devices
#1	Primary	310.00'	<b>Weir, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 310.00 310.85 310.85 311.50 Width (feet) 0.41 0.41 1.00 1.00

**Primary OutFlow** Max=1.36 cfs @ 12.27 hrs HW=310.97' TW=310.03' (Dynamic Tailwater)  
 ↳1=Weir (Weir Controls 1.36 cfs @ 2.91 fps)

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 50-yr Rainfall=6.62"

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**Summary for Pond 20P: DETENTION POND #2**

Inflow Area = 0.619 ac, 70.56% Impervious, Inflow Depth > 5.56" for 50-yr event  
 Inflow = 3.71 cfs @ 12.09 hrs, Volume= 0.287 af  
 Outflow = 0.79 cfs @ 12.50 hrs, Volume= 0.262 af, Atten= 79%, Lag= 25.0 min  
 Primary = 0.79 cfs @ 12.50 hrs, Volume= 0.262 af  
 Routed to Reach 7R : FLOW THROUGH WETLAND  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Routed to Reach 7R : FLOW THROUGH WETLAND

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 3  
 Peak Elev= 311.76' @ 12.50 hrs Surf.Area= 4,469 sf Storage= 5,899 cf  
 Flood Elev= 313.50' Surf.Area= 7,410 sf Storage= 14,430 cf

Plug-Flow detention time= 176.4 min calculated for 0.261 af (91% of inflow)  
 Center-of-Mass det. time= 133.0 min ( 910.6 - 777.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	310.00'	14,430 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
#2	311.00'	0 cf	<b>Sediment Forebay (No Storage) (Prismatic)</b> Listed below (Recalc)
			1,031 cf Overall x 0.0% Voids
		14,430 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
310.00	2,696	0	0
312.00	4,200	6,896	6,896
313.00	5,036	4,618	11,514
313.50	6,629	2,916	14,430

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
311.00	250	0	0
313.00	781	1,031	1,031

Device	Routing	Invert	Outlet Devices
#1	Primary	309.75'	<b>15.0" Round Culvert</b> L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 309.75' / 309.60' S= 0.0050 ' / Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	310.00'	<b>Custom Weir/Orifice, Cv= 2.62 (C= 3.28)</b> Elev. (feet) 310.00 311.50 311.50 313.00 Width (feet) 0.08 0.08 0.50 0.50
#3	Device 1	313.25'	<b>48.0" x 48.0" Horiz. Grate</b> C= 0.600 Limited to weir flow at low heads
#4	Secondary	313.35'	<b>5.0' long x 4.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

**2101131-POST-DEVELOPMENT\_REV2**

Type III 24-hr 50-yr Rainfall=6.62"

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**Primary OutFlow Max=0.79 cfs @ 12.50 hrs HW=311.76' TW=309.70' (Dynamic Tailwater)**

↑1=Culvert (Passes 0.79 cfs of 6.32 cfs potential flow)

↑2=Custom Weir/Orifice (Weir Controls 0.79 cfs @ 3.18 fps)

↑3=Grate ( Controls 0.00 cfs)

**Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=310.00' TW=309.62' (Dynamic Tailwater)**

↑4=Broad-Crested Rectangular Weir( Controls 0.00 cfs)

## **APPENDIX**

PRE-DEVELOPMENT DRAINAGE AREA PLAN  
POST-DEVELOPMENT DRAINAGE AREA PLAN  
STORMWATER OPERATION & MAINTENANCE PLAN

**STORMWATER  
OPERATION & MAINTENANCE PLAN**

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**Rock Road Townhomes**

**Map 17; Lot 25  
295 Rockingham Road  
Londonderry, New Hampshire**

**February 20, 2026**

**KNA Project No. 21-0113-1**

***KMA*** 

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*KEACH-NORDSTROM ASSOCIATES, INC.*

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11"x17" "Grading and Drainage Plan"

# I. General

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## Introduction

The project owner or their assigned heirs will maintain the stormwater treatment facilities during construction. The owner of the project is Page Rock, LLC, 5 Hutchings Drive, Suite 5D, Hollis, NH 03049. Upon completion of construction, the Condominium Association will assume ownership of long-term maintenance.

The subject property is referenced on Londonderry's Tax Map 17 as Lot 25. Any transfer of responsibility for inspection and maintenance activities or transfer of ownership shall be documented to the Town of Londonderry in writing. The contract documents will require the contractor to designate a person responsible for maintenance of the sedimentation control features during construction. Long-term operation and maintenance for the stormwater management facilities are presented below.

Maintenance will be performed as described unless and until the system is formally accepted by a municipality or quasi-municipal district or is placed under the jurisdiction of a legally created association that will be responsible for the maintenance of the system.

### Post Construction:

The following standards will be met after construction is complete:

#### Documentation:

A maintenance log will be kept summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. The following forms shall be submitted to the Londonderry Department of Engineering on an annual basis.

## Maintenance Requirements

### Stormwater Ponds:

- Systems should be inspected at least twice annually and following any rainfall event exceeding 2.5 inches in a 24-hour period, with maintenance or rehabilitation conducted as warranted by such inspection.
- System embankments should be mowed periodically to maintain grass cover and any other vegetation found on the embankment should be removed at each inspection.
- Trash and debris found within the pond or in the outlet structure should be removed at each inspection.
- Removal of accumulated sediment
- Inspection and repair of embankments, inlet and outlet structures, and appurtenances

### Sediment Forebays:

- Forebays help reduce the sediment load to downstream BMP's and will therefore require more frequent cleaning.
- Systems should be inspected at least annually.
- Conduct periodic mowing of embankments (generally two times per year) to control growth of woody vegetation.
- Trash and debris should be removed at each inspection.
- Accumulated sediment should be removed as warranted by such inspection.
- Install and maintain a staff gage or other measuring device, to indicate depth of sediment accumulation and level at which clean-out is required.

### Outlet Protection:

- Inspect the outlet protection annually for damage and deterioration. Repair damages immediately.

### General:

- Sweeping will be checked quarterly and completed as needed.
- If any invasive species begin to grow in the stormwater management practices the species shall be disposed of in an appropriate manner that will not allow the pest to survive or spread. The disposal of such species shall be witnessed or approved by a state inspector. Methods for disposal may include, but not be limited to:
  - Encapsulating the plant(s) in plastic bags and disposing of the plant material in one of the following ways:
    - Discarding in trash pickup;
    - Open burning;
    - Incineration; or
    - Burial of infested nursery.

## Landscape Management:

Objective: To maintain lawns and plantings to ensure survival, vigorous growth with proper nutrients, pest management and the avoidance of environmental stress such as drought.

### 1. Lawns & grass areas:

- a. The turfgrass mix selected for lawn areas will be varieties that are qualified, A-L.I.S.T. (Alliance for Low Input Sustainable Turf) or TWCA (Turfgrass Water Conservation Alliance). These organizations have high testing standards to insure lower fertilizer and pesticide inputs, lower water requirements, heat and drought tolerance.
- b. The lawn maintenance will be done by an experienced contractor.
- c. Nutrients will be applied to achieve a successful stand of turf following NH RSA 431
- d. Soil samples will be taken annually to help identify direct nutrient deficiencies and or excesses which will dictate annual nutrient program. Soil test will include, Organic matter, Phosphorus levels, pH, pH buffer, cation exchange capacity, cation base saturations and soil texture.
- e. Integrated pest management (IPM) practices will be followed to determine tolerable pest population levels. Treatments will be made as necessary based on pest thresholds.
- f. Grass varieties will need less watering by nature but the option of natural occurring moisture management product treatments to conserve water are available during periods of severe drought to ensure survival of the turf.
- g. Grass will be mowed as needed to a 2.5" – 3 "height depending on seasonal conditions.
- h. Grass will be watered as needed.

### 2. Trees & Shrubs:

- a. Initial plant installation will be a key factor to long-term survival and success
- b. Tree & shrub installation shall be performed in accordance with the growers' requirements.
- c. The tree & shrub maintenance will be done by an experienced contractor.
- d. As with the grass area, integrated pest management (IPM) practices will be followed to determine tolerable pest population levels. Treatments will be made as necessary based on pest thresholds.
- e. Trees & shrubs will be fertilized in the fall utilizing deep root feeding with a high percentage of organically derived nutrient sources.
- f. Watering will be done as needed throughout the season, especially during very dry periods to ensure plant survival.

### 3. Planting beds:

- a. Planting bed maintenance will be done by an experienced contractor.
- b. Planting beds will be mulched in the spring for reduced weed encroachment and water holding capacity to aid in plant survival and success.
- c. Beds will be weeded periodically as needed.
- d. Flowering annuals will be planted in the spring to add natural color.
- e. Annuals will be removed once the season is completed.

### Snow and Ice Management:

Objective: To maintain all paved areas to be free of snow, in a timely manner after every snow event. Ensure bare pavement with no residual ice to ensure occupant safety. Utilize best management practices and products to comply with NHDES Green SnowPro under RSA 489-C. The snow and ice removal contractor shall document the management process in accordance with the requirements of RSA 489-C and the certification guidelines.

#### 1. Snow plowing:

- a. Snow plowing will be done by a Certified NHDES Green SnowPro contractor.
- b. The driveway & parking lot will be plowed as needed during and after every snow event.
- c. Snow will be stockpiled in locations identified on the approved landscape plan.
- d. Walkways and entrances will be shoveled, or snow blown depending on snow volume.
- e. In the event of a higher than usual snow fall, snow will be trucked off-site to an approved snow stockpile facility.
- f. The property owner shall be responsible for reporting the annual salt usage to NHDES.

#### 2. Ice control:

- a. Ice control will be done by a Certified NHDES Green SnowPro contractor.
- b. The objective is to obtain bare and dry pavements at the earliest practical time following cessation of a storm.
- c. Ice melting products will be used as necessary to prevent "slip & fall" incidents as well and maintain motor vehicle control.
- d. Snow and Ice Management will follow NHDES Green SnowPro guidelines under RSA 489-C.
- e. Magic Salt ® by ProMelt, or equal, will be the primary ice melting product. Can melt ice to temperatures as low as - 25°F. Manufactured with a combination feed grade molasses and

magnesium chloride. Long lasting performance reduces re-application frequency.

- f. ProMelt Mag liquid, or equal, will also be used in low volumes as a pre-treat per manufactures recommendations. This practice is a similar practice used by NH DOT. ProMelt Mag is a high-performance magnesium chloride liquid that delivers a strong residual effect on road surfaces, improves melting and results in long lasting performance.

## **II. Supporting Documents**

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**Annual Inspection and Maintenance Reporting Form**  
**for**  
**Rock Road Townhomes**  
**Londonderry, New Hampshire**

**Date:** \_\_\_\_\_

**To:** Page Rock LLC

**Re:** Certification of Inspection and Maintenance; Submittal of Forms

Property Name: Rock Road Townhomes

Property Address: 295 Rockingham Road, Londonderry, NH

Contact Name: \_\_\_\_\_

Contact Phone #: \_\_\_\_\_

Contact Email Address: \_\_\_\_\_

I verify that the required stormwater facility inspections and required maintenance have been completed in accordance with the Operation & Maintenance Plan associated with the above referenced property.

The required Long-Term Inspection & Maintenance Plan Checklist is attached to this form.

\_\_\_\_\_  
Name of Party Responsible for Inspection & Maintenance

\_\_\_\_\_  
Date

\_\_\_\_\_  
Authorized Signature

## Long-Term Inspection & Maintenance Plan Checklist Rock Road Townhomes – Londonderry, NH

Current Owner Name:		Date:	
Business Address:		Inspector:	
Weather:			
Date of Last Rainfall:		Amount:	Inches:
<b>Best Management Practice</b>			
<b>Detention Pond #1</b>		Reason for Inspection	
		Spring <input type="checkbox"/>	Fall/Yearly <input type="checkbox"/> Spring <input type="checkbox"/>
Maintenance Required?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Corrective Action Needed & Notes:			
Sideslopes & berms need repair?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Clean inlet & outlet structures?                      Yes <input type="checkbox"/> No <input type="checkbox"/>			
<u>Attach Photos</u>			
<b>Detention Pond #2</b>		Reason for Inspection	
		Spring <input type="checkbox"/>	Fall/Yearly <input type="checkbox"/> Spring <input type="checkbox"/>
Maintenance Required?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Corrective Action Needed & Notes:			
Sideslopes & berms need repair?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Clean inlet & outlet structures?                      Yes <input type="checkbox"/> No <input type="checkbox"/>			
<u>Attach Photos</u>			
<b>Sediment Forebays</b>		Reason for Inspection	
		Spring <input type="checkbox"/>	Fall/Yearly <input type="checkbox"/> After Major Storm <input type="checkbox"/>
Maintenance Required?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Corrective Action Needed & Notes:			
<u>Attach Photos</u>			

Outlet Protection	Reason for Inspection		
	Spring <input type="checkbox"/>	Fall/Yearly <input type="checkbox"/>	After Major Storm <input type="checkbox"/>
HW#2 Maintenance Required?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Corrective Action Needed & Notes:			
Detention Pond #1 Weir Outlet Maintenance Required?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Corrective Action Needed & Notes:			
<u>Attach Photos</u>			
Lawn Areas and Landscaping	Reason for Inspection		
	Spring <input type="checkbox"/>	Fall/Yearly <input type="checkbox"/>	After Major Storm <input type="checkbox"/>
Maintenance Required?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Corrective Action Needed & Notes:			
<u>Attach Photos</u>			
General	Reason for Inspection		
	Spring <input type="checkbox"/>	Fall/Yearly <input type="checkbox"/>	After Major Storm <input type="checkbox"/>
Sweeping Maintenance Required?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Corrective Action Needed & Notes:			
Invasive Plant Removal Required?                      Yes <input type="checkbox"/> No <input type="checkbox"/> Corrective Action Needed & Notes:			
<u>Attach Photos</u>			



**Anti-icing Route Data Form**  
**Rock Road Townhomes – Londonderry, NH**

Truck Station:				
Date:				
Temperature:	Pavement Temperature:	Relative Humidity:	Dew Point:	Sky:
Reason For Applying:				
Route:				
Chemical:				
Application Time:				
Application Amount:				
Observation (first day):				
Observation (after event):				
Observation (before next application):				
Name:				



# How Salt Works

NH Best Management Practices

## BE PROACTIVE - ANTI-ICE

Anti-icing is the proactive method of preventing snow and ice from bonding to pavement. It can be more than 50% more efficient than deicing. See the NH Anti-icing Factsheet for more information.

## PRE-WETTING FOR FASTER ACTING SALT

Adding brine to salt before you apply it to pavement jump starts the melting process which means your pavement will be clear sooner. See the Pre-wetting Fact Sheet for more information.

## KNOW YOUR LIMITS

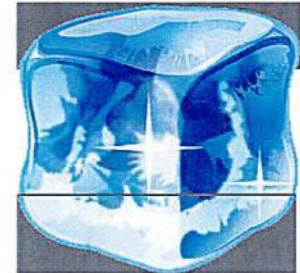
Dry salt becomes ineffective below 15°F if possible wait until the temperature rises before applying salt. At 30°F 1 lb of salt can melt 46.3 lb of ice in 5 minutes. At 15°F 1 lb of salt can melt 6.3 lb of ice in 1 hour.

## PLOW FIRST

Always plow before applying any kind of chemical deicer to avoid pushing it away!

## How Do We Melt Ice?

Ice can be melted by increasing the temperature, or lowering the freezing point of the water. It's not cost effective to use heat to melt ice on our roads so we use chemicals to reduce the freezing point—anything that will dissolve in water will work, including: salt, sugar, even alcohol!

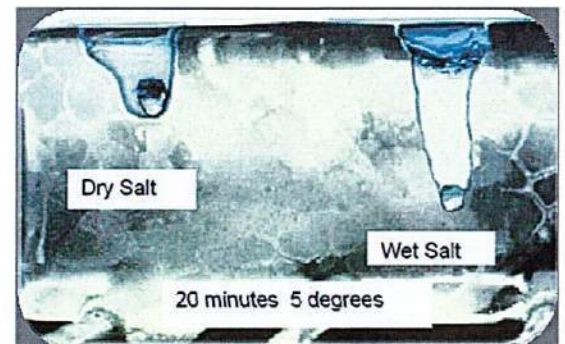


## Why Use Salt?

Salt (Sodium Chloride) is the cheapest and most readily available chemical that efficiently melts ice and can be easily applied to our roadways and parking lots. However salt does corrode our cars and bridges, contaminates drinking water and pollutes our streams. Alternatives include potassium acetate, and calcium magnesium acetate (CMA), — all of which are considerably more expensive than calcium chloride, and have their own environmental concerns.

## Brine Makes It Happen

The first step in melting ice is the formation of a brine. Salt crystals pull water molecules out of ice formation which creates a brine with a lower freeze point. Once the brine is formed melting is greatly accelerated. Save time and money by pre-wetting your salt with a brine before it hits the pavement to jump start melting! See the Pre-Wetting fact sheet for more information.



Source: Wisconsin DOT Transportation Bulletin #22



## Save \$\$ and the Environment

In New Hampshire there are over 40 watersheds currently contaminated from road salt. As the pavement temperature drops more salt is required. As the pavement temperature rises less salt is required. Save money and the environment by using only what is needed to do the job. See NH application rate charts for recommended rates.

Produced in partnership with:





# Anti-Icing

NH Best Management Practices

## GET OUT EARLY

Typically anti-icing is most effective if applied 1-2 hours before the precipitation begins however it can be applied up to 24 hours in advance.

## TRY IT FIRST

Trying anti-icing for the first time? Make a 23.3% brine solution and before a storm spray pavement on your own property using a masonry/plant sprayer. Use this experiment to determine how best to use it with your clients.

## LEAVE SOME PAVEMENT BARE

It's always best to use stream nozzles instead of fan tip to avoid creating a slippery condition. If the anti-icing liquid freezes the bare pavement will still provide a traction surface.

## USE A FILTER

Having a filter in your liquid dispensing system will reduce clogs in your nozzle. Automotive in line fuel filters work quiet well. If your liquid dispenser is not functioning properly be sure to check the filter first.

## A Proactive Treatment

Anti-icing before a storm is very similar to using a non-stick spray on a pan before cooking. Just like a non-stick spray prevents food from bonding to the pan, anti-icing prevents snow and ice from bonding to the pavement so that it can be plowed away. Anti-icing can save you **money** as it costs 50% less than reactive deicing.



## How Much Should I Use and When?

You can apply brine up to 24 hours in advance of the storm. Typical application rates range from 0.5 to 0.75 gallon per 1000 sq.ft. (10' x 100' area). Other chemicals such as magnesium are also available—consult your supplier for application rates. Anti-icing is **not** advised prior to freezing rain events.



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## Make Your Own Salt Brine

When making brine it is important to add enough salt to produce a 23.3% solution which freezes around 0°F. Roughly 2.5lb per gallon of water will produce a 23.3% solution. You can verify using a salometer (~\$20) a 23.3% solution will have a specific gravity of 1.176, or 85% salinity. Consult the Brine Making BMP sheet for more info.



## Getting Started

Try making your own salt brine by putting 13 lb of salt in 5 gallons of water to get a 23.3% salt brine solution. Mix the brine until all of the salt is dissolved. Using a masonry sprayer apply the liquid several hours before a storm. Start by applying about 0.25—0.5 gallons to a 10' x 50' area. Adjust the application rates based on your experience. Being careful not to over apply and cause a slippery condition.





# Pre-wetting

NH Best Management Practices

## PRE-WETTING?

Pre-wetting is the process of coating a solid de-icer with a liquid before it is spread on a roadway.

## WHY PRE-WET?

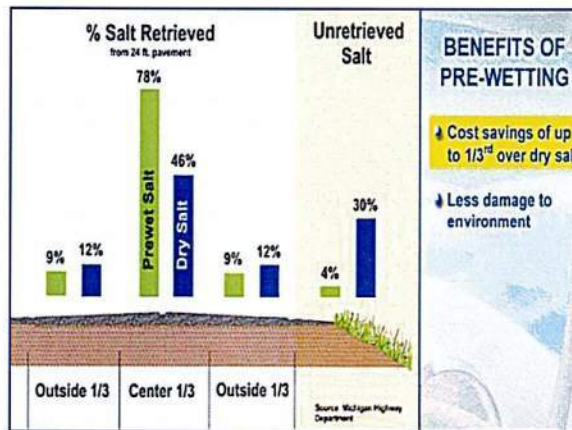
De-icing chemicals must form a brine before they can begin melting ice. Pre-wetting your chemicals accelerates the brine making process, which improves the melting action of the material. Pre-wetting also reduces bounce and scatter of material during spreading, and reduces the total amount of de-icer needed to obtain the desired results.

## REDUCED RATES

If you are pre-wetting, don't forget to reduce your application rates accordingly. Reductions in the range of 15-20% are typical.

## HOW MUCH LIQUID?

A good rule of thumb is to use 8-10 gallons of pre-wetting liquid for every ton of de-icer. For other chemicals, such as magnesium chloride, consult your supplier for application rates



## Pre-wetting Liquids

You have a few options for pre-wetting liquids. The most commonly used is a 23% sodium chloride brine solution. Calcium chloride at 32% solution is also used, as well as Magic Minus Zero™ and other patented products.

## Spraying the Pile

This is the easiest and most cost effective way to get started in pre-wetting. The first step is to spread your salt pile on a flat, impermeable surface. Next, spray the salt while it is spread out, and mix it around to ensure adequate and consistent liquid coverage. After the salt is sufficiently covered, re-stack the salt in your storage shed for later use.

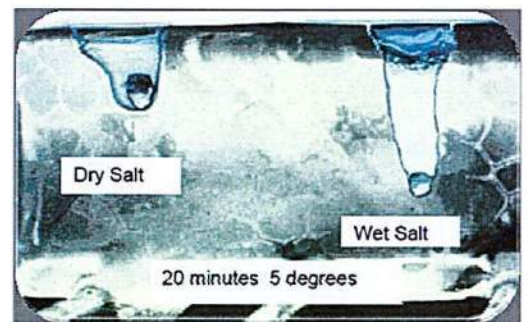


Produced in partnership with:



## Getting Started

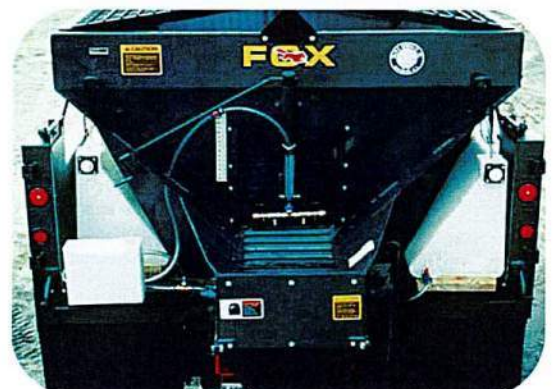
Wet the pile! There are two ways to pre-wet your de-icing chemicals. The easiest way to get started with pre-wetting is to spread your salt pile, spray it with pre-wetting liquid, mix it around, and re-pile it. More advanced truck mounted pre-wet systems can be installed on your trucks if you decide to make the investment.



Source: Wisconsin DOT Transportation Bulletin

## Truck Mounted Systems

These systems are mounted in the truck bed and coat the de-icer with liquid as it comes off the conveyor/auger onto the spinner. These systems have the benefit of applying liquid only to the material you use as you use it. However, these systems must be installed on every truck that will be used to spread pre-wetted material.





# Brine Making

NH Best Management Practices

## GET THE LOWEST FREEZE POINT

When salt brine is 23% salt (measured with a hydrometer: 1.176, or with a salimeter: 85%) it has the lowest freeze point possible (about 0°F).

## BRINE STORAGE

23% brine solution may be stored outside, however if temperatures get below 0°F the brine may freeze. A circulator pump will reduce the risk of freezing. If possible store brine indoors to eliminate risk of freezing.

## COST OF BRINE

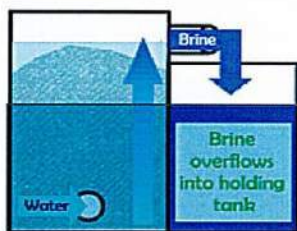
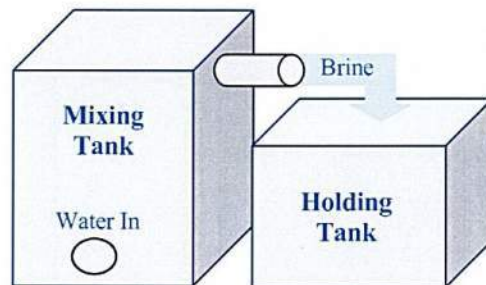
Calcium chloride brine costs about 7¢ / gallon (assuming \$58/ton for salt) after you have your equipment setup.

## MULTIPLE USES

Brine can be used directly for anti-icing, for prewetting salt as it is dispensed from your truck, or to pretreat salt before it is loaded into your truck. Brine can be safely stored for up to a year, however, the concentration should be tested before use.

## What Do You Need?

Brine making is a fairly simple process—the only ingredients are salt and water, and the only equipment you'll need is an open top mixing tank, a holding tank, a small pump, and a salimeter.



Images courtesy of Iowa DOT

## Step 1: Fill Mixing Tank

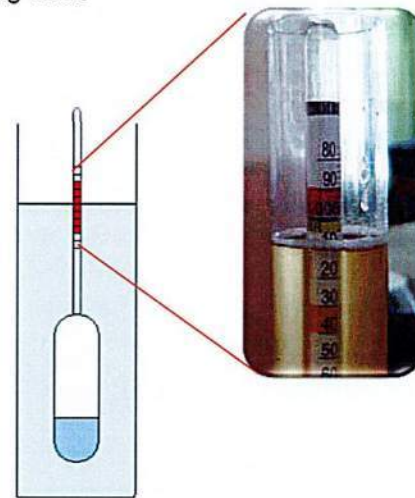
**Add Salt:** Add about 2.5 lb of salt per gallon of water you plan to add. Make sure your mixing tank has a large opening to make adding salt easy.

**Add Water:** Slowly add water from the bottom of your brine mixing tank. This will allow it to percolate up through the salt and overflow into the holding tank.

## Step 2: Check Concentration

Float a hydrometer or salimeter directly in your holding tank and read the value at the surface of the water. The number should be either 85% or 1.176 depending on the units of your device.

If the values are too low, pump some brine from your holding tank back into the mixing tank and allow it to overflow. If values are too high simply add some fresh water



Produced in partnership with:



## Quality Control & Documentation

Make sure that you record the date when you create each batch of brine and document who mixed it and checked the concentration. It is also a good idea to note the final concentration. These records should be kept for at least two years to protect your group in the event of litigation.





# Hydraulic-Run Spreader Calibration

NH Best Management Practices

## WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

## REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration chart *will* be different than the sand calibration chart).

Calibrations should be performed annually, or after a spreader is serviced.

## CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration.

Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.



## Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

## Step 2: Set Your Controls

**Gate Height:** Set the gate height to its lowest practical setting (~2"). This should be kept constant throughout the calibration process. If you find that not enough material is dispensed with this setting, try 2.5" to 3".  
**Engine Speed:** Warm the truck up and run the engine at the typical rate seen during spreading (approximately 2000 rpm).



## Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each conveyor/auger setting you are calibrating. Round your numbers to the nearest half foot and record them in column "W" of the calibration chart (see reverse side).

## Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each conveyor/auger setting that is typically used. Average these three values together and record in the orange column in the calibration chart.



## Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and conveyor/auger setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

## Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration chart in the truck you just calibrated. Also, leave a copy of the calibration chart in the office so you have a copy in case the original is damaged.

Produced in partnership with:



# Calibration Chart (Hydraulic Type)

Material: \_\_\_\_\_ Truck/Spreader ID: \_\_\_\_\_

Date: \_\_\_\_\_ Performed by: \_\_\_\_\_

Tarp/Canvas/Bucket Weight: \_\_\_\_\_

Conveyor or Auger Setting	W Spread Width (ft.)	A 5.28 x W	Discharge Rate (lb/min.)			B Average Discharge Rate $((Run1 + Run2 + Run3)/3)$	D Pounds of Material Discharged per 1000 square ft. ( $D = B \times C \div A$ )									
			Run 1	Run 2	Run 3		5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)				
1																
2																
3																
4																
5																
EX	14	5.28 x 14 = 73.92	87	92	93	$(87+92+93) \div 3 =$ 90.67	$12 \times 90.67 \div$ 73.92 = <b>14.72</b>	$6 \times 90.67 \div$ 73.92 = <b>7.36</b>	$4 \times 90.67 \div$ 73.92 = <b>4.91</b>	$3 \times 90.67 \div$ 73.92 = <b>3.68</b>	$2.4 \times 90.67 \div$ 73.92 = <b>2.94</b>	$2 \times 90.67 \div$ 73.92 = <b>2.45</b>				

Calculation Instructions: Multiply the spread width from column **W** by **5.28** and record the answer in column **A**. For each conveyor/auger setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by **3** and record in column **B** to get the average discharge rate. To find the pounds of material discharged per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable "**C**". The "**C**" value for each travel speed is shown in red under that given speed. Multiply column **B** by the "**C**" value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$



# Pony Motor-Run Spreader Calibration

NH Best Management Practices

## WHY CALIBRATE?

You can't reduce your salt use if you don't know how much salt you actually use! The goal of calibrating is to know how much material you are putting down on a roadway or parking lot for every setting on your truck that you use. This is why calibrating your equipment is the first step to reducing salt use and saving money!

## REMEMBER:

Each truck must be independently calibrated for each material it will be used to spread (the salt calibration card *will* be different than the sand calibration card).

Calibrations should be performed annually, or after a spreader is serviced.

## CALCULATIONS:

There are a few simple calculations you must perform in order to complete the calibration.

Once all of the necessary data is recorded, head back inside and warm up! Refer to the reverse side of this fact sheet for calculation instructions.



## Step 1: Load the Truck

Partially load the truck. Half of a full load should be more than adequate for calibration purposes.

## Step 2: Set Your Controls

**Gate Height:** Set the gate height to its lowest practical setting to start (approximately 1" to 1.5"). After the truck is calibrated for the lowest gate setting, calibrate for each 1/2" increment greater than the lowest setting. Continue until all gate settings you use are calibrated.

**Engine Speed:** Set the pony motor speed to the maximum setting, or to the setting you would normally use.



## Step 3: Measure Spread Width

Measure the width that the material covers during spreading. Do this for each gate setting you are calibrating. Round your numbers to the nearest half foot and record them in column "W" of the calibration chart (see reverse side).

## Step 4: Collect & Weigh Material

You will need either a sheet of canvas, a tarp, or a bucket to collect the material that is dispensed from the spreader, as well as a scale. Weight the object you are using to collect the material in, and record that value in the purple box above the discharge rate column. Collect material for 1 minute. Weigh the collected material and subtract the weight of the tarp/canvas/bucket. Record this value in the first purple column of the calibration chart. Do this 3 times for each gate opening that is typically used. Average these three values together and record in the orange column in the calibration chart.



## Step 5: Perform Calculations

Go inside and calculate your discharge rate using the calibration chart for each truck speed and gate setting you normally use. Refer to the reverse side of this fact sheet for calculation instructions. The formula you will be using is shown below:

$$D = \frac{B \times C}{A}$$

## Step 6: Distribute Completed Calibration Cards!

Put a copy of the calibration card in the truck you just calibrated. Also, leave a copy of the calibration card in the office so you have a copy in case the original is damaged.



# Calibration Chart (Pony Motor Type)

Material: \_\_\_\_\_ Truck/Spreader ID: \_\_\_\_\_

Date: \_\_\_\_\_ Performed by: \_\_\_\_\_

Gate Opening		Tarp/Canvas/Bucket Weight:		Discharge Rate (lb/min.)			B Average Discharge Rate ((Run1 + Run2 + Run3)/3)	D Pounds of Material Discharged per 1000 square ft. (D = B x C ÷ A)								
		W Spread Width (ft.)	A 5.28 x W	Run 1	Run 2	Run 3		5 mph (C = 12)	10 mph (C = 6)	15 mph (C = 4)	20 mph (C = 3)	25 mph (C = 2.4)	30 mph (C = 2)			
1"																
1.5"																
2"																
2.5"																
3"																
EX		14	5.28 x 14 = 73.92	87	92	93	(87+92+93)÷3 = 90.67	12 x 90.67 ÷ 73.92 = 14.72	6 x 90.67 ÷ 73.92 = 7.36	4 x 90.67 ÷ 73.92 = 4.91	3 x 90.67 ÷ 73.92 = 3.68	2.4 x 90.67 ÷ 73.92 = 2.94	2 x 90.67 ÷ 73.92 = 2.45			

Calculation Instructions: Multiply the spread width from column **W** by 5.28 and record the answer in column **A**. For each gate setting, add **Run 1**, **Run 2**, and **Run 3** together. Divide the result by 3 and record in column **B** to get the average discharge rate. To find the pounds of material discharge per 1000 square feet, you must know the number of minutes it takes to travel one mile at every truck speed you intend to calibrate for. These numbers are designated as variable "C". The "C" value for each travel speed is shown in red under that given speed. Multiply column **B** by the "C" value for that speed and divide by the **A** column to find the number of pounds of material discharged per 1000 square feet for the given speed. Record these numbers in the **D** columns. The full equation is shown here:

$$D = \frac{B \times C}{A}$$

**Example: Step #1, blank calibration form**

See the References and Resources section for a full size form to copy for calibration. This is how the empty form looks. (Keep a stack of these on a clipboard when ready to begin the calibration.)

**CALIBRATION CHART FOR AUGER OR CONVEYOR SYSTEMS**

DATE \_\_\_\_\_ SPREADER # \_\_\_\_\_ MATERIAL \_\_\_\_\_

SETTING	POUNDS PER MINUTE	5 MPH (x12)	10 MPH (x6)	15 MPH (x4)	20 MPH (x3)
1					
2					
3					

Figure 10: Blank calibration form

**Example: Step #2, calibration form filled out during calibration**

Fill in the header information and column 2, the discharge weight per setting.

**CALIBRATION CHART FOR AUGER OR CONVEYOR SYSTEMS**

DATE 8-Aug-15 SPREADER # A4219 MATERIAL Rock Salt

SETTING	POUNDS PER MINUTE	5 MPH (x12)	10 MPH (x6)	15 MPH (x4)	20 MPH (x3)
1	10				
2	22				
3	34				

Figure 11: Example calibration form with discharge and header information filled out

**Example: Step #3, calibration form ready to put in truck for road application**

Back in the shop, do the calculations to fill in the rest of the blanks. Multiply the weight in column 2 with the multiplier in the top row. This provides the pounds per mile that needed to fill in the table.

**CALIBRATION CHART FOR AUGER OR CONVEYOR SYSTEMS**

DATE 8-Aug-15 SPREADER # A4219 MATERIAL Rock Salt

SETTING	POUNDS PER MINUTE	5 MPH (x12)	10 MPH (x6)	15 MPH (x4)	20 MPH (x3)
1	10	* 120	60	40	30
		**			
2	22	264	132	88	66
3	34	408	204	136	102

\* top half of each row = lbs/lane mile. To get this number, multiply lbs/min by the factor shown for each speed.

\*\* bottom half of each row = lbs/1000 sq.ft. To find this, divide the number in the top half by 63.

Figure 12: Example calibration form with pounds per lane mile filled out



**Some fish species are affected by concentrations of less than 1000 ppm NaCl, about 1 to 1.5 tablespoons of salt in 5 gallons of water.**

**Example: Step #4, calibration form ready to zip tie to hand spreader or put in truck for parking lot application.**

Divide by 63 to convert pounds per lane mile to pounds per 1,000 square feet. This is very useful for parking lot and sidewalk applications.

## CALIBRATION CHART FOR AUGER OR CONVEYOR SYSTEMS

DATE 8-Aug-15 SPREADER # A4219 MATERIAL Rock Salt

SETTING	POUNDS PER MINUTE	5 MPH (x12)	10 MPH (x6)	15 MPH (x4)	20 MPH (x3)
1	10	*120	60	40	30
		**1.9	1.0	0.6	0.5
2	22	264	132	88	66
		4.2	2.1	1.4	1.0
3	34	408	204	136	102
		6.5	3.2	2.2	1.6

\* top half of each row = lbs/lane mile. To get this number, multiply lbs/min by the factor shown for each speed.

\*\* bottom half of each row = lbs/1000 sq.ft. To find this, divide the number in the top half by 63.

Figure 13: Example calibration form with pounds per 1000 sq. ft. filled out

### Gravity Flow Equipment

This is applicable for equipment that does not have a motorized delivery system such as an auger. This type of equipment might be a pickup mounted spreader, gator mounted spreader or a hand push spreader. Gravity flow equipment is typically controlled by gate opening and speed of application.

#### **Step 1: Calculate discharge rate**

- Mark out a 10-foot stretch of pavement. (By increasing the size of the test area i.e., the longer the test area, the more accurate the results will be).
- Sweep it clean of sand or any other material.
- Using a constant speed, apply one pass of material to the test area.
- Measure the width the material is spread or bounces, in feet.
- Sweep up and weigh the material that is within the marked 10-foot stretch.
- Record the lever position/setting for the gate/chute. If there are no numbers for the positions, make permanent marks on the equipment to identify the positions.
- To improve accuracy, repeat this two more times and calculate the average weight of material applied.
- Record results in columns A, B, C, and D (Figure 14).

#### **Step 2: Repeat step #1 for various settings.**

### Step 3: Fill out chart.

- Fill out columns E, F, and G (Figure 14).
- If using more than one type of material, repeat the test for each material.
- Place the completed calibration chart with the equipment.

### Shortcuts:

- Put down a tarp over the application area; this makes it quicker to recover and weigh material.
- After the first pass, put a bag around spreader to catch discharge material. The first pass is needed to determine the spread width.

### Calculate application rate:

Equipment: \_\_\_\_\_ Material: \_\_\_\_\_ Date: \_\_\_\_\_

A	B	C	D	E	F	G
Speed	Lever position or gate setting	Pounds spread in 10 feet*	Spread width in feet	Coverage area in sq. ft. (D x 10)*	Application rate in lbs./1000 ft <sup>2</sup> (1000/E x C)	Application rate in lbs./lane mile (12' width) (F x 63.4)
.....EXAMPLE.....						
20 MPH	Half-closed	0.4 lbs.	13 feet	130 sq. ft.	3.1 lbs. per 1000 sq. ft.	196 lbs./mile

\* If changing the test strip length, adjust the title in column C and the multiplier in column E.

Figure 14: Example calibration chart for gravity flow equipment

### What if calibration is not a practice?

Even without calibrating the equipment, the amount of material to use can be determined but will take more time to calculate. Know the material, the size of the area to be treated, and the pavement temperature, then consult the application rate chart (application rate section) and do the math. Without calibration, the way to evenly distribute the recommended amount across the maintenance area must be determined by the professional. This approach may work well for treating sidewalks using the “chicken feed” method. For example:

- 20°F degrees pavement temperature and rising
- Using dry salt
- Sidewalk is 2,000 square feet
- Table recommends 2.25 lbs. per 1,000 square feet (for this situation)
- Measure about 4.5 lbs. of salt
- Figure out a way to spread it evenly over the 2,000 sq. ft. surface



**Sand fills in lake bottoms, accelerating the aging process of lakes.  
Lakes get shallower as they age, some eventually becoming wetlands.**



**CALIBRATION CHART FOR AUGER OR CONVEYOR SYSTEMS**

DATE \_\_\_\_\_ SPREADER # \_\_\_\_\_ MATERIAL \_\_\_\_\_

SETTING	POUNDS PER MINUTE	Quantity Area	5 MPH (x12)	10 MPH (x6)	15 MPH (x4)	20 MPH (x3)
1		lbs/lane mile				
		lbs/1000 sq.ft.				
2		lbs/lane mile				
		lbs/1000 sq.ft.				
3		lbs/lane mile				
		lbs/1000 sq.ft.				
4		lbs/lane mile				
		lbs/1000 sq.ft.				
5		lbs/lane mile				
		lbs/1000 sq.ft.				
6		lbs/lane mile				
		lbs/1000 sq.ft.				

Figure 16: Blank calibration chart for augured or conveyed manual controlled spreaders



**Hiring a NH Certified Green SnowPro as your snow removal contractor will help protect you and your company from slip and fall claims arising from snow and ice conditions.**

### **What can you do?**

Look for a certified salt applicator at <http://des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/salt-applicator-certification.htm> or ask your current contractor to take the Green SnowPro course and become certified.

### **How can your organization benefit from the certification?**

#### **Reduce Your Liability**

Under RSA 508:22, certified applicators and those who hire them are granted liability protection from claims arising from snow and ice conditions (slip and fall claims).

#### **Certified Green SnowPros**

NH Certified Green SnowPros are leaders in the snow removal industry who are trained in the most up to date technologies and snow management practices to ensure a high level of service and safety to their customers.

#### **Reduce Impacts to Local Waterbodies**

Once in our water supplies, there is no practical way to remove salt. Certified Green SnowPros are trained in salt reduction practices to help ensure clean water for future generations.

### **Why is salt reduction important?**

As of 2014, 46 water bodies in New Hampshire are polluted with chloride due to road salt application. In several watersheds analyzed in the southern I-93 corridor, more than 50% of the salt load comes from private roads and parking lots. The other major sources are state and local roads and highways.

### **Training**

For upcoming Green SnowPro Training dates go to <http://t2.unh.edu/greensnowpro-training-and-certification>

### **For more information:**

Visit <http://www.des.nh.gov> and see "Road Salt Reduction" under the A-Z list.

**Contact: Patrick Woodbrey**  
[Patrick.Woodbrey@des.nh.gov](mailto:Patrick.Woodbrey@des.nh.gov)  
(603) 271-5329



## ATTACHMENT B – SMART SALTING PRACTICES

A checklist for snow and ice maintenance contractors.

Recommended practice	Check which response applies to current practices and anticipated site maintenance activities for job site.				
	Already do	Will do	Might do	Will not do	If "will not do"....why not?
Use an application rate chart.					
Calibrate equipment each year.					
Learn about the deicer ingredients and use the appropriate one for the condition.					
Look for reasons if and why materials are leaking or spilling from vehicles and fix them (e.g. gaps, overfilling, etc).					
Develop a comprehensive winter maintenance policy. Follow your policy.					
Measure and use pavement temperatures.					
Use anti-icing appropriately prior to the storm.					
Plow before applying deicers.					
Use wet materials (pre-wet or pre-treated).					
Don't apply sodium chloride (road salt) for pavement temperatures below 15°F.					
Don't apply deicers for pavement temps under -10° F. It's too cold.					
Separate salt and sand. Use salt for melting. Use sand for traction.					
Apply deicers in the center of the road or on the high side of the curve.					
Store the salt in a building or under secure cover.					
Store salt away from water flow and direct the water away from storage area.					
Store snow away from lakes, ponds and wetlands.					
Sweep up sand, dispose of properly.					
For each event, document what you did and how well it worked. Use this information to make improvements.					

*Checklist is adapted from worksheet created by Fortin Consulting as a part of the Minnesota Pollution Control Agency Smart Salting Voluntary Certification Program.*

### III. Control of Invasive Plants

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Invasive plants are introduced, alien, or non-native plants, which have been moved by people from their native habitat to a new area. Some Exotic plants are imported for human use such as landscaping, erosion control, or food crops. They also can arrive as “hitchhikers” among shipments of other plants, seeds, packing materials, or fresh produce. Some exotic plants become invasive and cause harm by:

- becoming weedy and overgrown;
- killing established shade trees;
- obstructing pipes and drainage systems;
- forming dense beds in water;
- lowering water levels in lakes, streams, and wetlands;
- destroying natural communities;
- promoting erosion on stream banks and hillsides; and
- resisting control except by hazardous chemical.

During maintenance activities, check for the presence of invasive plants and suitably remove according to the methods provided in the table below. The following table, based on the “Control of Invasive Plants” published by the New Hampshire Department of Agriculture, describes the most common invasive plants in this region and proper methods of disposal.

Name	Description	Invasive Qualities	Control Methods
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<b>Invasive Trees</b>			
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<p>Norway Maple</p>	<ul style="list-style-type: none"> <li>- Large leaves</li> <li>- Will exude milky white sap when leaves are broken</li> <li>- Leaves turn color in Late October (fall foliage is yellow)</li> </ul>	<ul style="list-style-type: none"> <li>- Suppresses growth of grass, garden plants, and forest understory</li> <li>- Wind-borne seeds can germinate and grow in deep shade</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out plants, including the root systems. Use a forked spade or weed wrench.</li> <li>- Cut down the tree. Grind out the stump, or clip off re-growth.</li> <li>- Girdle<sup>1</sup></li> <li>- Frill<sup>2</sup></li> <li>- Cut stem/ cut stump with glyphosate. Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> <li>- Foliar spray with glyphosate <sup>3*</sup> (mid-October to early November).</li> </ul>
<p>Tree of Heaven</p>	<ul style="list-style-type: none"> <li>- Long compound leaves with 11-25 lance shaped leaflets</li> <li>- Smell like peanut butter or burnt coffee when crushed</li> </ul>	<ul style="list-style-type: none"> <li>- Tough, can grow in poor conditions</li> <li>- Produces large quantities of wind-borne seeds</li> <li>- Grows rapidly</li> <li>- Secretes a toxin that kills other plants</li> <li>- Cannot be removed by mechanical means alone</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings when soil is moist.</li> <li>- Frill<sup>2</sup> (no more than 1" gap between cuts). Use Garlon 3a herbicide.</li> <li>- Cut stem/ cut stump with Garlon 3a. Follow label directions for cut stump application. Clip off sucker sprouts or paint with Garlon 3a.*</li> <li>- Foliar spray<sup>3*</sup> (on regrowth)</li> <li>- Paint bottom 12" of bark with Garlon 4 Ultra (February/March). Use maximum strength specified on label for all herbicide applications.</li> </ul>

<b>Invasive Shrubs</b>			
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<p>Autumn Olive</p>	<ul style="list-style-type: none"> <li>- Formerly recommended for erosion control and wildlife value</li> </ul>	<ul style="list-style-type: none"> <li>- Highly invasive, diminishes the overall quality of wildlife habitat</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems. Use a forked spade or weed wrench for trees or shrubs (up to 4" diameter trunks).</li> <li>- Cut down the tree. Grind out the stump, or clip off re-growth.</li> <li>- Cut stem/ cut stump with glyphosate. Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> <li>- Bury stump</li> <li>- Do not mow</li> </ul>
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**Invasive Shrubs (continued)**

<p><b>Multiflora Rose</b></p>	<ul style="list-style-type: none"> <li>- Formerly recommended for erosion control, hedges, and wildlife habitat</li> <li>- Covered in white flowers in June</li> <li>- Very hard, curved thorns</li> <li>- Fringed edge to leaf stalk</li> </ul>	<ul style="list-style-type: none"> <li>- Huge shrub that chokes out all other vegetation</li> <li>- Too dense for most birds to nest in</li> <li>- Grows up trees like a vine in Shade</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems (at least 6" from the crown and 6" down). Use a forked spade or weed wrench for trees or shrubs.</li> <li>- Controlled burning<sup>4</sup> (on extensive infestations)</li> <li>- Cut stem/ cut stump with glyphosate. Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> <li>- Foliar spray<sup>3*</sup> (mix Rodeo with extra sticker-spreader, or use Roundup Sure Shot Foam on small plants)</li> <li>- Herbicide may be applied in winter when other plants are dormant.</li> </ul>
<p><b>Bush Honeysuckles</b></p>	<ul style="list-style-type: none"> <li>- Includes Belle, Amur, Morrow's, and Tatarian Honeysuckle</li> </ul>	<ul style="list-style-type: none"> <li>- Creates dense shade reducing plant diversity and eliminating nest sites in forest interior spaces</li> </ul>	<ul style="list-style-type: none"> <li>- Deadhead to prevent spread of seeds (on ornamentals). Cut off seeds or fruits before they ripen. Bag and burn, or send to a landfill.</li> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems. Use a forked spade or weed wrench for trees or shrubs.</li> <li>- Mow or cutting at least 4 times a season to deplete plants' store of nutrients and carbohydrates, reduce seed formation, and kill or minimize spread of plants. If necessary, repeat each year (on shady sites only, brush cut in early spring and fall).</li> <li>- Controlled burning<sup>4</sup> (during growing season)</li> <li>- Cut down the tree. Grind out the stump, or clip off re-growth.</li> <li>- Cut stem/ cut stump with Glyphosate (late in the growing season). Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> </ul>

### Invasive Shrubs (continued)

<p><b>Blunt-Leaved Privet</b></p>	<ul style="list-style-type: none"> <li>- Medium sized shrub</li> <li>- Simple, oblong, dark green leaves 1-2" in length</li> <li>- Fragrant white flowers (spring)</li> <li>- Blackish-purple fruit (late summer)</li> </ul>	<ul style="list-style-type: none"> <li>- Toxic to mammals</li> <li>- Loss of valuable habitat</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems. Use a forked spade or weed wrench for trees or shrubs.</li> <li>- Cut down the tree. Grind out the stump, or clip off re-growth.</li> <li>- Cut stem/ cut stump with Glyphosate. Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> <li>- Trim off all flowers</li> <li>- Do not cut back or mow</li> </ul>
<p><b>Burning Bush, Winged Euonymus</b></p>	<ul style="list-style-type: none"> <li>- Wide, corky wings on the Branches</li> <li>- Brilliant red autumn leaves</li> <li>- Fruit</li> </ul>	<ul style="list-style-type: none"> <li>- High seed production</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems. Use a forked spade or weed wrench for trees or shrubs.</li> <li>- Cut down the tree. Grind out the stump, or clip off re-growth.</li> <li>- Cut stem/ cut stump with Glyphosate. Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> <li>- Trim off all flowers</li> </ul>
<p><b>Japanese Barberry</b></p>	<ul style="list-style-type: none"> <li>- Spiny deciduous shrub</li> <li>- Small leaves</li> </ul>	<ul style="list-style-type: none"> <li>- Very dense, displaces native plants</li> <li>- Can change chemistry of soil</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems. Use a forked spade or weed wrench for trees or shrubs.</li> <li>- Cut down the tree. Grind out the stump, or clip off re-growth.</li> <li>- Cut stem/ cut stump with Glyphosate. Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> <li>- Trim off all flowers</li> </ul>

### Invasive Woody Vines

<p style="text-align: center;"><b>Japanese Honeysuckle</b></p>	<ul style="list-style-type: none"> <li>- Gold and White flowers</li> <li>- Heavy scent and sweet nectar in June</li> </ul>	<ul style="list-style-type: none"> <li>- Shade shrubs and young trees of the forest understory, eventually killing them, and changing the open structure of the forest into a dense tangle</li> <li>- Rampant grower</li> <li>- Spirals around trees, often strangling them</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems. Use a forked spade or weed wrench for trees or shrubs.</li> <li>- Mow or cutting at least 4 times a season to deplete plants' store of nutrients and carbohydrates, reduce seed formation, and kill or minimize spread of plants. If necessary, repeat each year.</li> <li>- Cut stem/ cut stump with Glyphosate. Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> <li>- Foliar spray<sup>3*</sup> (fall or early spring when native vegetation is dormant)</li> <li>Plan to re-treat repeatedly</li> </ul>
<p style="text-align: center;"><b>Oriental Bittersweet</b></p>	<ul style="list-style-type: none"> <li>- Bright orange seed capsules in clusters all along the stem</li> <li>- Flowers</li> </ul>	<ul style="list-style-type: none"> <li>- Shade shrubs and young trees of the forest understory, eventually killing them, and changing the open structure of the forest into a dense tangle</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist. Dig out larger plants, including the root systems. Use a forked spade or weed wrench for trees or shrubs.</li> <li>- Keep ornamental plants cut back, remove all fruits as soon as they open, and bag or burn fruits.</li> <li>- Cut stem/ cut stump with Garlon 3a. Follow label directions for cut stump application. Clip off sucker sprouts or paint with Garlon 3a.*</li> </ul>
<p style="text-align: center;"><b>Japanese Knotweed, Mexican Bamboo</b></p>	<ul style="list-style-type: none"> <li>- The stems have knotty joints, similar to bamboo</li> <li>- Grows 6-10' tall</li> <li>- Large, pointed oval or triangular leaves</li> </ul>	<ul style="list-style-type: none"> <li>- Shade shrubs and young trees of the forest understory, eventually killing them, and changing the open structure of the forest into a dense tangle</li> <li>- Can grow in shade</li> </ul>	<ul style="list-style-type: none"> <li>- Cut stem/ cut stump with Glyphosate (at least 3 times each during growing season). Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> <li>- Foliar spray<sup>3*</sup></li> <li>- Treat with Rodeo</li> <li>- In gardens, heavy mulch or dense shade may kill it.</li> </ul>

### Invasive Herbaceous Plants

<p>Garlic Mustard</p>	<ul style="list-style-type: none"> <li>- White-flowered biennial</li> <li>- Rough scalloped leaves (kidney, heart, or arrow shaped)</li> <li>- Garlic smell, mustard taste when its leaves are crushed</li> </ul>	<ul style="list-style-type: none"> <li>- Shade shrubs and young trees of the forest understory, eventually killing them, and changing the open structure of the forest into a dense tangle</li> <li>- Rampant grower</li> <li>- Spirals around trees, often strangling them</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist (before it flowers in spring). Dig out larger plants, including the crown and root systems. Use a forked spade or weed wrench for trees or shrubs. Tamp down soil afterwards.</li> <li>- Deadhead to prevent spread of seeds. Cut off seeds or fruits before they ripen. Bag and burn or send to a landfill.</li> <li>- Foliar spray<sup>3*</sup> (may be appropriate in some settings)</li> </ul>
<p>Japanese Stilt Grass</p>	<ul style="list-style-type: none"> <li>- Lime green color</li> <li>- Line of silvery hairs down the middle of the 2-3" long blade</li> </ul>	<ul style="list-style-type: none"> <li>- Tolerates sun or dense shade</li> <li>- Quickly invades areas left bare or disturbed by tilling or flooding</li> <li>- Builds a large seed bank in the soil</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist (pulled easily in early to mid-summer). Dig out larger plants, including root systems. Use a forked spade or weed wrench for trees or shrubs. Be sure to pull before it goes to seed. If seeds have formed, bag and burn or send to a landfill.</li> <li>- Mow or cutting at least 4 times a season to deplete plants' store of nutrients and carbohydrates, reduce seed formation, and kill or minimize spread of plants. If necessary, repeat each year. Mowing weekly or when it has just begun to flower may prevent it from setting seed.</li> <li>- Foliar spray<sup>3*</sup> (use glyphosate or herbicidal soap on large infestations).</li> <li>- Use a corn-based pre-emergence herbicide on annual weeds (spring). This product is also an organic fertilizer, i.e., it can stimulate growth of existing plants, including weeds, so it is appropriate for lawns and gardens but may not be appropriate in woodlands.</li> </ul>

### Invasive Herbaceous Plants (continued)

<p>Mile-A-Minute Vine, Devil's Tail Tearthumb</p>	<ul style="list-style-type: none"> <li>- Triangular leaves</li> <li>- Barbed stems</li> <li>- Turquoise berries</li> </ul>	<ul style="list-style-type: none"> <li>- Rapid growth</li> <li>- Quickly covers and shades out herbaceous plants</li> </ul>	<ul style="list-style-type: none"> <li>- Pull seedlings and small or shallow-rooted plants when soil is moist (pulled easily in early to mid-summer). Dig out larger plants, including root systems. Use a forked spade or weed wrench for trees or shrubs. Be sure to pull before it goes to seed. If seeds have formed, bag and burn or send to a landfill.</li> <li>- Mow or cutting at least 4 times a season to deplete plants' store of nutrients and carbohydrates, reduce seed formation, and kill or minimize spread of plants. If necessary, repeat each year. Mowing weekly or when it has just begun to flower may prevent it from setting seed.</li> <li>- Foliar spray<sup>3*</sup> (use glyphosate or herbicidal soap on large infestations).</li> <li>- Use a corn-based pre-emergence herbicide on annual weeds (spring). This product is also an organic fertilizer, i.e., it can stimulate growth of existing plants, including weeds, so it is appropriate for lawns and gardens but may not be appropriate in woodlands.</li> </ul>
<p>Spotted Knapweed</p>	<ul style="list-style-type: none"> <li>- Thistle-like flowers</li> </ul>	<ul style="list-style-type: none"> <li>- Dense, crowds out native species</li> </ul>	<ul style="list-style-type: none"> <li>- Do not pull unless the plant is young and the ground is very soft. The root will break and produce several new plants.</li> <li>- Wear sturdy gloves</li> <li>- Deadhead to prevent spread of seeds. Cut off seeds or fruits before they ripen. Bag and burn, or send to a landfill.</li> <li>- In lawns, spot treat with broad-leaf weed killer. Good lawn care practices (test soil; use lime and fertilizer only when soil test shows a need; mow high and frequently; leave clippings on lawn) reduce weed infestations.</li> <li>- Cut stem/ cut stump with Glyphosate. Follow label directions for cut stump application. Clip off sucker sprouts or paint with glyphosate.*</li> <li>- Foliar spray<sup>3*</sup></li> </ul>

<sup>1</sup>Girdle: Cut through the bark and growing layer all around the trunk, about 6" above the ground. Girdling is most effective in spring (when the sap is rising) & middle-late summer (when the tree is sending food to the roots). Clip off sucker sprouts.

<sup>2</sup>Frill: Using a machete, hatchet, or similar device, hack scars (several holes in larger trees) downward into the growing layer, and squirt in glyphosate (or triclopyr if specified in table). Follow label directions for injection and frill applications. This is most effective from middle to late summer. Clip off any sucker sprouts or treat with glyphosate.

<sup>3</sup>Foliar Spray: Use a backpack or garden sprayer or mist blower, following label directions. Avoid overspray and/or dripping onto non-target plants, because glyphosate kills most plants except moss. If it rolls off waxy or grass-like foliage, use additional sticker-spreader. Deciduous trees, shrubs, and perennials move nutrients down to the roots in late summer. Glyphosate is particularly effective at this time and when plants have just gone out of flowering. Several invasive species retain their foliage after native plants have lost theirs, and resume growth earlier in spring than most natives. This allows you to treat them without harming the natives. However, the plant must be actively growing for the herbicide to work. Retreatments may be necessary the following year if suckering occurs or the plant hasn't been entirely killed.

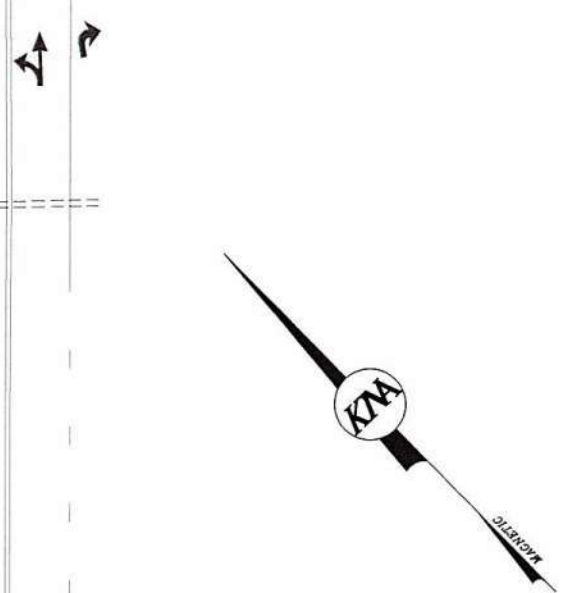
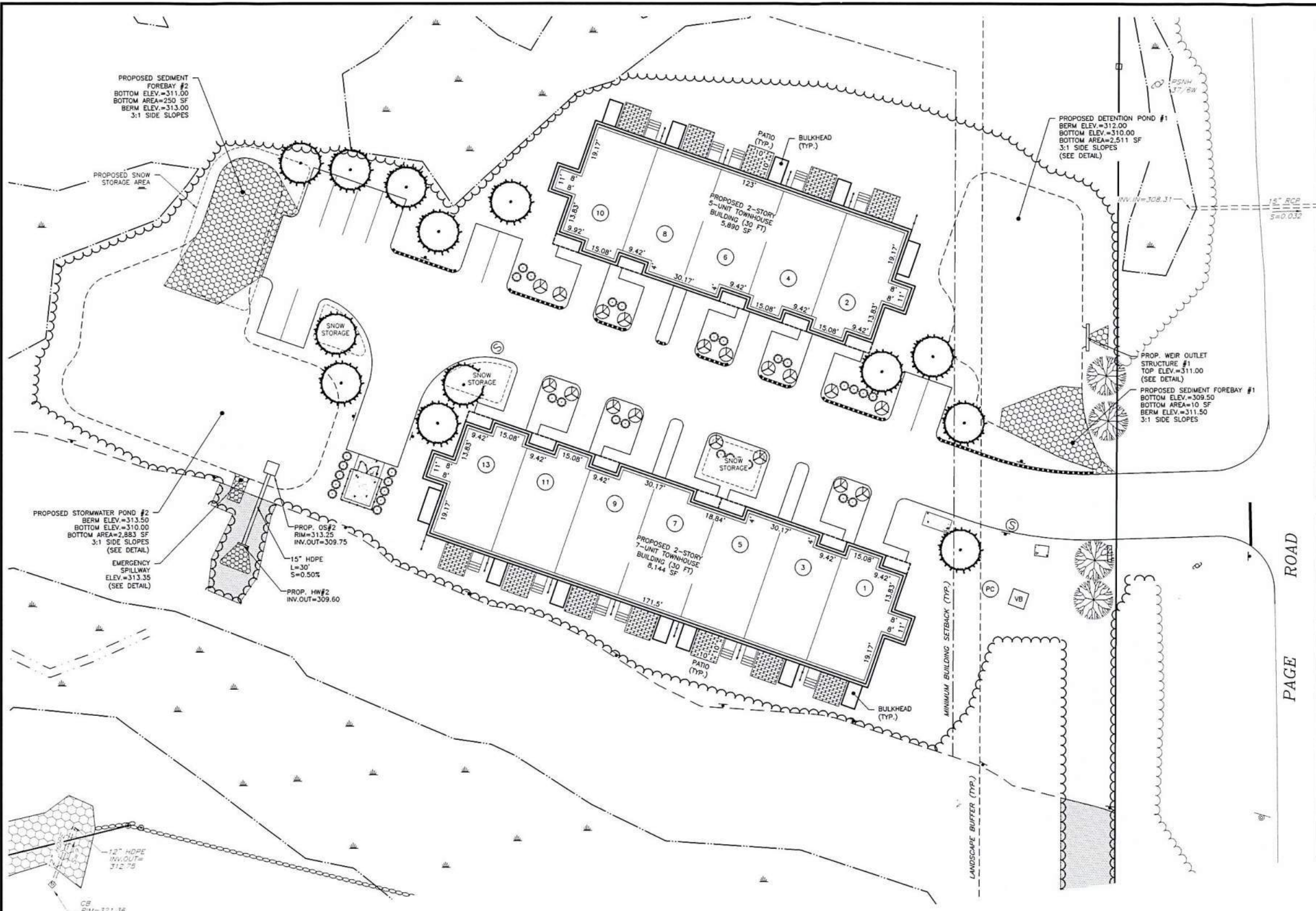
<sup>4</sup>Controlled Burning: Burning during the spring (repeated over several years) will allow native vegetation to compete more effectively with the invasive species. This requires a permit. Spot treatment with glyphosate in late fall can be used to make this method more effective

\*Herbicides: It is highly recommended that small populations try to be controlled using non-chemical methods where feasible. However, for large infestations, and for a few plants herbicide use is essential. Apply herbicides carefully to avoid non-target plants, glyphosate is the least environmentally damaging herbicide in most cases. Add food coloring for visibility, and a soap-based sticker such as Cide-Kick. Glyphosate is ineffective on some plants; for these, triclopyr or Garlon 3a may be indicated. When using herbicides read the entire label and observe all precautions listed, including proper disposal. If in doubt, call your local Cooperative Extension Service.

## **IV. Stormwater Practice Location Plan**

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N:\project\2101131\dwg\Production Drawings\LOT 25 Townhouses\LOT 25 Townhouse Site\_REV2.dwg, 2/18/2025 3:44:27 PM, \\KNA-DC01\TOSHIBA 7525AC



**LEGEND**

●	REBAR FOUND	---	PROPERTY LINE
○	IRON PIPE FOUND	---	ABUTTER LINE
+	UTILITY POLE	---	TREELINE
×	SIGN	---	EDGE OF PAVEMENT
○	GAS VALVE	---	BUILDING SETBACK
○	WATER VALVE	---	BUFFER LINE
○	HYDRANT	---	10' CONTOUR
○	WATER SHUT OFF	---	2' CONTOUR
○	CATCH BASIN	---	DRAINAGE LINE
○	TOP OF WALL	---	STONEWALL
○	BOTTOM OF WALL	---	WETLAND
○	TOP OF CURB	---	
○	BOTTOM OF CURB	---	
○	SEWER MANHOLE	---	
○	RIPRAP	---	
○	CONCRETE	---	



BENCHMARK DATA				REVISIONS		
LOCATION	DATUM	DESCRIPTION	NO.	DATE	DESCRIPTION	BY
N:155165.31, E:1054227.35	ELEV.=317.51 (NAVD88)	BENCHMARK #1 - MAGNAIL SET	1	11/25/25	ENGINEERING & DRC REVISIONS	PCM
N:154442.42, E:1054087.65	ELEV.=311.87 (NAVD88)	BENCHMARK #2 - MAGNAIL SET	2	2/20/25	ENGINEERING REVISIONS	PCM

**OWNER/APPLICANT:**  
 PAGE ROCK, LLC  
 5 HUTCHINGS DRIVE, SUITE 50  
 HOLLIS, N.H. 03049  
 BK. 6276 PG. 396

**STORMWATER PRACTICE LOCATION PLAN**  
**ROCK ROAD TOWNHOMES**

MAP 17 LOT 25  
 295 ROCKINGHAM ROAD  
 LONDONDERRY, NEW HAMPSHIRE  
 ROCKINGHAM COUNTY

**PROJ. NO:** 21-0113-1  
**DATE:** MAY 6, 2025  
**SCALE:** 1" = 20'  
**FILE NO.:**  
**SHEET NO.** 1 OF 1

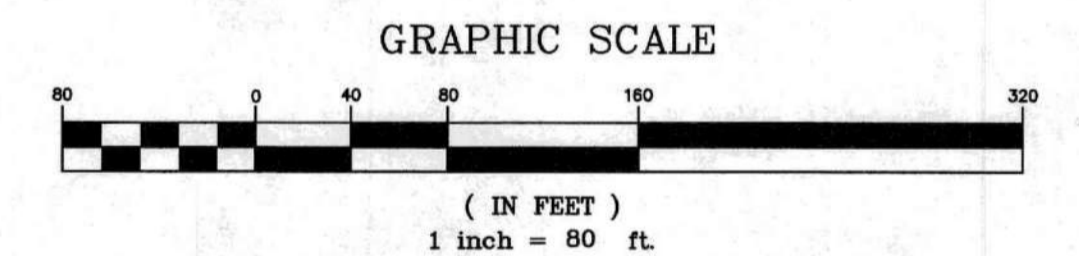
**KNA**  
 KEACH-NORDSTROM ASSOCIATES, INC.  
 Civil Engineering Land Surveying Landscape Architecture  
 10 Commerce Park North, Suite 3B, Bedford, NH 03110 Phone (603) 427-2881



- NOTES:**
1. THE PURPOSE OF THIS PLAN IS TO DEPICT THE VARIOUS STORMWATER SUBCATCHMENT AREAS, CORRESPONDING TIMES OF CONCENTRATION, PONDS, AND REACHES ASSOCIATED WITH THE SUBJECT PARCEL PRIOR TO DEVELOPMENT.
  2. EXISTING FEATURES DEPICTED ON THIS PLAN WERE TAKEN FROM A COMBINATION OF EXISTING CONDITIONS PLAN, PAGE ROCK TOWNHOMES, PREPARED BY KEACH-NORDSTROM ASSOCIATES, INC. DATED JANUARY 7, 2025\*, EXISTING CONDITIONS PLAN, ROCK ROCK TOWNHOMES, PREPARED BY KEACH-NORDSTROM ASSOCIATES, INC. DATED MAY 6, 2025\*, AND TOWN GIS INFORMATION.
  3. THE AREA OF EACH SUBCATCHMENT IS AS FOLLOWS:
    - SUBCATCHMENT 1S = 0.872 ACRES
    - SUBCATCHMENT 2S = 0.692 ACRES
    - SUBCATCHMENT 3S = 0.840 ACRES
    - SUBCATCHMENT 4S = 0.268 ACRES
    - SUBCATCHMENT 5S = 1.002 ACRES
    - SUBCATCHMENT 6S = 14.673 ACRES
    - SUBCATCHMENT 7S = 0.413 ACRES
    - SUBCATCHMENT 8S = 0.697 ACRES
    - SUBCATCHMENT 9S = 1.091 ACRES
    - SUBCATCHMENT 10S = 0.837 ACRES
    - SUBCATCHMENT 11S = 0.790 ACRES
    - SUBCATCHMENT 12S = 2.487 ACRES
    - SUBCATCHMENT 13S = 0.570 ACRES

**DRAINAGE LEGEND:**

- THE LEGEND BELOW REFLECTS THE HYDROCAD MODEL USED FOR DRAINAGE CALCULATIONS.
- ..... SCS SOIL LINES
  - SITE SPECIFIC SOIL LINES
  - 44B DENOTES SOIL TYPE
  - P DENOTES POND
  - S DENOTES SUBCATCHMENT AREA
  - L DENOTES POINT OF INTEREST
  - R DENOTES REACH
  - LIMIT OF SUBCATCHMENT AREA
  - TIME OF CONCENTRATION
  - REACH



**SITE SPECIFIC SOIL MAP UNIT KEY**

SYMBOL	MAP UNIT	SLOPE CLASS	DRAINAGE CLASS	HSG
44B	MONTAUK	0-8%	WELL DRAINED	C
42D	CANTON	15-25%	WELL DRAINED	B
42E	CANTON	25+%	WELL DRAINED	B
446B	SCITUATE-NEWFIELDS COMPLEX	0-8%	MODERATELY WELL DRAINED	C
446C	SCITUATE-NEWFIELDS COMPLEX	8-15%	MODERATELY WELL DRAINED	C
448B	SCITUATE	0-8%	MODERATELY WELL DRAINED	C
448C	SCITUATE	8-15%	MODERATELY WELL DRAINED	C
448D	SCITUATE	15-25%	MODERATELY WELL DRAINED	C
444D	NEWFIELDS	15-25%	MODERATELY WELL DRAINED	C
546B/P	WALPOLE	0-8%	POORLY DRAINED	C
115B/VP	SCITUATE-NEWFIELDS COMPLEX	0-8%	VERY POORLY DRAINED	D

THIS MAP PRODUCT IS WITHIN THE TECHNICAL STANDARDS OF THE NATIONAL COOPERATIVE SOIL SURVEY. IT IS A SPECIAL PURPOSE PRODUCT, INTENDED FOR INFILTRATION REQUIREMENTS BY THE NH DES ALTERATION OF TERRAIN BUREAU. IT WAS PRODUCED BY A PROFESSIONAL SOIL SCIENTIST, AND IS NOT A PRODUCT OF THE USDA NATURAL RESOURCES CONSERVATION SERVICE. THERE IS A REPORT THAT ACCOMPANIES THIS MAP.

THE SITE SPECIFIC SOIL SURVEY (SSSS) WAS PRODUCED JULY 8, 2022, AND WAS PREPARED BY LUKE HURLEY, CWS # 095, BSC, INC. THE SURVEY AREA IS LOCATED AT 295 ROCKINGHAM ROAD, LONDONDERRY, NH.

SOILS WERE IDENTIFIED WITH THE NEW HAMPSHIRE STATE-WIDE NUMERICAL SOILS LEGEND, USDA NRCS, DURHAM, NH, ISSUE # 10, JANUARY 2011. THE NUMERIC LEGEND WAS AMENDED TO IDENTIFY THE CORRECT SOIL COMPONENTS OF THE COMPLEX.

HYDROLOGIC SOIL GROUP FROM KSAT VALUES FOR NEW HAMPSHIRE SOILS, SOCIETY OF SOIL SCIENTISTS OF NEW ENGLAND, SPECIAL PUBLICATION NO. 5, SEPTEMBER, 2009.

**SCS SOILS LEGEND**

- 43B CANTON FINE SANDY LOAM 0 TO 8 PERCENT SLOPES, VERY STONY
  - 446B SCITUATE-NEWFIELDS COMPLEX 3 TO 8 PERCENT SLOPES
  - 547B WALPOLE VERY FINE SANDY LOAM 3 TO 8 PERCENT SLOPES, VERY STONY
  - 44B MONTAUK FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES
  - 299 UDORTMENTS, SMOOTHED
- SOURCE: USDA-SCS WEB SOIL SURVEY ROCKINGHAM COUNTY

**REVISIONS**

NO.	DATE	DESCRIPTION	BY
1	11/25/25	ENGINEERING & DRC REVISIONS	PCM
2	2/20/25	ENGINEERING REVISIONS	PCM

**OWNER/APPLICANT:**  
PAGE ROCK, LLC  
5 HUTCHINGS DRIVE, SUITE 5D  
HOLLIS, N.H. 03049

**PRE-DEVELOPMENT DRAINAGE AREA PLAN**  
**ROCK ROAD TOWNHOMES**  
MAP 17 LOT 25  
295 ROCKINGHAM ROAD  
LONDONDERRY, NEW HAMPSHIRE  
ROCKINGHAM COUNTY

**KMA KEACH-NORDSTROM ASSOCIATES, INC.**  
Civil Engineering Land Surveying Landscape Architecture  
10 Commerce Park North, Suite 3B, Bedford, NH 03110 Phone (603) 627-2881

PROJ. NO: 21-0113-1  
DATE: MARCH 20, 2025  
SCALE: 1" = 80'  
FILE NO.:  
SHEET NO. 1 OF 2



SCALE

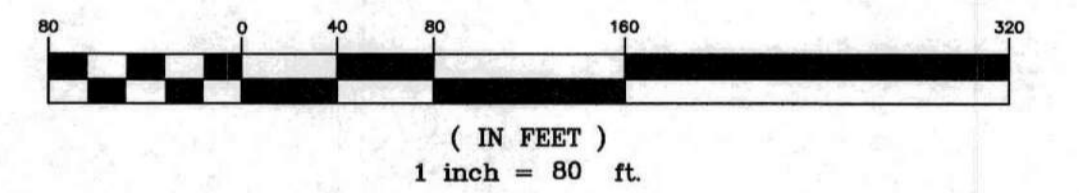
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  3. PROPOSED FEATURES DEPICTED ON THIS PLAN WERE TAKEN FROM "GRADING & DRAINAGE PLAN, ROCK ROAD TOWNHOMES, PREPARED BY KEACH-NORDSTROM ASSOCIATES, INC. DATED MAY 6, 2025".
  4. THE AREA OF EACH SUBCATCHMENT IS AS FOLLOWS:  
 SUBCATCHMENT 15 = 0.872 ACRES  
 SUBCATCHMENT 25 = 0.692 ACRES  
 SUBCATCHMENT 35 = 0.840 ACRES  
 SUBCATCHMENT 45 = 0.153 ACRES  
 SUBCATCHMENT 55 = 1.002 ACRES  
 SUBCATCHMENT 65 = 14.362 ACRES  
 SUBCATCHMENT 75 = 0.413 ACRES  
 SUBCATCHMENT 85 = 0.697 ACRES  
 SUBCATCHMENT 95 = 1.091 ACRES  
 SUBCATCHMENT 105 = 0.837 ACRES  
 SUBCATCHMENT 115 = 0.790 ACRES  
 SUBCATCHMENT 125 = 1.759 ACRES  
 SUBCATCHMENT 135 = 0.570 ACRES  
 SUBCATCHMENT 145 = 0.535 ACRES  
 SUBCATCHMENT 155 = 0.619 ACRES

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**GRAPHIC SCALE**



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  - 44B MONTAUK FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES
  - 299 UDORTHENTS, SMOOTHED
- SOURCE: USDA-SCS WEB SOIL SURVEY, ROCKINGHAM COUNTY

**REVISIONS**

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