file

TOWN OF DURHAM
8 NEWMARKET RD
DURHAM, NH 03824-2898
PHONE: 603/868-8064
www.ci.durham.nh.us

APPLICATION FOR SITE PLAN REVIEW

Note: This form and all required information must be filed at least 21 days before the date of the meeting at which it is to be submitted to the Board. Filing is to be done at the Planning Office, Durham Town Office Building or by mail to 8 Newmarket Road, Durham NH 03824.

1. Name and mailing address of applicant
GREAT BAY ANIMAL HOSPITAL, LLC
27 & 31 NEWMARKET ROAD
DURHAM, NH 03824
Phone Number: (603)868-7387
Email Address: drjim@greatbayah.com

2. Name and mailing address of owner of record if other than applicant
same
Phone Number:
Email Address:

3. Location of Proposed Project 31 Newmarket Road

Tax Map 6 Lot Number 11-8 Zoning District RC

4. Name of Proposed Project Kennel office expansion and general parking expansion

5. Number of units for which approval is sought N/A

6. Name, mailing address and telephone number of surveyor and/or agent
MJS ENGINEERING, P.C.
P.O. BOX 359
NEWMARKET, NH 03857
Phone Number: (603)659-4979
Email Address: mjs@mjs-engineering.com

7. Abutters: Attach a separate sheet listing the Durham Tax Map number, Lot number, name, and mailing address of all abutters, including those across a street, brook or stream. The list of abutters must also include any holders of conservation, preservation, or agricultural preservation restrictions in accordance with RSA 676:4(I)(d). Names should be those of current owners as recorded in the tax records five (5) days prior to the submission of this application.

Note: Names submitted on the Request for Preapplication Review may not be current. No application shall be heard unless all abutters as described herein have been notified.

8. Items on the attached Site Plan Review Application Submission Checklist

9. Payment of all applicable fees:

submittal fees	$ 250.00
advertising/posting costs	225.00
abutter notification (each) x $9 (10)	90.00
proposed road (per foot)	
administrative and technical review costs	
TOTAL	$ 565.00

9. The applicant and/or owner or agent*, certifies that this application is correctly completed with all attachments and requirements, and that any additional costs for engineering or professional services incurred by the Planning Board or the Town of Durham, in the site plan review process of this property, shall be borne by the applicant and/or owner.

10. Within five (5) business days of submitting a formal application, the applicant shall meet with the Director of Planning and Community Development to discuss issues related to completeness and acceptance of the application. If this review discloses that all requirements specified on the Site Plan Application Checklist have not been met, the applicant will be notified in writing what specific items are still needed.

11. Prior to the next regularly scheduled meeting of the Planning Board, the applicant, at the discretion of the Director of Planning and Community Development, shall meet with the appropriate Department Heads of the Town of Durham to discuss the implications the application will have on the various Departments of the town.

12. If this application is determined by the Planning Staff to be complete, it will be placed on the Planning Board agenda on 11/29/17 for acceptance.

***If the applicant is an agent of the owner, a separate signed letter from the owner of record is required which clearly states the authority of the agent or representative for this application. If the agent does not have the power of attorney of the owner, all documents shall be signed by the owner.**

"I hereby authorize the Durham Planning Board and its agents to access my land for the purpose of reviewing the proposed site plan, performing road inspections and any other inspections deemed necessary by the Board or its agents, to ensure conformance of the on-site improvements with the approved plan and all Town of Durham ordinances and regulations."

Date 11-8-17 *Applicant, Owner, or Agent*

MJS ENGINEERING, P.C.
CIVIL • STRUCTURAL • ENVIRONMENTAL

5 Railroad Street • P.O. Box 359
Newmarket, NH 03857
Phone: (603) 659-4979
Email: mjs@mjs-engineering.com

November 3, 2017

Durham Planning Board
8 Newmarket Road
Durham, NH 03824

Dear Chairperson:

I hereby authorize Michael J. Sievert, P.E of MJS Engineering, P.C. to represent me at the Durham Planning Board and technical review committee meetings for site plan review approval. The subject parcel is shown on Tax Map 6 as Lot 11-8, located at 31 Newmarket Road and is the site of Great Bay Animal Hospital, Kennel, and Doggie Day Care.

Sincerely;

11/3/17

Dr. Jim McKiernan
Owner

LIST OF OWNERS OF ABUTTING PROPERTY

(This includes property directly across the street or streams from the land under consideration. **List must also include any and all preparers of plans, studies, etc...)**

PLEASE PROVIDE NAME & MAILING ADDRESS

PROPERTY OWNER: 27 & 31 Newmarket Rd MAP 6/LOT 11-8 GREAT BAY ANIMAL HOSPITAL, LLC 27 & 31 NEWMARKET ROAD DURHAM, NH 03824	**AGENT:** MJS ENGINEERING, PC P. O. BOX 359 NEWMARKET, NH 03857
MAP 6/LOT 11-6 21 Newmarket Rd DOUGLAS A. MacLENNAN REV TRUST SUSAN R. MacLENNAN REV TRUST 21 NEWMARKET ROAD DURHAM, NH 03824	**LAND SURVEYOR:** McENEANEY SURVEY ASSOCIATES, INC. 24 CHESTNUT STREET DOVER, NH 03820
MAP 6/LOT 11-2 25 Newmarket Rd SCOTT M. & LORIEANN JENKINS 49 OLD COUNTRY ROAD NO. FRANCESTOWN, NH 03043	**ARCHITECT:** SCHOONMAKER ARCHITECTS 10 MATHES TERRACE DURHAM, NH 03824
MAP 6/LOT 11-7 35 Newmarket Rd CHRISTINA H. FELIX 35 NEWMARKET ROAD DURHAM, NH 03824	MAP 6/LOT 9-8 Newmarket Rd THOMAS A. TOYE IV REV TRUST 278 WASHINGTON STREET DOVER, NH 03820
MAP 6/LOT 9-5 26 Newmarket Rd PILAR FAMILY TRUST 9 CHURCHILL ROAD DURHAM, NH 03824	MAP 11/LOT 34-1 27 Durham Point Rd GREGORY E. SANCOFF ONE HARBOUR PLACE UNIT 4F PORTSMOUTH, NH 03801
MAP 6/LOT 9-6-1 28 Newmarket Rd MPC DEVELOPMENT 278 WASHINGTON STREET DOVER, NH 03820	

Site Plan Checklist

For formal applications – for both residential and nonresidential plans
Town of Durham Planning Department
To be filled out by the applicant/agent

Project Name: Kennel office expansion and general parking expansion
Map: 6 Lot: 11-8 Date: _____

Applicant/agent: MJS Engineering, P.C. Signature: _____

Please see the Durham Site Plan Regulations for more information, in particular, Section 2.2 Formal Application Content. Note that various items may be submitted later.

General items	**Yes**	**No**	**N/A**	**Waiver Requested**	**Comments**
Application fee including fee for notices	☑	☐	☐	☐	
15 copies of completed application	☑	☐	☐	☐	
15 copies of letter of intent	☑	☐	☐	☐	
3 sets of full-size plans	☑	☐	☐	☐	
15 sets of 11 X 17 reductions, including one sheet of site plan in color	☑	☐	☐	☐	
Electronic version of materials via email	☑	☐	☐	☐	
Completed abutters list (See Administrative Assistant)	☑	☐	☐	☐	
Copy of existing covenants, easements, and deed restrictions	☐	☐	☑	☐	

Plan Information

Basic information including: ☑ ☐ ☐ ☐

- Title sheet and index, when applicable
- Title block
- Name of Project
- Date of preparation
- North arrow
- Scale
- Legend
- Revision block
- Acreage and square footage of site
- Vicinity sketch/location plan - not less than 1" = 1,000'
- Aerial photo showing the site and proposed building footprint

	Yes	No	N/A	Waiver Requested	Comments
Name and address of developer/applicant	☑	☐	☐	☐	
Name, stamp, and NH license # of surveyor, engineer, and/or architect	☑	☐	☐	☐	
Town tax map & lot #'s	☑	☐	☐	☐	
Street(s) and street name(s)	☑	☐	☐	☐	
Approval block (for signature by staff attesting to Planning Board approval)	☑	☐	☐	☐	
Deed information and references to related plans and subdivisions	☑	☐	☐	☐	
Surveyed property lines including: • existing and proposed bearings • existing and proposed distances • pins, stakes, bounds • monuments • benchmarks	☑	☐	☐	☐	
Information on abutting properties: • owner name • owner address • tax map and lot # • approximate building footprints • use	☑	☐	☐	☐	
Locations, widths, and types of easements	☑	☐	☐	☐	
Zoning Zoning designations of subject tract and in vicinity of tract	☑	☐	☐	☐	
Zoning requirements for district: • frontage • lot size and dimensions • all setbacks • lot coverage	☑	☐	☐	☐	
Zoning overlay districts, including Wetland, Shoreland, Aquifer, and Historic districts	☑	☐	☐	☐	
Existing Topographic Features: Contour lines (not to exceed two-foot Intervals, except on steep slopes) and	☑	☐	☐	☐	

spot elevations

	Yes	No	N/A	Waiver Requested	Comments
Soil types and boundaries	☑	☐	☐	☐	
Soil test pit locations, profiles, and depth to water table and ledge	☑	☐	☐	☐	
Percolation test locations and results	☐	☐	☑	☐	
Water features (ponds, streams)	☑	☐	☐	☐	
Wetlands, including name of certified wetlands scientist	☐	☐	☑	☐	
Statement whether located in flood area, And, if so,100 year flood elevation	☑	☐	☐	☐	
Delineation of trees and open areas	☑	☐	☐	☐	
Overview of types of trees and vegetation	☑	☐	☐	☐	
Stone walls and archaeological features	☑	☐	☐	☐	
Locations of trails, paths, fences, and walls	☑	☐	☐	☐	
Other natural/cultural resources (significant trees, farmland, habitats, rock outcrops, historic structures, etc.)	☑	☐	☐	☐	

Building Information

Existing buildings/structures including square footage and use	☑	☐	☐	☐	
Proposed buildings/structures including • square footage • grades at foundation • first floor elevation • use • # bedrooms and beds per unit if residential	☑	☐	☐	☐	
Architectural renderings of proposed buildings and structures: • Showing all four sides • Drawn to scale with dimensions • Showing height • Showing exterior materials • Showing exterior colors • Name of architect/designer	☑	☐	☐	☐	

	Yes	No	N/A	Waiver Requested	Comments
Circulation and Parking Plan					
Existing and proposed driveways and access points including: • Width of opening • Turning radii • Cross section of driveway	☑	☐	☐	☐	
Pavement, curbing & edge treatment	☑	☐	☐	☐	
Traffic control devices, if appropriate:	☐	☐	☑	☐	
Number of parking spaces • required by ordinance • proposed	☑	☐	☐	☐	
Parking layout and dimensions of spaces	☑	☐	☐	☐	
Handicap spaces and signage	☐	☐	☑	☐	Existing
Loading area	☐	☐	☑	☐	
Pedestrian circulation plan (including existing sidewalks in vicinity, if any)	☐	☐	☑	☐	
Bicycle racks, locations and design	☐	☐	☑	☐	
Buffers, landscaping & screening	☑	☐	☐	☐	
Snow storage areas and plan	☑	☐	☐	☐	
Proposed porous pavement	☐	☐	☑	☐	
Utilities Show all pertinent existing and proposed profiles, elevations, materials, sizes, and details					
Water lines/well (with protective radius)	☑	☐	☐	☐	
Sewer lines/septic and leaching areas	☑	☐	☐	☐	
Pump stations	☐	☐	☑	☐	
Fire hydrant location(s) and details	☐	☐	☑	☐	
Electric, telephone, cable TV	☑	☐	☐	☐	
Gas lines	☑	☐	☐	☐	

	Yes	No	N/A	Waiver Requested	Comments
Fire alarm connections	☐	☐	☑	☐	
Treatment of solid waste/dumpsters	☑	☐	☐	☐	Existing Dumpsters
Stormwater Management					
Stormwater management system: pipes, culverts,, catch basins detention/ retention basins, swales, rip rap, etc.	☑	☐	☐	☐	
Drainage study with calculations, impact analysis, and mitigation plan	☑	☐	☐	☐	
Grading (existing and proposed grades)	☑	☐	☐	☐	
Erosion and sedimentation plan	☑	☐	☐	☐	
Landscaping Plan					
Demarcation of limits of construction, clear delineation of vegetation to be saved, and strategy for protecting vegetation	☑	☐	☐	☐	
Proposed ground cover, shrubbery, and trees including: • botanical and common names • locations and spacing • total number of each species • size at installation	☑	☐	☐	☐	
Planting plan (size of holes, depth of planting, soil amendments, etc.)	☑	☐	☐	☐	
Irrigation plan and details	☐	☑	☐	☐	
Protection of landscaping from vehicles (Curb stops, berm, railroad ties, etc)	☐	☐	☑	☐	
Specification of all finished ground surfaces and edges (greenspace, mulch, asphalt, concrete, etc.)	☑	☐	☐	☐	
Fencing/screening	☐	☑	☐	☐	
Signage					
On-site traffic-control signs:	☑	☐	☐	☐	
Location and type of advertising signs: • Attached to building • Freestanding	☐	☐	☑	☐	No New Signs

- Directional, if appropriate

	Yes	No	N/A	Waiver Requested	Comments
Dimensions of signs: • Height • Area • Setback	☐	☐	☑	☐	
Elevation drawings with colors & materials	☐	☐	☑	☐	
Type of Illumination, if proposed	☐	☐	☑	☐	
Outdoor Lighting					
Locations	☑	☐	☐	☐	
Height of fixtures	☑	☐	☐	☐	
Wattage	☑	☐	☐	☐	
Type of light (high pressure sodium, etc)	☑	☐	☐	☐	
Design/cut sheets of fixtures	☑	☐	☐	☐	
Illumination study, if appropriate	☐	☑	☐	☐	
Other Elements					
Construction management plan	☐	☐	☑	☐	
Energy checklist (may be submitted later)	☐	☐	☐	☐	
Traffic study, if appropriate	☐	☐	☑	☐	
Proposed covenants, easements, and deed restrictions, if any	☐	☐	☑	☐	
Fiscal impact study, if requested	☐	☐	☑	☐	
System for addressing buildings and units	☐	☐	☑	☐	

Additional Comments:

MJS ENGINEERING, P.C.
CIVIL • STRUCTURAL • ENVIRONMENTAL

5 Railroad Street • P. O.Box 359
Newmarket, NH 03857
Phone: (603) 659-4979
Email: mjs@mjs-engineering.com

Letter of Intent – Site Plan Review Application for Great Bay Animal Hospital Located at 31 Newmarket Rd., Tax Map 6 / Lot 11-8

November 8, 2017

1.0 Project Purpose

The intent of this project is to permit the construction of an addition to the Kennel building and a new parking lot. The new addition will provide expanded office space, storage, and reconfigure kennels. The total area of the addition is approximately 555 SF. The addition is proposed on the southeasterly corner of the Kennel building and will require the relocation of a small shed. The proposed parking lot is approximately 60' x 65' and will accommodate 14 vehicles.

2.0 Existing Conditions

The subject property is located in the Residence Costal District (RC). The parcel is bordered on the west by Route 108 with approximately 286' of frontage, and on all other sides by residential properties. The parcel does have frontage on the Oyster River to the north. The property is served by onsite well and septic and has vehicle access off Route 108 (Newmarket Rd). Overhead utilities service the site from Route 108.

There are currently three buildings on the site. The uses include an animal hospital/veterinary clinic and kennel with dog daycare as part of the kennel operation. The parcel is accessed by the main entrance driveway with parking directly off the driveway near each building. The existing parking is inadequate in both configuration with respect to access aisle width, parking space size and number of spaces for each use in addition to employees.

3.0 Redevelopment Proposal

The proposal is to construct the new addition to the existing kennel building to provide more office space and better function for the business operation. The addition will improve the daily operations for customer service and provide a more convenient layout to access kennels and the enclosed run area.

In addition, the new parking lot will improve the parking on the site. The decision was made to construct a new parking lot rather than reconstruct the existing parking configuration to minimize disruption to the daily operations. This parking lot will provide separate employee parking to better utilize the existing parking near each respective building for customers.

Map 6

N

PROPERTY MAP
DURHAM
NEW HAMPSHIRE

13
5
11
15
15
MILL POND
OYSTER RIVER
OYSTER RIVER SCHOOL DISTRICT
UNH
DURHAM COMMUNITY CHURCH
SMITH CHAPEL
TOWN
B and M R.R.
MAIN STREET
COLLEGE ROAD
MILL ROAD
MC DANIEL DRIVE
FACULTY ROAD
VALENTINE HILL ROAD
MAGRATH ROAD
CHESLEY DRIVE
MILL POND ROAD
SCHOOLHOUSE LANE
DOTHAM ROAD
NEWMARKET ROAD
HOITT DRIVE
OYSTER ROAD
GARDEN LANE
CROSSMAN LANE
THOMPSON LANE
BURNHAM LANE
MILL POND ROAD
FARM ROAD
ORCHARD DRIVE
RYAN WAY
FOSS ROAD
STEVENS WAY
LAUREL LANE
NEWMARKET ROAD
HAMEL DR.
YORK DR.
SUNNYSIDE DRIVE
PINECREST LANE
DURHAM POINT
PALMER DRIVE
WILLEY ROAD
HEMLOCK WAY

Legend

- Adjacent Map Sheets
- Current Map Sheet
- †† Cemetery

1 inch = 500 feet

This map was originally produced by Strafford Regional Planning Commission in October 2004, and was updated by the Town of Durham in March 2016.

THIS MAP IS FOR ASSESSMENT PURPOSES. IT IS NOT INTENDED FOR LEGAL DESCRIPTION OR CONVEYANCE.

DRAWING NAME: P:\17pro\17-043\Internal\Drawing Files\17-043 C1D.dwg Wed, 08 Nov 2017 - 10:59AM

AERIAL

JOB: 17-043

SHEET 1 OF 1

MJS ENGINEERING, P.C.
CIVIL • STRUCTURAL • ENVIRONMENTAL
5 Railroad St., P.O. Box 359
Newmarket, NH 03857
Phone: (603) 659-4979, Fax: (603) 659-4627
E-mail: mjs@mjs-engineering.com

AERIAL MAP

prepared for

GREAT BAY ANIMAL HOSPITAL, LLC

TAX MAP 6, LOT 11-8
31 NEWMARKET ROAD DURHAM, NH

DATE:	11/7/17
SCALE:	1"=150'
DESIGNER:	MS
DRAWN BY:	MS
APPROVED BY:	MJS
DRAWING FILE:	

SEAL:

DRAINAGE REPORT

Prepared for:

Great Bay Animal Hospital, LLC

31 Newmarket Road

Durham, NH 03824

Tax Map 6 Lot 11-8

Prepared on:

November 8, 2017

MJS ENGINEERING, P.C.
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9. Erosion & Sediment Control 4
10. Conclusion 4

Appendix Number	Description
A	Drainage Plan
B	Pre-Development Drainage Analysis
C	Post-Development Drainage Analysis
D	Cornell Extreme Precipitation Table
E	Ksat Table for Soils

1. Project Background / Purpose

Great Bay Animal Hospital located at 31 Newmarket Road is proposing to construct a 555-square foot addition to the existing kennel building to be used as office space. A 14-space parking area off the existing access drive will be constructed to provide needed spaces for the veterinary clinic, kennel and dog daycare. The parcel is located in the Residence Coastal District (RC) in Durham, New Hampshire.

2. Methodology

The watershed areas have been determined via inspection by our office and a topographical survey. This analysis utilizes HydroCAD modeling software which models the runoff based on the SCS TR-20 method and the time of concentration based on the SCS TR-55 method. This analysis compares the runoff rates for the 1-inch, 2, 10, and 25-year USDA/SCS Type III 24-hour extreme storm events. The rainfall data used in the model is referenced from the Cornell extreme precipitation rainfall table found in Appendix D of this report.

3. Soils

The soils on site consist mostly of very rocky fine sandy loam and silt loam with Hydrologic Soil Groups determined to be B and D. The soils in this analysis have been identified in accordance with the NRCS Web Soil Survey. The soils in the area of the development are more typical of a Charlton soil.

Soil Types

Label	Description	HSG:
BzB	Buxton Silt Loam	C
HdC	Hollis-Charlton Very Rocky Fine Sandy Loam	B

4. Pre-Development Conditions

The enclosed Pre-Development portion of the Drainage Plan (Appendix 1) depicts the contributing runoff area of the property. The watershed areas have been determined via inspection by our office as well as a topographical survey. The watershed boundary only encompasses areas that are directly impacted by the development of the site.

The 555-square foot expansion of the kennel is located directly off the southeast corner of the existing kennel building. The parking area is proposed on the north side of the access drive. This area slopes toward the roadside swale along Route 108 which is identified as Point of Analysis 1 (POA 1). From this point runoff eventually reaches the Oyster River approximately 500 feet north of the access drive.

The building expansion is located in a mostly impervious area consisting of a shed and gravel. The shed is proposed to be relocated adjacent to the south side of the day care building. The increase in runoff from these two areas is negligible and both flow to the east approximately 550 to 700 feet to the Oyster River through lawn and woods. The woods area extends well beyond the limits of the 250' Protected Shoreland. The negligible increase in runoff will have no effect on the Oyster River and therefore is not included in this analysis. The hydrologic

evaluation of the existing runoff conditions is provided in the Pre-Development Drainage Analysis (Appendix B).

Subcatchment 1 is the contributing watershed area that drains to POA 1. Runoff flows down the hill and into the swale along Route 108. The cover types used in the model are woods, impervious and lawn areas. The lawn and woods are considered to be in good condition.

The hydrologic analysis of the existing runoff conditions is provided in Appendix B.

5. Post-Development Conditions

The proposal involves the construction of a new 14 space parking area, a 555-square foot expansion of the kennel building and relocating an existing shed.

The location of the POA used in the Pre-Development Analysis has been maintained for the Post-Development Analysis. The hydrologic evaluation of the proposed runoff conditions is provided in the enclosed 17-044 POST HydroCAD™ output (Appendix C). The subcatchment areas have changed to reflect the proposed grading of the site. The overall outer boundary has been maintained. The cover types are the same as in the Pre-Development.

Subcatchments 1A is collected by the proposed bioretention system. The bioretention system has been designed to mitigate the effects of increased impervious coverage on the lot by filtrating and infiltrating stormwater. A sediment forebay will allow for the settling of suspended solids from stormwater generated in the paved parking lot prior to entering the bioretention system. An underdrain system will collect runoff that does not infiltrate into the ground and outlet it within the lawn area. A spillway is provided for larger storm events. The spillway is 15 feet long to promote the dispersion of stormwater as sheet flow down the slope.

The design infiltration rate for the bioretention system was determined per the NHDES Alteration of Terrain rules. The saturated hydraulic conductivity (Ksat) for the limiting layer of the Hollis-Charlton soil series is taken as 0.6 inches per hour. A 50% multiplier is applied in accordance with NHDES (Appendix E). The resultant design infiltration rate is 0.30 in/hr.

Subcatchment 1B comprises the remaining area not captures by the bioretention system.

The hydrologic analysis of the proposed runoff conditions is provided in Appendix C.

6. Comparison of Pre- and Post-Development Conditions

The following tables quantify the peak rate of discharge and discharge volume leaving the parcel at POA 1 as shown on the Pre- and Post-Development Drainage Plan. The analysis has been modeled using the extreme rainfall quantities.

Table 1: Peak Rate of Runoff at POA 1 Summary Table

Storm	Pre-Development (cfs)	Post-Development (cfs)	Difference
1-Inch	0.00	0.00	0.00
2-Year	0.38	0.37	-0.01
10-Year	1.38	1.10	-0.28
25-Year	2.36	2.28	-0.08

Table 2: Discharge Runoff Volume at POA 1 Summary Table

Storm	Pre-Development (cfs)	Post-Development (cfs)	Difference
1-Inch	0.00	3	+3
2-Year	2,035	2,703	+668
10-Year	5,613	6,678	+1,065
25-Year	9,075	10,401	+1,326

There is a reduction in the peak rate of runoff during all the design storm events at POA 1. The reduction in peak rate of discharge is attributed to the bioretention system, which provides peak flow attenuation and volume reduction. There is an increase in the runoff volume due to the limited infiltration capacity of the native soils. The spillway of the bioretention system has been designed for the 100-year storm (See Appendix C).

7. Stormwater Treatment and Pretreatment Practices

Stormwater pre-treatment will be provided by sediment forebays. Stormwater treatment will be provided by a bioretention system.

8. WQV Calculations

A factor of 0.4 and 0.16 is applied to HSG C and D soils, respectively that are replaced by impervious area. The required volume to be infiltrated for this project is as follows;

Proposed impervious area: 5,866 sf (HSG C Soil)
5,866 sf x 0.4 x (1'/12") = 196 cf

Table 3: Bioretention System Infiltration Volume	
Storm	Volume Infiltrated (cf)
1 inch	44
2 Year	87
10 Year	132
25 Year	115

As shown in Table 3, the bioretention system provides for some infiltration but not the total volume. This is a result of the limited capacity of only 0.3 inch/hour of the native soil for infiltration. The bioretention system effectively treats runoff so as not to create or contribute to water quality impairment.

9. Erosion & Sediment Control

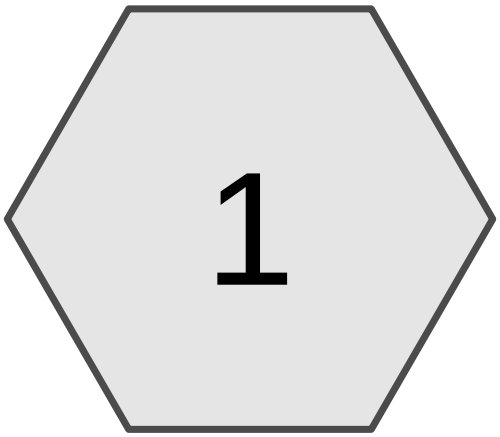
Temporary and permanent practices are used to prevent and minimize erosion and sedimentation on site. The installation of Silt Soxx™ at the perimeter of construction areas will provide sediment retention during the construction phase of the development. Erosion control matting is proposed on all spillways to prevent erosion prior to the establishment of permanent vegetation.

10. Conclusion

The enclosed comparative hydrologic model provides sufficient evidence that the stormwater design will mitigate the typical increase in peak rate of stormwater discharge resulting from the proposed development of the site. Stormwater treatment practices will provide treatment of runoff from proposed paved surfaces. The use of erosion and sediment controls and proper construction practices will minimize the impact of this project to downstream surface waters.

APPENDIX A

APPENDIX B



Subcatchment 1

Subcat Reach Pond Link

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
30,086	61	>75% Grass cover, Good, HSG B (1)
943	74	>75% Grass cover, Good, HSG C (1)
2,101	98	Paved parking, HSG B (1)
113	98	Paved parking, HSG C (1)
10,526	55	Woods, Good, HSG B (1)
5,790	70	Woods, Good, HSG C (1)
49,559	**63**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
42,713	HSG B	1
6,846	HSG C	1
0	HSG D	
0	Other	
49,559		**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1: Subcatchment1 Runoff Area=49,559 sf 4.47% Impervious Runoff Depth=0.00"
Flow Length=371' Tc=11.4 min CN=63 Runoff=0.00 cfs 0 cf

Total Runoff Area = 49,559 sf Runoff Volume = 0 cf Average Runoff Depth = 0.00"
95.53% Pervious = 47,345 sf 4.47% Impervious = 2,214 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1: Subcatchment1 Runoff Area=49,559 sf 4.47% Impervious Runoff Depth=0.49"
Flow Length=371' Tc=11.4 min CN=63 Runoff=0.38 cfs 2,035 cf

Total Runoff Area = 49,559 sf Runoff Volume = 2,035 cf Average Runoff Depth = 0.49"
95.53% Pervious = 47,345 sf 4.47% Impervious = 2,214 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1: Subcatchment1 Runoff Area=49,559 sf 4.47% Impervious Runoff Depth=1.36"
Flow Length=371' Tc=11.4 min CN=63 Runoff=1.38 cfs 5,613 cf

Total Runoff Area = 49,559 sf Runoff Volume = 5,613 cf Average Runoff Depth = 1.36"
95.53% Pervious = 47,345 sf 4.47% Impervious = 2,214 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1: Subcatchment1 Runoff Area=49,559 sf 4.47% Impervious Runoff Depth=2.20"
Flow Length=371' Tc=11.4 min CN=63 Runoff=2.36 cfs 9,075 cf

Total Runoff Area = 49,559 sf Runoff Volume = 9,075 cf Average Runoff Depth = 2.20"
95.53% Pervious = 47,345 sf 4.47% Impervious = 2,214 sf

Summary for Subcatchment 1: Subcatchment 1

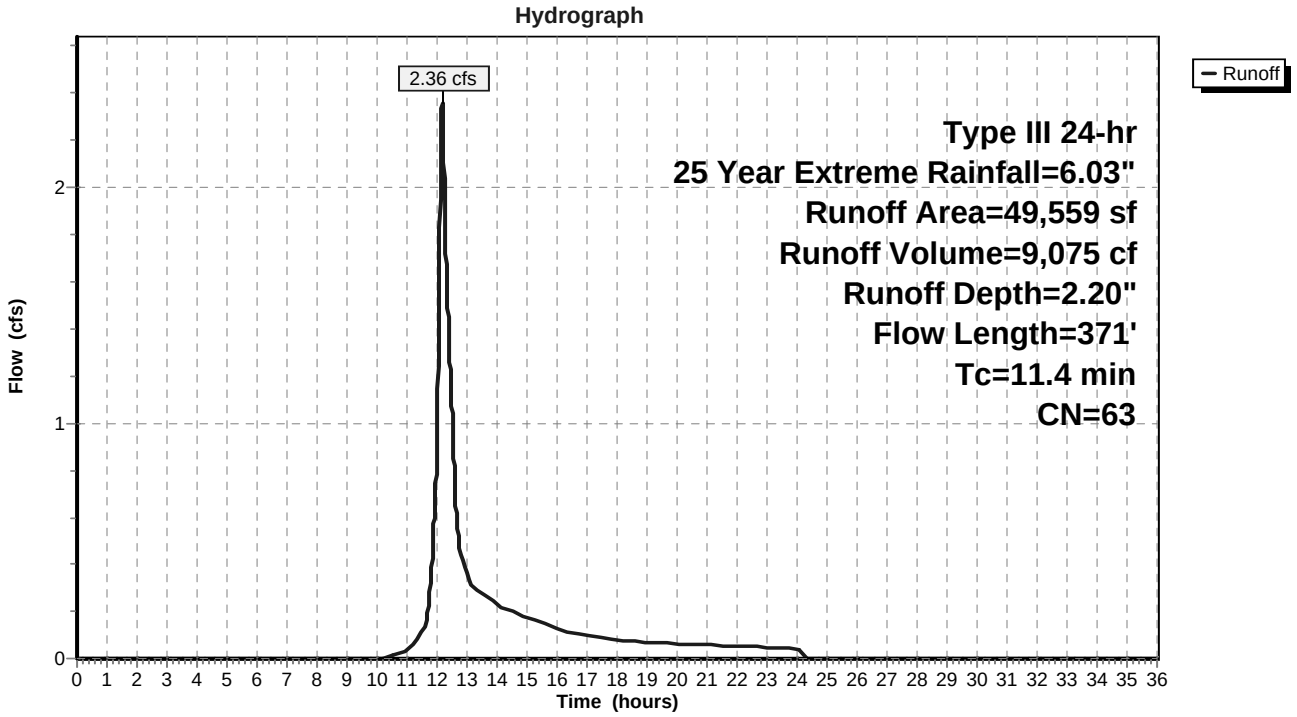
Runoff = 2.36 cfs @ 12.17 hrs, Volume= 9,075 cf, Depth= 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Extreme Rainfall=6.03"

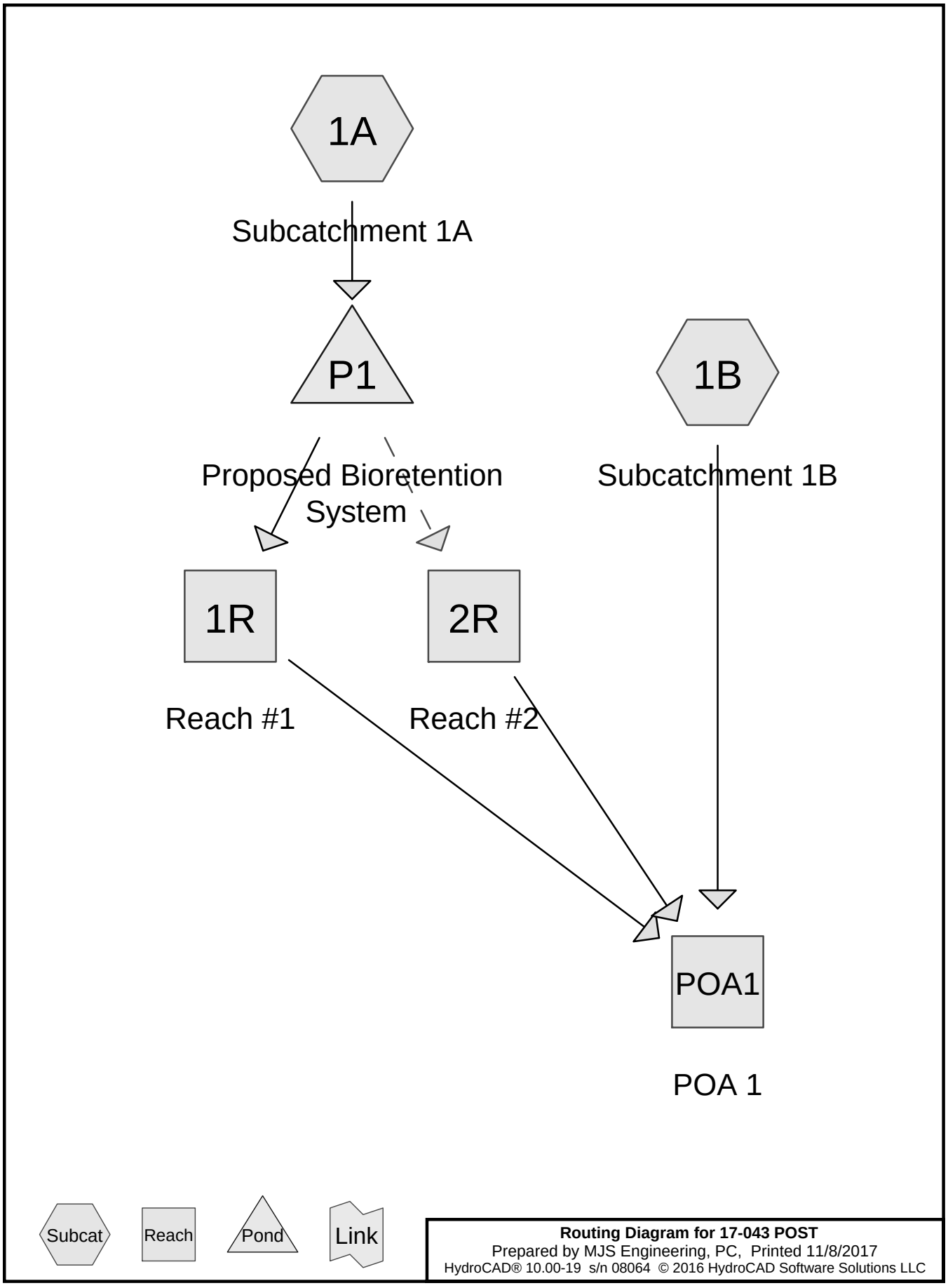
Area (sf)	CN	Description
5,790	70	Woods, Good, HSG C
10,526	55	Woods, Good, HSG B
113	98	Paved parking, HSG C
2,101	98	Paved parking, HSG B
943	74	>75% Grass cover, Good, HSG C
30,086	61	>75% Grass cover, Good, HSG B
49,559	63	Weighted Average
47,345		95.53% Pervious Area
2,214		4.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0840	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.14"
0.2	13	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	15	0.0450	1.48		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	51	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0380	1.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	202	0.0850	1.46		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	371	Total			

Subcatchment 1: Subcatchment 1



APPENDIX C



Routing Diagram for 17-043 POST
Prepared by MJS Engineering, PC, Printed 11/8/2017

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
24,875	61	>75% Grass cover, Good, HSG B (1A, 1B)
943	74	>75% Grass cover, Good, HSG C (1B)
7,312	98	Paved parking, HSG B (1A, 1B)
113	98	Paved parking, HSG C (1B)
10,526	55	Woods, Good, HSG B (1B)
5,790	70	Woods, Good, HSG C (1B)
49,559	**67**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
42,713	HSG B	1A, 1B
6,846	HSG C	1B
0	HSG D	
0	Other	
49,559		**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A Runoff Area=14,663 sf 39.73% Impervious Runoff Depth=0.04"
Flow Length=162' Tc=6.0 min CN=76 Runoff=0.00 cfs 47 cf

Subcatchment 1B: Subcatchment 1B Runoff Area=34,896 sf 4.59% Impervious Runoff Depth=0.00"
Flow Length=371' Tc=11.4 min CN=63 Runoff=0.00 cfs 0 cf

Reach 1R: Reach #1 Avg. Flow Depth=0.00' Max Vel=0.19 fps Inflow=0.00 cfs 3 cf
n=0.050 L=175.0' S=0.0851 '/' Capacity=41.67 cfs Outflow=0.00 cfs 3 cf

Reach 2R: Reach #2 Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0 cf
n=0.035 L=200.0' S=0.0875 '/' Capacity=60.35 cfs Outflow=0.00 cfs 0 cf

Reach POA1: POA 1 Inflow=0.00 cfs 3 cf
Outflow=0.00 cfs 3 cf

Pond P1: Proposed Bioretention System Peak Elev=110.76' Storage=1 cf Inflow=0.00 cfs 47 cf
Discarded=0.00 cfs 44 cf Primary=0.00 cfs 3 cf Secondary=0.00 cfs 0 cf Outflow=0.00 cfs 47 cf

Total Runoff Area = 49,559 sf Runoff Volume = 47 cf Average Runoff Depth = 0.01"
85.02% Pervious = 42,134 sf 14.98% Impervious = 7,425 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A Runoff Area=14,663 sf 39.73% Impervious Runoff Depth=1.11"
Flow Length=162' Tc=6.0 min CN=76 Runoff=0.42 cfs 1,357 cf

Subcatchment 1B: Subcatchment 1B Runoff Area=34,896 sf 4.59% Impervious Runoff Depth=0.49"
Flow Length=371' Tc=11.4 min CN=63 Runoff=0.26 cfs 1,433 cf

Reach 1R: Reach #1 Avg. Flow Depth=0.03' Max Vel=0.68 fps Inflow=0.11 cfs 1,270 cf
n=0.050 L=175.0' S=0.0851 '/' Capacity=41.67 cfs Outflow=0.11 cfs 1,270 cf

Reach 2R: Reach #2 Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0 cf
n=0.035 L=200.0' S=0.0875 '/' Capacity=60.35 cfs Outflow=0.00 cfs 0 cf

Reach POA1: POA 1 Inflow=0.37 cfs 2,703 cf
Outflow=0.37 cfs 2,703 cf

Pond P1: Proposed Bioretention System Peak Elev=113.57' Storage=335 cf Inflow=0.42 cfs 1,357 cf
Discarded=0.00 cfs 87 cf Primary=0.11 cfs 1,270 cf Secondary=0.00 cfs 0 cf Outflow=0.12 cfs 1,357 cf

Total Runoff Area = 49,559 sf Runoff Volume = 2,790 cf Average Runoff Depth = 0.68"
85.02% Pervious = 42,134 sf 14.98% Impervious = 7,425 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A Runoff Area=14,663 sf 39.73% Impervious Runoff Depth=2.34"
Flow Length=162' Tc=6.0 min CN=76 Runoff=0.92 cfs 2,858 cf

Subcatchment 1B: Subcatchment 1B Runoff Area=34,896 sf 4.59% Impervious Runoff Depth=1.36"
Flow Length=371' Tc=11.4 min CN=63 Runoff=0.97 cfs 3,952 cf

Reach 1R: Reach #1 Avg. Flow Depth=0.04' Max Vel=0.71 fps Inflow=0.13 cfs 2,706 cf
n=0.050 L=175.0' S=0.0851 '/' Capacity=41.67 cfs Outflow=0.13 cfs 2,706 cf

Reach 2R: Reach #2 Avg. Flow Depth=0.01' Max Vel=0.57 fps Inflow=0.05 cfs 20 cf
n=0.035 L=200.0' S=0.0875 '/' Capacity=60.35 cfs Outflow=0.03 cfs 20 cf

Reach POA1: POA 1 Inflow=1.10 cfs 6,678 cf
Outflow=1.10 cfs 6,678 cf

Pond P1: Proposed Bioretention System Peak Elev=114.61' Storage=970 cf Inflow=0.92 cfs 2,858 cf
Discarded=0.01 cfs 132 cf Primary=0.13 cfs 2,706 cf Secondary=0.05 cfs 20 cf Outflow=0.19 cfs 2,858 cf

Total Runoff Area = 49,559 sf Runoff Volume = 6,811 cf Average Runoff Depth = 1.65"
85.02% Pervious = 42,134 sf 14.98% Impervious = 7,425 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A: Subcatchment 1A Runoff Area=14,663 sf 39.73% Impervious Runoff Depth=3.41"
Flow Length=162' Tc=6.0 min CN=76 Runoff=1.34 cfs 4,162 cf

Subcatchment 1B: Subcatchment 1B Runoff Area=34,896 sf 4.59% Impervious Runoff Depth=2.20"
Flow Length=371' Tc=11.4 min CN=63 Runoff=1.66 cfs 6,390 cf

Reach 1R: Reach #1 Avg. Flow Depth=0.04' Max Vel=0.71 fps Inflow=0.13 cfs 3,326 cf
n=0.050 L=175.0' S=0.0851 '/' Capacity=41.67 cfs Outflow=0.13 cfs 3,326 cf

Reach 2R: Reach #2 Avg. Flow Depth=0.06' Max Vel=1.47 fps Inflow=0.73 cfs 685 cf
n=0.035 L=200.0' S=0.0875 '/' Capacity=60.35 cfs Outflow=0.62 cfs 685 cf

Reach POA1: POA 1 Inflow=2.28 cfs 10,401 cf
Outflow=2.28 cfs 10,401 cf

Pond P1: Proposed Bioretention System Peak Elev=114.68' Storage=1,024 cf Inflow=1.34 cfs 4,162 cf
Discarded=0.01 cfs 151 cf Primary=0.13 cfs 3,326 cf Secondary=0.73 cfs 685 cf Outflow=0.87 cfs 4,162 cf

Total Runoff Area = 49,559 sf Runoff Volume = 10,552 cf Average Runoff Depth = 2.56"
85.02% Pervious = 42,134 sf 14.98% Impervious = 7,425 sf

Summary for Subcatchment 1A: Subcatchment 1A

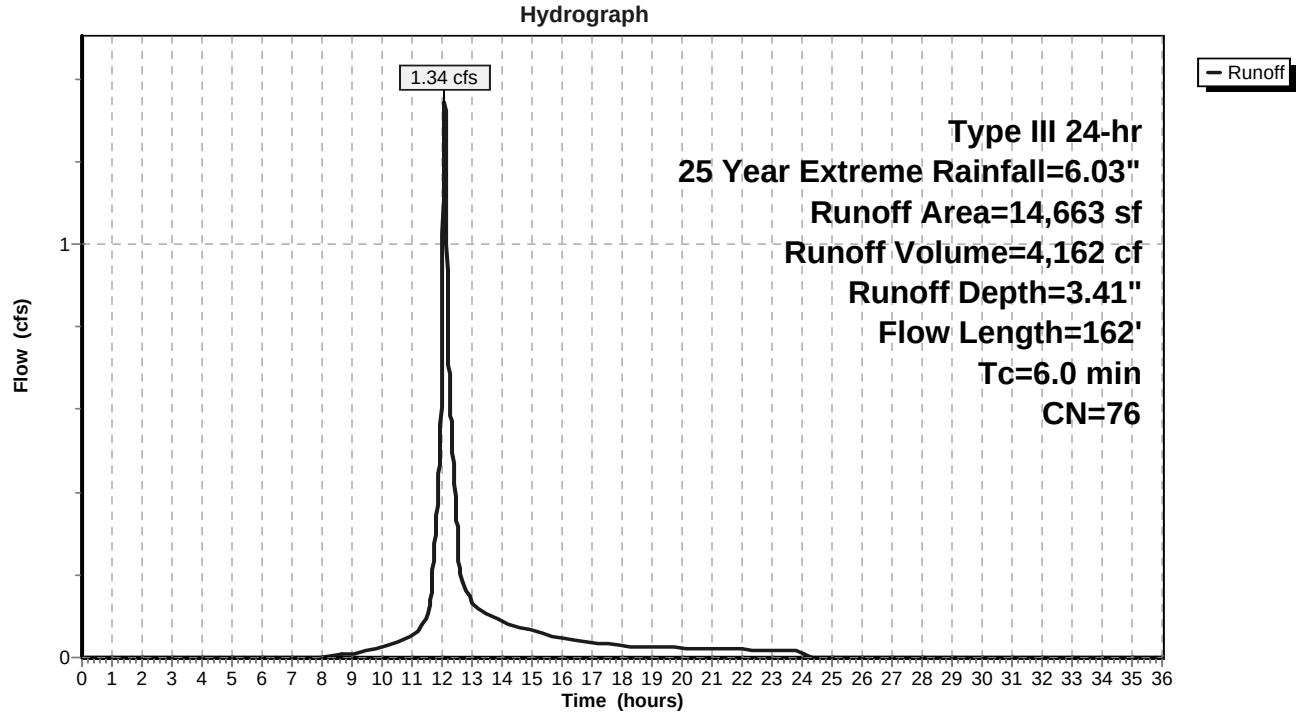
Runoff = 1.34 cfs @ 12.09 hrs, Volume= 4,162 cf, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Extreme Rainfall=6.03"

Area (sf)	CN	Description
5,825	98	Paved parking, HSG B
8,838	61	>75% Grass cover, Good, HSG B
14,663	76	Weighted Average
8,838		60.27% Pervious Area
5,825		39.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	49	0.0640	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.14"
0.1	28	0.0570	4.85		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	24	0.0950	2.16		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	61	0.0200	2.04	3.58	**Trap/Vee/Rect Channel Flow,** Bot.W=2.00' D=0.50' Z= 3.0 '/' Top.W=5.00' n= 0.050
4.3	162	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1A: Subcatchment 1A



Summary for Subcatchment 1B: Subcatchment 1B

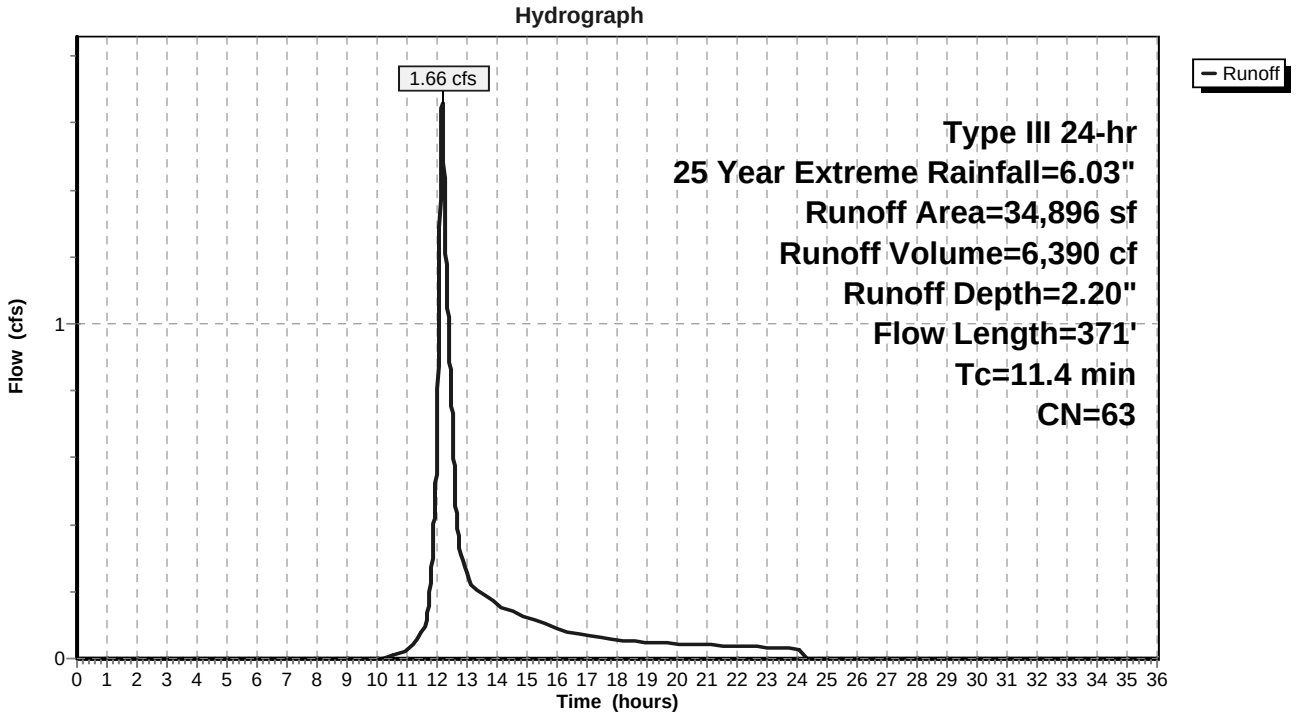
Runoff = 1.66 cfs @ 12.17 hrs, Volume= 6,390 cf, Depth= 2.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Extreme Rainfall=6.03"

Area (sf)	CN	Description
5,790	70	Woods, Good, HSG C
10,526	55	Woods, Good, HSG B
113	98	Paved parking, HSG C
1,487	98	Paved parking, HSG B
943	74	>75% Grass cover, Good, HSG C
16,037	61	>75% Grass cover, Good, HSG B
34,896	63	Weighted Average
33,296		95.41% Pervious Area
1,600		4.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.0840	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.14"
0.2	13	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.2	15	0.0450	1.48		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.2	51	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	40	0.0380	1.36		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
2.3	202	0.0850	1.46		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
11.4	371	Total			

Subcatchment 1B: Subcatchment 1B



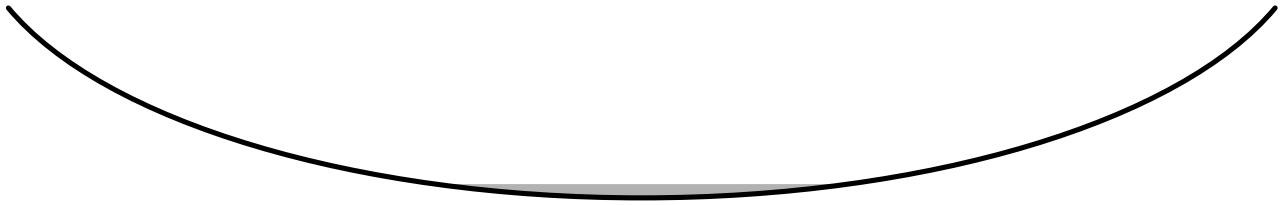
Summary for Reach 1R: Reach #1

Inflow Area = 14,663 sf, 39.73% Impervious, Inflow Depth = 2.72" for 25 Year Extreme event
Inflow = 0.13 cfs @ 12.18 hrs, Volume= 3,326 cf
Outflow = 0.13 cfs @ 12.33 hrs, Volume= 3,326 cf, Atten= 0%, Lag= 8.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.71 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 6.1 min

Peak Storage= 33 cf @ 12.33 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 41.67 cfs

30.00' x 0.50' deep Parabolic Channel, n= 0.050
Length= 175.0' Slope= 0.0851 '/'
Inlet Invert= 110.40', Outlet Invert= 95.50'



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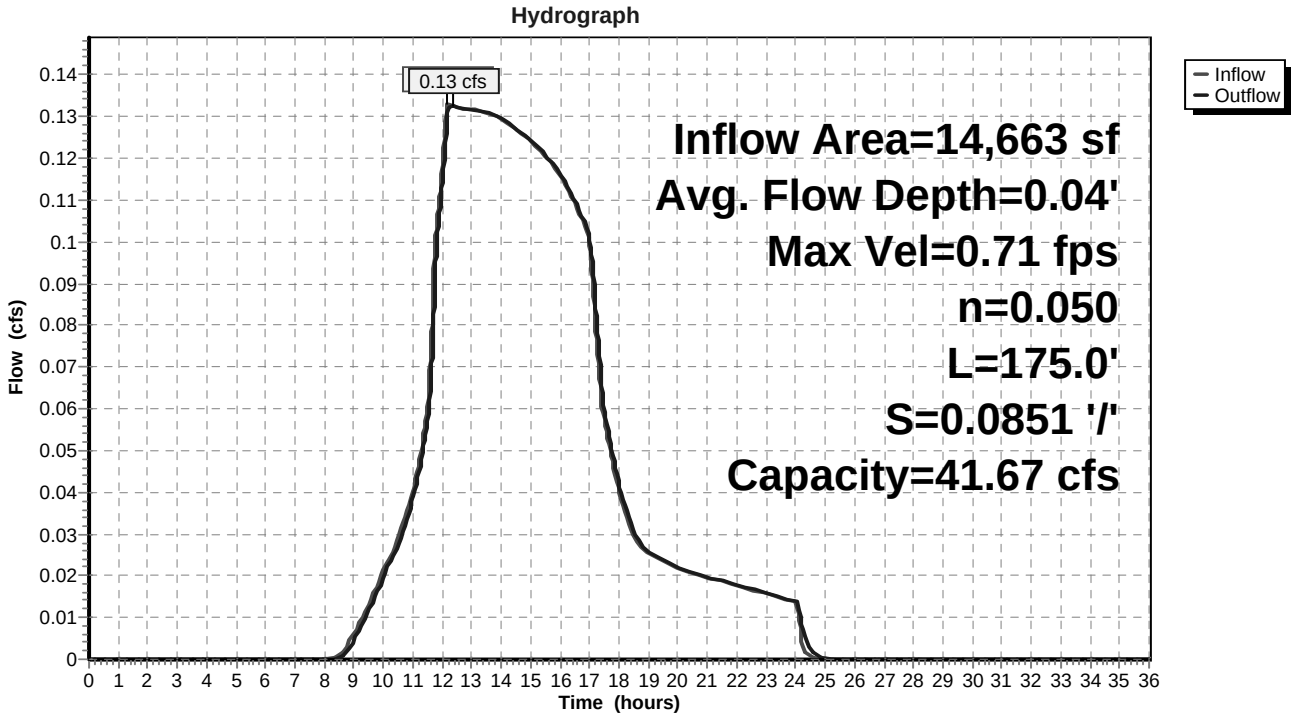
Reach 1R: Reach #1



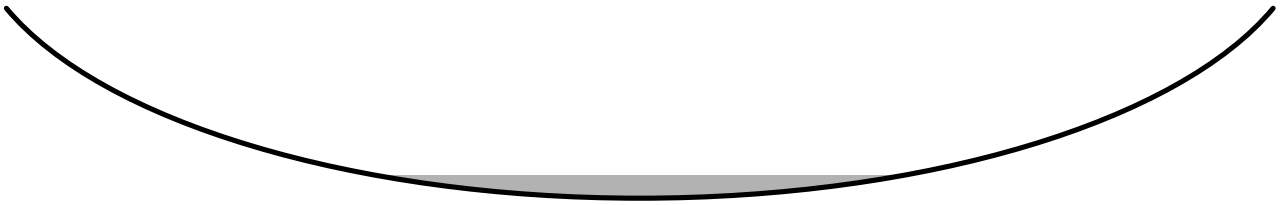
Summary for Reach 2R: Reach #2

Inflow = 0.73 cfs @ 12.18 hrs, Volume= 685 cf
Outflow = 0.62 cfs @ 12.23 hrs, Volume= 685 cf, Atten= 16%, Lag= 2.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.47 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 0.59 fps, Avg. Travel Time= 5.7 min

Peak Storage= 84 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 0.50' Flow Area= 10.0 sf, Capacity= 60.35 cfs

30.00' x 0.50' deep Parabolic Channel, n= 0.035 Earth, dense weeds
Length= 200.0' Slope= 0.0875 '/'
Inlet Invert= 113.00', Outlet Invert= 95.50'



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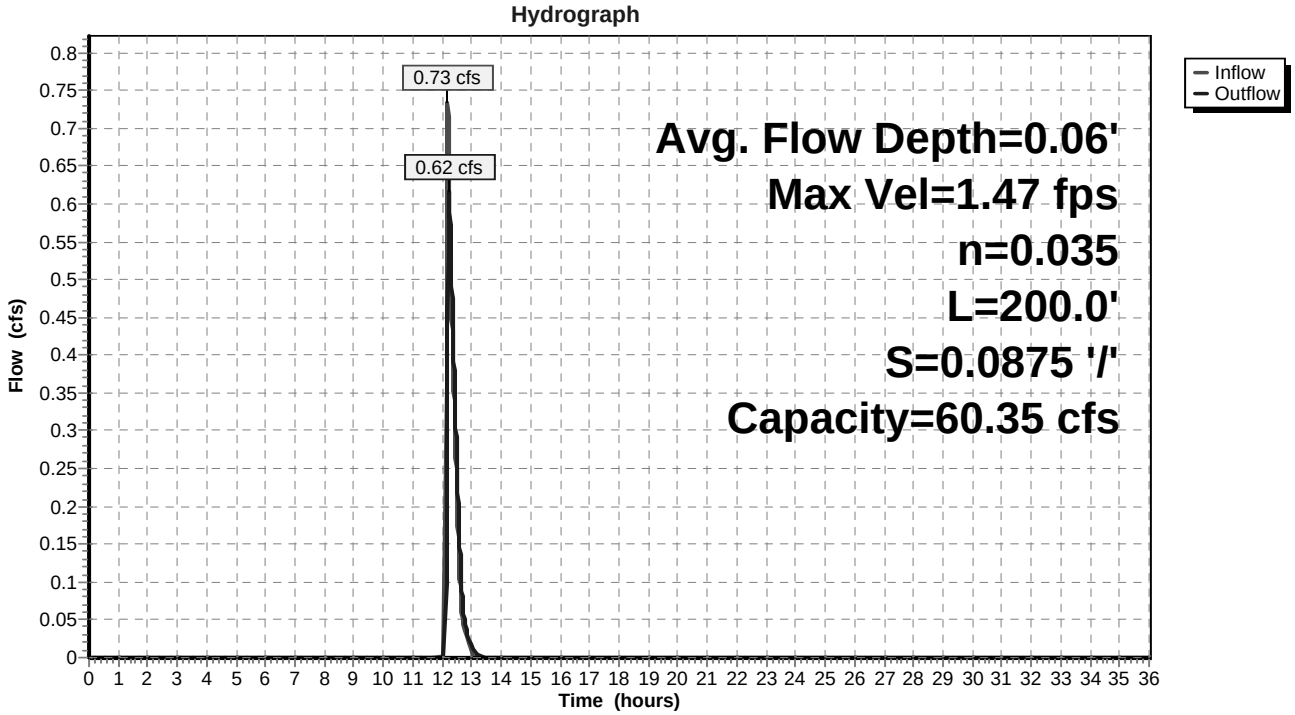
Reach 2R: Reach #2



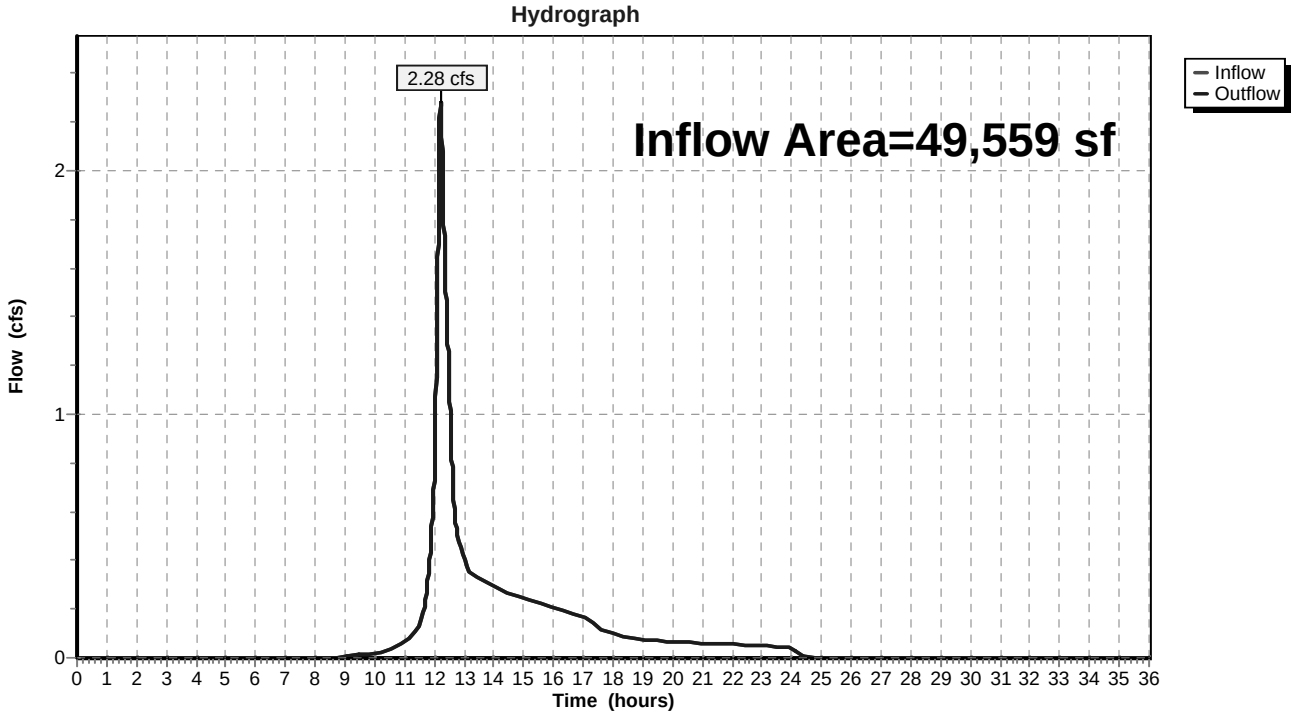
Summary for Reach POA1: POA 1

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

Inflow Area = 49,559 sf, 14.98% Impervious, Inflow Depth = 2.52" for 25 Year Extreme event
Inflow = 2.28 cfs @ 12.21 hrs, Volume= 10,401 cf
Outflow = 2.28 cfs @ 12.21 hrs, Volume= 10,401 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach POA1: POA 1



Summary for Pond P1: Proposed Bioretention System

Inflow Area = 14,663 sf, 39.73% Impervious, Inflow Depth = 3.41" for 25 Year Extreme event
Inflow = 1.34 cfs @ 12.09 hrs, Volume= 4,162 cf
Outflow = 0.87 cfs @ 12.18 hrs, Volume= 4,162 cf, Atten= 35%, Lag= 5.7 min
Discarded = 0.01 cfs @ 12.18 hrs, Volume= 151 cf
Primary = 0.13 cfs @ 12.18 hrs, Volume= 3,326 cf
Secondary = 0.73 cfs @ 12.18 hrs, Volume= 685 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 114.68' @ 12.18 hrs Surf.Area= 872 sf Storage= 1,024 cf

Plug-Flow detention time= 53.5 min calculated for 4,162 cf (100% of inflow)
Center-of-Mass det. time= 53.4 min (877.2 - 823.8)

Volume	Invert	Avail.Storage	Storage Description
#1	110.75'	2,098 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
110.75	235	73.0	0.0	0	0	235
111.58	235	73.0	40.0	78	78	296
112.83	235	73.0	20.0	59	137	387
113.00	235	73.0	40.0	16	153	399
114.75	910	165.0	100.0	938	1,090	2,154
115.50	1,830	366.0	100.0	1,008	2,098	10,650

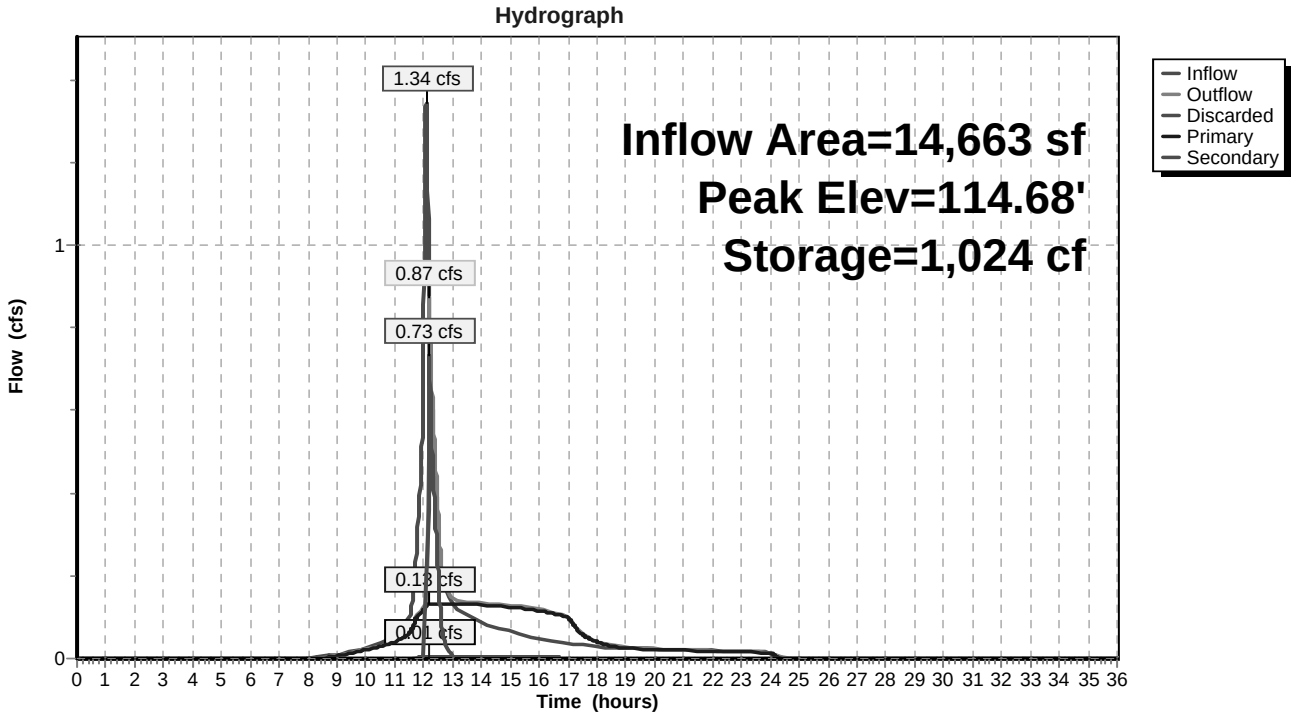
Device	Routing	Invert	Outlet Devices
#1	Primary	110.75'	**4.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.75' / 110.55' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#2	Device 1	110.75'	**0.2" Vert. Orifice/Grate X 64.00** C= 0.600
#3	Secondary	114.60'	**15.0' long x 6.0' breadth Broad-Crested Rectangular Weir** 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#4	Discarded	110.75'	**0.300 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 12.18 hrs HW=114.67' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.13 cfs @ 12.18 hrs HW=114.67' TW=110.43' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.13 cfs of 0.52 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 9.53 fps)

Secondary OutFlow Max=0.73 cfs @ 12.18 hrs HW=114.67' TW=113.05' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.73 cfs @ 0.65 fps)

Pond P1: Proposed Bioretention System



Summary for Pond P1: Proposed Bioretention System

Inflow Area = 14,663 sf, 39.73% Impervious, Inflow Depth = 5.74" for 100 Year Extreme event
Inflow = 2.25 cfs @ 12.09 hrs, Volume= 7,018 cf
Outflow = 2.22 cfs @ 12.10 hrs, Volume= 7,018 cf, Atten= 1%, Lag= 0.8 min
Discarded = 0.01 cfs @ 12.10 hrs, Volume= 184 cf
Primary = 0.13 cfs @ 12.10 hrs, Volume= 4,474 cf
Secondary = 2.08 cfs @ 12.10 hrs, Volume= 2,360 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 114.75' @ 12.10 hrs Surf.Area= 911 sf Storage= 1,091 cf

Plug-Flow detention time= 46.0 min calculated for 7,016 cf (100% of inflow)
Center-of-Mass det. time= 45.9 min (854.8 - 808.9)

Volume	Invert	Avail.Storage	Storage Description
#1	110.75'	2,098 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
110.75	235	73.0	0.0	0	0	235
111.58	235	73.0	40.0	78	78	296
112.83	235	73.0	20.0	59	137	387
113.00	235	73.0	40.0	16	153	399
114.75	910	165.0	100.0	938	1,090	2,154
115.50	1,830	366.0	100.0	1,008	2,098	10,650

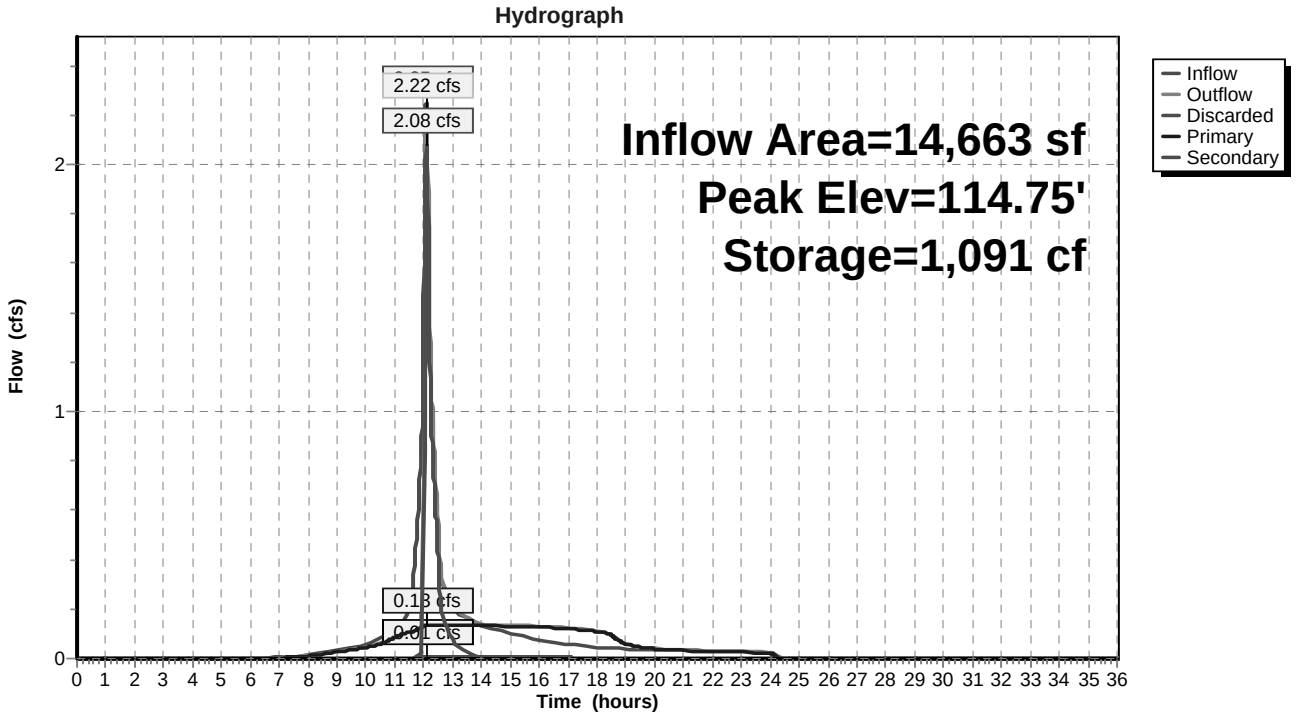
Device	Routing	Invert	Outlet Devices
#1	Primary	110.75'	**4.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 110.75' / 110.55' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#2	Device 1	110.75'	**0.2" Vert. Orifice/Grate X 64.00** C= 0.600
#3	Secondary	114.60'	**15.0' long x 6.0' breadth Broad-Crested Rectangular Weir** 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) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83
#4	Discarded	110.75'	**0.300 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.01 cfs @ 12.10 hrs HW=114.75' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.13 cfs @ 12.10 hrs HW=114.75' TW=110.44' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.13 cfs of 0.52 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.13 cfs @ 9.62 fps)

Secondary OutFlow Max=2.08 cfs @ 12.10 hrs HW=114.75' TW=113.10' (Dynamic Tailwater)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 2.08 cfs @ 0.92 fps)

Pond P1: Proposed Bioretention System



APPENDIX D

Extreme Precipitation Tables

Northeast Regional Climate Center

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

Smoothing	Yes
State	New Hampshire
Location	
Longitude	70.917 degrees West
Latitude	43.129 degrees North
Elevation	0 feet
Date/Time	Mon, 23 Oct 2017 15:42:17 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.40	0.50	0.65	0.81	1.03	**1yr**	0.70	0.98	1.20	1.55	2.00	2.61	2.84	**1yr**	2.31	2.74	3.14	3.86	4.44	**1yr**
2yr	0.32	0.49	0.61	0.81	1.01	1.29	**2yr**	0.88	1.17	1.50	1.91	2.44	3.14	3.48	**2yr**	2.78	3.34	3.84	4.57	5.21	**2yr**
5yr	0.37	0.57	0.72	0.96	1.23	1.58	**5yr**	1.06	1.44	1.85	2.38	3.07	3.98	4.46	**5yr**	3.52	4.29	4.90	5.79	6.55	**5yr**
10yr	0.40	0.63	0.80	1.09	1.42	1.85	**10yr**	1.22	1.69	2.18	2.83	3.66	4.76	5.39	**10yr**	4.21	5.18	5.90	6.92	7.80	**10yr**
25yr	0.46	0.74	0.94	1.29	1.72	2.27	**25yr**	1.48	2.09	2.69	3.53	4.62	6.03	6.91	**25yr**	5.34	6.65	7.53	8.78	9.83	**25yr**
50yr	0.51	0.83	1.06	1.48	2.00	2.66	**50yr**	1.72	2.46	3.18	4.19	5.51	7.22	8.36	**50yr**	6.39	8.04	9.06	10.51	11.72	**50yr**
100yr	0.58	0.93	1.20	1.70	2.32	3.12	**100yr**	2.00	2.89	3.74	4.97	6.56	8.64	10.11	**100yr**	7.65	9.72	10.91	12.58	13.97	**100yr**
200yr	0.64	1.04	1.35	1.95	2.69	3.67	**200yr**	2.32	3.40	4.43	5.91	7.84	10.36	12.22	**200yr**	9.16	11.75	13.14	15.07	16.66	**200yr**
500yr	0.75	1.24	1.61	2.34	3.29	4.53	**500yr**	2.84	4.22	5.50	7.40	9.89	13.16	15.72	**500yr**	11.64	15.12	16.81	19.15	21.05	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.37	0.45	0.60	0.74	0.90	**1yr**	0.64	0.88	0.91	1.26	1.56	2.02	2.52	**1yr**	1.79	2.42	2.93	3.27	4.01	**1yr**
2yr	0.31	0.49	0.60	0.81	1.00	1.18	**2yr**	0.86	1.16	1.37	1.83	2.36	3.04	3.39	**2yr**	2.69	3.26	3.74	4.46	5.05	**2yr**
5yr	0.35	0.54	0.67	0.92	1.16	1.40	**5yr**	1.01	1.37	1.62	2.15	2.78	3.72	4.14	**5yr**	3.29	3.98	4.59	5.43	6.14	**5yr**
10yr	0.38	0.59	0.73	1.02	1.32	1.60	**10yr**	1.14	1.57	1.82	2.45	3.13	4.30	4.82	**10yr**	3.80	4.63	5.34	6.30	7.08	**10yr**
25yr	0.44	0.67	0.83	1.18	1.56	1.91	**25yr**	1.35	1.87	2.11	2.85	3.66	5.03	5.87	**25yr**	4.45	5.65	6.54	7.68	8.56	**25yr**
50yr	0.48	0.74	0.92	1.32	1.77	2.19	**50yr**	1.53	2.14	2.36	3.20	4.11	5.77	6.81	**50yr**	5.11	6.55	7.63	8.92	9.87	**50yr**
100yr	0.54	0.82	1.02	1.48	2.03	2.51	**100yr**	1.75	2.45	2.64	3.59	4.60	6.60	7.89	**100yr**	5.84	7.59	8.91	10.35	11.35	**100yr**
200yr	0.60	0.90	1.15	1.66	2.31	2.87	**200yr**	2.00	2.80	2.94	4.01	5.14	7.55	9.15	**200yr**	6.68	8.80	10.41	12.02	13.08	**200yr**
500yr	0.70	1.05	1.34	1.95	2.78	3.45	**500yr**	2.40	3.37	3.42	4.65	5.98	8.99	11.12	**500yr**	7.95	10.69	12.80	14.67	15.72	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.87	1.08	**1yr**	0.75	1.05	1.24	1.75	2.22	2.84	3.03	**1yr**	2.51	2.91	3.38	4.18	4.78	**1yr**
2yr	0.33	0.51	0.62	0.84	1.04	1.25	**2yr**	0.90	1.22	1.48	1.95	2.50	3.26	3.58	**2yr**	2.88	3.44	3.95	4.71	5.40	**2yr**
5yr	0.39	0.60	0.75	1.03	1.31	1.58	**5yr**	1.13	1.55	1.85	2.50	3.19	4.23	4.77	**5yr**	3.74	4.59	5.22	6.16	6.93	**5yr**
10yr	0.46	0.70	0.87	1.21	1.57	1.92	**10yr**	1.35	1.88	2.23	3.04	3.84	5.21	5.94	**10yr**	4.61	5.71	6.48	7.56	8.45	**10yr**
25yr	0.55	0.84	1.05	1.50	1.97	2.48	**25yr**	1.70	2.42	2.87	3.96	4.93	7.05	7.95	**25yr**	6.24	7.65	8.59	9.94	11.01	**25yr**
50yr	0.64	0.97	1.21	1.74	2.34	2.99	**50yr**	2.02	2.92	3.48	4.83	5.99	8.73	9.93	**50yr**	7.73	9.55	10.65	12.21	13.47	**50yr**
100yr	0.74	1.12	1.41	2.03	2.79	3.61	**100yr**	2.40	3.53	4.23	5.91	7.27	10.81	12.40	**100yr**	9.57	11.92	13.19	15.02	16.48	**100yr**
200yr	0.86	1.29	1.64	2.37	3.31	4.38	**200yr**	2.86	4.28	5.14	7.23	8.81	13.43	15.50	**200yr**	11.88	14.91	16.34	18.47	20.19	**200yr**
500yr	1.05	1.56	2.01	2.92	4.15	5.63	**500yr**	3.58	5.50	6.63	9.47	11.40	17.92	20.82	**500yr**	15.86	20.02	21.69	24.30	26.43	**500yr**

Powered by ACIS Northeast Regional Climate Center

APPENDIX E

Soil Series	legend number	Ksat low - B in/hr	Ksat high - B in/hr	Ksat low - C in/hr	Ksat high - C in/hr	Hyd. Grp.	Group	Land Form	Temp.	Soil Textures	Spodosol ?	Other
Abenaki	501	0.6	2.0	6.00	99.0	B	2	Outwash and Stream Terraces	frigid	loamy over sandy-skeletal	no	loamy over gravelly
Acton	146	2.0	20.0	2.00	20.0	B	3	Loose till, sandy textures	mesic	sandy-skeletal	no	cobbly loamy sand
Adams	36	6.0	20.0	20.00	99.0	A	1	Outwash and Stream Terraces	frigid	sandy	yes	
Agawam	24	6.0	20.0	20.00	100.0	B	2	Outwash and Stream Terraces	mesic	loamy over sandy	no	loamy over sand/gravel
Allagash	127	0.6	2.0	6.00	20.0	B	2	Outwash and Stream Terraces	frigid	loamy over sandy	yes	loamy over sandy
Au Gres	516					B	5	Outwash and Stream Terraces	frigid	sandy	yes	single grain, loose
Bangor	572	0.6	2.0	0.60	2.0	B	2	Friable till, silty, schist & phyllite	frigid	loamy	yes	silt loam
Becket	56	0.6	2.0	0.06	0.6	C	3	Firm, platy, sandy till	frigid	loamy	yes	gravelly sandy loam in Cd
Belgrade	532	0.6	2.0	0.06	2.0	B	3	Terraces and glacial lake plains	mesic	silty	no	strata of fine sand
Bemis	224	0.6	0.2	0.00	0.2	C	5	Firm, platy, loamy till	cryic	loamy	no	
Berkshire	72	0.6	6.0	0.60	6.0	B	2	Loose till, loamy textures	frigid	loamy	yes	fine sandy loam
Bernardston	330	0.6	2.0	0.06	0.2	C	3	Firm, platy, silty till, schist & phyllite	mesic	loamy	no	channery silt loam in Cd
Bice	226	0.6	6.0	0.60	6.0	B	2	Loose till, loamy textures	frigid	loamy	no	sandy loam
Biddeford	234	0.0	0.2	0.00	0.2	D	6	Silt and Clay Deposits	frigid	fine	no	organic over clay
Binghamville	534	0.2	2.0	0.06	0.2	D	5	Terraces and glacial lake plains	mesic	silty	no	
Boscawen	220	6.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	frigid	sandy-skeletal	no	loamy cap
Boxford	32	0.1	0.2	0.00	0.2	C	3	Silt and Clay Deposits	mesic	fine	no	silty clay loam
Brayton	240	0.6	2.0	0.06	0.6	C	5	Firm, platy, silty till, schist & phyllite	frigid	loamy	no	
Buckland	237	0.6	2.0	0.06	0.2	C	3	Firm, platy, loamy till	frigid	loamy	no	loam in Cd
Bucksport	895					D	6	Organic Materials - Freshwater	frigid	sapric	no	deep organic
Burnham	131	0.2	6.0	0.02	0.2	D	6	Firm, platy, silty till, schist & phylitte	frigid	loamy	no	organic over silt
Buxton	232	0.1	0.6	0.00	0.2	C	3	Silt and Clay Deposits	frigid	fine	no	silty clay
Cabot	589	0.6	2.0	0.06	0.2	D	5	Firm, platy, silty till, schist & phyllite	frigid	loamy	no	
Caesar	526	20.0	100.0	20.00	100.0	A	1	Outwash and Stream Terraces	mesic	coarse sand	no	
Canaan	663	2.0	20.0	2.00	20.0	C	4	Weathered Bedrock Till	frigid	loamy-skeletal	yes	less than 20 in. deep
Canterbury	166	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	no	loam in Cd
Canton	42	2.0	6.0	6.00	20.0	B	2	Loose till, sandy textures	mesic	loamy over sandy	no	loamy over loamy sand
Cardigan	357	0.6	2.0	0.60	2.0	B	4	Friable till, silty, schist & phyllite	mesic	loamy	no	20 to 40 in. deep
Catden	296					A/D	6	Organic Materials - Freshwater	mesic	sapric	no	deep organic
Champlain	35	6.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	frigid	gravelly sand	no	
Charles	209	0.6	100.0	0.60	100.0	C	5	Flood Plain (Bottom Land)	frigid	silty	no	
Charlton	62	0.6	6.0	0.60	6.0	B	2	Loose till, loamy textures	mesic	loamy	no	fine sandy loam
Chatfield	89	0.6	6.0	0.60	6.0	B	4	Loose till, bedrock	mesic	loamy	no	20 to 40 in. deep
Chatfield Var.	289	0.6	6.0	0.60	6.0	B	3	Loose till, bedrock	mesic	loamy	no	mwd to swpd
Chesuncook	126	0.6	2.0	0.02	0.2	C	3	Firm, platy, silty till, schist & phyllite	frigid	loamy	yes	channery silt loam in Cd
Chichester	442	0.6	2.0	2.00	6.0	B		Loose till, sandy textures	frigid	loamy over sandy	no	loamy over loamy sand
Chocorua	395			6.00	20.0	D	6	Organic Materials - Freshwater	frigid	sandy or sandy-skeletal	no	organic over sand
Cohas	505	0.6	2.0	0.60	100.0	C	5	Flood Plain (Bottom Land)	frigid	co. loamy over sandy (skeletal)	no	
Colonel	927	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	yes	loam in Cd
Colton	22	6.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	frigid	sandy-skeletal	yes	
Colton, gravelly	21	6.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	frigid	sandy-skeletal	yes	gravelly surface
Croghan	613	20.0	100.0	20.00	100.0	B	3	Outwash and Stream Terraces	frigid	sandy	yes	single grain in C
Dartmouth	132	0.6	2.0	0.06	0.6	B	3	Terraces and glacial lake plains	mesic	silty	no	thin strata silty clay loam
Deerfield	313	6.0	20.0	20.00	100.0	B	3	Outwash and Stream Terraces	mesic	sandy	no	single grain in C
Dixfield	378	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	yes	fine sandy loam in Cd
Dixmont	578	0.6	2.0	0.60	2.0	C	3	Friable till, silty, schist & phyllite	frigid	loamy	yes	silt loam, platy in C
Duane	413	6.0	20.0	6.00	20.0	B	3	Outwash and Stream Terraces	frigid	sandy-skeletal	yes	cemented (ortstein)
Dutchess	366	0.6	2.0	0.60	2.0	B	2	Friable till, silty, schist & phyllite	mesic	loamy	no	very channery
Eldridge	38	6.0	20.0	0.06	0.6	C	3	Sandy/loamy over silt/clay	mesic	sandy over loamy	no	
Elliottsville	128	0.6	2.0	0.60	2.0	B	4	Friable till, silty, schist & phyllite	frigid	loamy	yes	20 to 40 in. deep
Elmridge	238	2.0	6.0	0.00	0.2	C	3	Sandy/loamy over silt/clay	mesic	loamy over clayey	no	
Elmwood	338	2.0	6.0	0.00	0.2	C	3	Sandy/loamy over silt/clay	frigid	loamy over clayey	no	
Finch	116					C	3	Outwash and Stream Terraces	frigid	sandy	yes	cemented (ortstein)

STORMWATER SYSTEMS INSPECTION & MAINTENANCE MANUAL

Prepared for:

Great Bay Animal Hospital, LLC

31 Newmarket Road

Durham, NH 03824

Tax Map 6 Lot 11-8

Prepared on:

November 6, 2017

Prepared by:

MJS ENGINEERING, P.C.
CIVIL • STRUCTURAL • ENVIRONMENTAL

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2.0 EXECUTIVE SUMMARY

The Stormwater Systems Inspection and Maintenance Manual (SSIMM) provides a complete reference guide for use by the property owner and their chosen maintenance subcontractor for the inspection and maintenance of the storm water best management practices (BMPs) adjacent to the proposed 14 space parking area at The Great Bay Animal Hospital located at 31 Newmarket Road in Durham, NH. The SSIMM describes each BMP and identifies necessary inspection activities, schedules and record keeping requirements. Compliance with the recommendations in the SSIMM will assure expected operation, performance, and life cycle of the BMPs which have a common purpose of collecting and treating storm water runoff in an effort to protect the quality of public waters.

3.0 CONTACT INFORMATION

The individual responsible for the required reporting, inspection, and maintenance activities specified in this manual is;

Jim McKiernan
31 Newmarket Road
Durham, NH 03824
(603)-868-7387

4.0 PERMANENT BEST MANAGEMENT PRACTICES

The section identifies the BMPs employed on this development and provides a brief summary to establish their purpose in the collection and treatment train within the storm water system. See the included Storm Water Systems Overview Plan for the location(s) of each of the BMPs.

4.1 OUTLET PROTECTION

Erosion control matting is used as spillway protection for the bioretention system to reduce the velocity of stormwater and prevent erosion at the outlet.

4.2 CONVEYANCE SWALES

Conveyance swales are vegetated channels that collect and transport runoff to pre-treatment and treatment practices. Conveyance swales do not provide stormwater treatment.

4.3 BIORETENTION SYSTEM

A bioretention system is a landscaped depression that allows runoff to pond before it filters through an 15 inch deep soil mix, and infiltrates in to the ground or is collected by an underdrain system. The rain garden incorporates vegetation specifically planned for the uptake of runoff.

The rain garden is designed to temporarily hold runoff like a detention pond and allow time for the vegetation to uptake the runoff. The rain garden incorporates a spillway outlet stabilized with erosion control matting.

4.4 SEDIMENT FOREBAYS

A sediment forebay is a pre-treatment practice that consists of a small basin designed to dissipate the energy of incoming runoff and allow for settling of suspended solids. A staff gage (wood stake) marked at 6 inch increments shall be permanently installed to measure the depth of sediment accumulation. Runoff outlets through a spillway.

4.5 CONTROL OF INVASIVE PLANTS

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.

5.0 LONG TERM MAINTENANCE OF PERMANENT BMPS

This section will be useful to the property owner and their maintenance subcontractor to establish a systematic approach for the inspection and maintenance of the on-site storm water system components. Included in Appendix B is an Inspection Matrix which summarizes the inspection needs described below. An Inspection Report is provided in Appendix C. Completion of the Inspection Report and Matrix is required and a record shall be kept on site of each inspection.

5.1 OUTLET PROTECTION

Inspect rip rap aprons annually for damage and repair as needed. Ensure outlet is free of debris.

5.2 CONVEYANCE SWALES

Inspect annually for sediment accumulation, erosion, and condition of vegetation. Remove sediment and debris, repair eroded areas, and reseed bare areas as necessary. Channel should be mowed at least once per year to a minimum height of 4 inches.

5.3 BIORETENTION SYSTEM

The Bioretention system 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. At least once annually the bioretention system should be inspected for drawdown time. If bioretention system does not drain within 72 hours following a rainfall event, then a qualified professional should assess the system, to determine required measures to restore infiltration and filtration capacity which may include removal of sediment or reconstruction of filter media.

The vegetation and riverstone mulch will be the major visible features of this BMP. Mow and cut back the vegetation to the extent necessary and practical to prevent overgrowth. Augmentation of the riverstone mulch may be needed every two or three years. Any fallen leaves, branches, and other detritus material should be removed each fall prior to the winter season with a final clean-up in the spring. Watering may be necessary during extended periods of extremely hot and/or dry weather.

5.4 SEDIMENT FOREBAYS

Inspect annually for sediment accumulation, erosion, and condition of vegetation. Sediment should be removed and properly disposed of from the forebay at least once per year and more if accumulation exceeds 1 foot in depth as noted on the staff gage. Embankments should be mowed at least twice per year. Inspect spillway outlet annually and repair as necessary.

5.5 CONTROL OF INVASIVE PLANTS

During maintenance activities, check for the presence of invasive plants and remove in a safe manner as described in Appendix D. They should be controlled as described in Appendix D.

6.0 REFERENCES

The Storm Water Systems Management Plan incorporates many standard and accepted practices. Specifically, the following references were utilized:

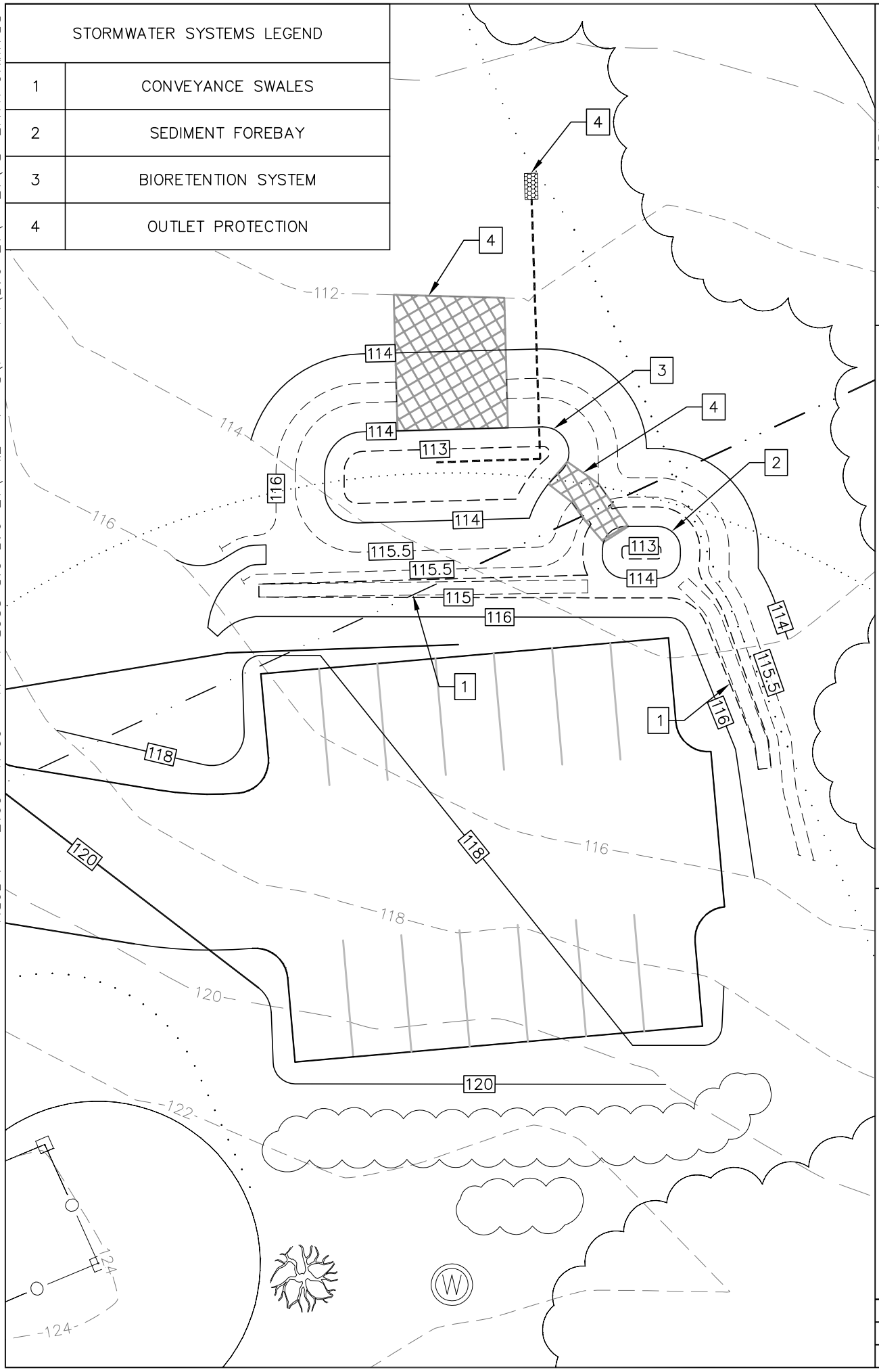
The New Hampshire Stormwater Manual, December 2008, Revision 1.0.

Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire. Rockingham County Conservation District, August 1992, or latest edition.

APPENDIX A:

STORMWATER SYSTEMS OVERVIEW PLAN

STORMWATER SYSTEMS LEGEND	
1	CONVEYANCE SWALES
2	SEDIMENT FOREBAY
3	BIORETENTION SYSTEM
4	OUTLET PROTECTION



SEAL:

DATE:	11/6/17
SCALE:	1"=20'
DESIGNER:	MS
DRAWN BY:	EHK
APPROVED BY:	MJS
DRAWING FILE:	

SSOP MAP
prepared for
GREAT BAY ANIMAL HOSPITAL, LLC
TAX MAP 6, LOT 11-8
31 NEWMARKET ROAD DURHAM, NH 03824

MJS ENGINEERING, P.C.
CIVIL • STRUCTURAL • ENVIRONMENTAL
5 RAILROAD ST., P.O. BOX 359
NEWMARKET, NH 03857
PHONE: (603) 659-4979, FAX: (603) 659-4627
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SHEET 1 OF 1
JOB: 17-043
SSOP

DRAWING NAME: P:\17pro\17-043\Internal\Drawing Files\17-043 C1D SSOP.dwg Mon, 06 Nov 2017 - 4:36PM

APPENDIX B:

MAINTENANCE MATRIX

LONG TERM BMP INSPECTION / MAINTENANCE MATRIX

		Inspection / Maintenance Interval				
BMP	**Major Inspection / Maintenance Criterion [1]**	**Spring [2]**	**Summer**	**Fall [3]**	**Winter**	**Other / Notes**
Outlet Protection	I - check damage to rip rap apron M - remove debris including accumulated leaves and branches M - Repair rip rap apron	I - RQ M - RQ	I - O	I - R M - R	I - O	
Conveyance Swale	I - check for sediment accumulation M - remove debris and sediment M - mow once per year M - reseed bare areas M - repair eroded areas	I - RQ M - RQ	I - O	I - R M - R	I - O	Grass shall be mowed to a height of 4 inches minimum. Reseed with grass mix noted on sheet D1.
Bioretention System	I - check for drawdown time I - check earthen dam for settlement, rodent damage, failures M - augment riverstone mulch as needed M - remove fallen leaves, branches, etc M - mow, head, prune to control overgrowth. Cut back ground cover if necessary. M - remove accumulated sediment	I - RQ M - R	I - O	I - RQ M - RQ	I - O	
Sediment Forebay	I - read staff gage to determine depth of sediment accumulation M - remove accumulated sediment. M - mow embankments at least twice per year	I - RQ M - RQ	I - O	I - R M - R	I - O	Remove sediment annually or more if over 1 foot depth as measured with staff gage.

Notes

(1) The BMP should be inspected as recommended and maintenance shall be performed as needed. Maintenance may be needed at shorter or longer intervals depending on weather conditions, and use of the property and contributing watershed

(2) Early Spring as vegetation begins to blossom or earlier

(3) Late Fall after majority of leaf fall, but prior to snow fall

Abbreviations

I - Inspection
M - Maintenance
O - Optional
R - Recommended
RQ - Required

APPENDIX C:

MAINTENANCE REPORTS

MJS ENGINEERING, P.C.
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BMP Maintenance Report

Site Name:	The Great Bay Animal Hospital
Site Location:	31 Newmarket Road
Installation Date:	

Owner:	Jim McKiernan	Contractor:	TBD
Contact Name:	Jim McKiernan	Contact Name:	
Company Name:		Company Name:	
Telephone:	603-868-7387	Telephone:	
Fax:		Fax:	
Address:	31 Newmarket Road Durham, NH 03824	Address:	

Maintenance Log

Items Inspected	Checked		Maintenance Needed		Comments
	Yes	No	Yes	No	
Conveyance Swale					
Sediment Forebay					
Bioretention System					
Outlet Protection					

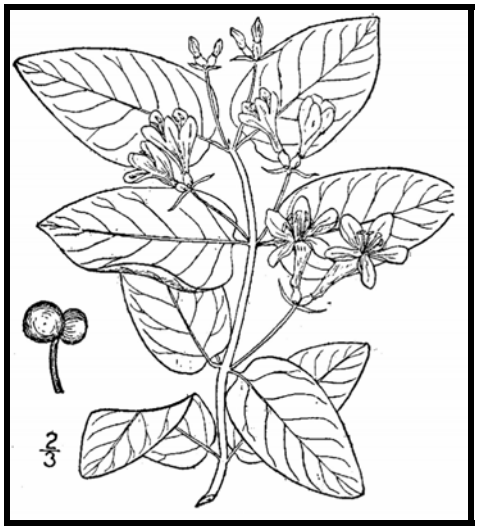
APPENDIX D:

CONTROL OF INVASIVE SPECIES

UNIVERSITY of NEW HAMPSHIRE COOPERATIVE EXTENSION

Methods for Disposing Non-Native Invasive Plants

Prepared by the Invasives Species Outreach Group, volunteers interested in helping people control invasive plants. Assistance provided by the Piscataquog Land Conservancy and the NH Invasives Species Committee. Edited by Karen Bennett, Extension Forestry Professor and Specialist.



Tatarian honeysuckle
Lonicera tatarica
USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions*. Vol. 3: 282.

Non-native invasive plants crowd out natives in natural and managed landscapes. They cost taxpayers billions of dollars each year from lost agricultural and forest crops, decreased biodiversity, impacts to natural resources and the environment, and the cost to control and eradicate them.

Invasive plants grow well even in less than desirable conditions such as sandy soils along roadsides, shaded wooded areas, and in wetlands. In ideal conditions, they grow and spread even faster. There are many ways to remove these non-native invasives, but once removed, care is needed to dispose the removed plant material so the plants don't grow where disposed.

Knowing how a particular plant reproduces indicates its method of spread and helps determine the appropriate disposal method. Most are spread by seed and are dispersed by wind, water, animals, or people. Some reproduce by vegetative means from pieces of stems or roots forming new plants. Others spread through both seed and vegetative means.

Because movement and disposal of viable plant parts is restricted (see NH Regulations), viable invasive parts can't be brought to most transfer stations in the state. Check with your transfer station to see if there is an approved, designated area for invasives disposal. This fact sheet gives recommendations for rendering plant parts non-viable.

Control of invasives is beyond the scope of this fact sheet. For information about control visit www.nhinvasives.org or contact your UNH Cooperative Extension office.

New Hampshire Regulations

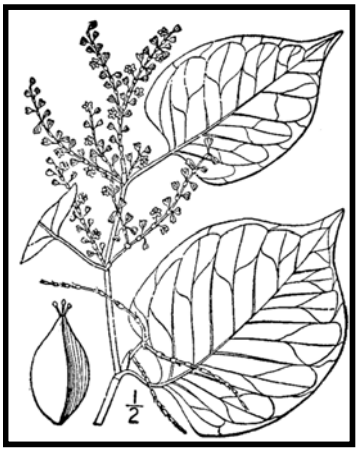
Prohibited invasive species shall only be disposed of in a manner that renders them nonliving and nonviable. (Agr. 3802.04)

No person shall collect, transport, import, export, move, buy, sell, distribute, propagate or transplant any living and viable portion of any plant species, which includes all of their cultivars and varieties, listed in Table 3800.1 of the New Hampshire prohibited invasive species list. (Agr 3802.01)

How and When to Dispose of Invasives?

To prevent seed from spreading remove invasive plants before seeds are set (produced). Some plants continue to grow, flower and set seed even after pulling or cutting. Seeds can remain viable in the ground for many years. If the plant has flowers or seeds, place the flowers and seeds in a heavy plastic bag "head first" at the weeding site and transport to the disposal site. The following are general descriptions of disposal methods. See the chart for recommendations by species.

Burning: Large woody branches and trunks can be used as firewood or burned in piles. For outside burning, a written fire permit from the local forest fire warden is required unless the ground is covered in snow. Brush larger than 5 inches in diameter can't be burned. Invasive plants with easily airborne seeds like black swallow-wort with mature seed pods (indicated by their brown color) shouldn't be burned as the seeds may disperse by the hot air created by the fire.



Japanese knotweed
Polygonum cuspidatum
USDA-NRCS PLANTS Database / Britton, N.L., and A. Brown. 1913. *An illustrated flora of the northern United States, Canada and the British Possessions*. Vol. 1: 676.

Bagging (solarization): Use this technique with softer-tissue plants. Use heavy black or clear plastic bags (contractor grade), making sure that no parts of the plants poke through. Allow the bags to sit in the sun for several weeks and on dark pavement for the best effect.

Tarping and Drying: Pile material on a sheet of plastic and cover with a tarp, fastening the tarp to the ground and monitoring it for escapes. Let the material dry for several weeks, or until it is clearly nonviable.

Chipping: Use this method for woody plants that don't reproduce vegetatively.

Burying: This is risky, but can be done with watchful diligence. Lay thick plastic in a deep pit before placing the cut up plant material in the hole. Place the material away from the edge of the plastic before covering it with more heavy plastic. Eliminate as much air as possible and toss in soil to weight down the material in the pit. Note that the top of the buried material should be at least three feet underground. Japanese knotweed should be at least 5 feet underground!

Drowning: Fill a large barrel with water and place soft-tissue plants in the water. Check after a few weeks and look for rotted plant material (roots, stems, leaves, flowers). Well-rotted plant material may be composted. A word of caution- seeds may still be viable after using this method. Do this before seeds are set. This method isn't used often. Be prepared for an awful stink!

Composting: Invasive plants can take root in compost. Don't compost any invasives unless you know there is no viable (living) plant material left. Use one of the above techniques (bagging, tarping, drying, chipping, or drowning) to render the plants nonviable before composting. Closely examine the plant before composting and avoid composting seeds.

Be diligent looking for seedlings for *years* in areas where removal and disposal took place.

Suggested Disposal Methods for Non-Native Invasive Plants

This table provides information concerning the disposal of removed invasive plant material. If the infestation is treated with herbicide and left in place, these guidelines don't apply. Don't bring invasives to a local transfer station, unless there is a designated area for their disposal, or they have been rendered non-viable. This listing includes wetland and upland plants from the New Hampshire Prohibited Invasive Species List. The disposal of aquatic plants isn't addressed.

<table>
<tr><th>Woody Plants</th><th>Method of Reproducing</th><th>Methods of Disposal</th></tr>
<tr><td rowspan="2">Norway maple
(Acer platanoides)
European barberry
(Berberis vulgaris)
Japanese barberry
(Berberis thunbergii)
autumn olive
(Elaeagnus umbellata)
burning bush
(Euonymus alatus)
Morrow's honeysuckle
(Lonicera morrowii)
Tatarian honeysuckle
(Lonicera tatarica)
showy bush honeysuckle
(Lonicera x bella)
common buckthorn
(Rhamnus cathartica)
glossy buckthorn
(Frangula alnus)</td><td rowspan="2">Fruit and Seeds
  </td><td>Prior to fruit/seed ripening
Seedlings and small plants
▪ Pull or cut and leave on site with roots exposed. No special care needed.
Larger plants
▪ Use as firewood.
▪ Make a brush pile.
▪ Chip.
▪ Burn.</td></tr>
<tr><td>After fruit/seed is ripe
Don't remove from site.
▪ Burn.
▪ Make a covered brush pile.
▪ Chip once all fruit has dropped from branches.
▪ Leave resulting chips on site and monitor.</td></tr>
<tr><td rowspan="2">oriental bittersweet
(Celastrus orbiculatus)
multiflora rose
(Rosa multiflora)</td><td rowspan="2">Fruits, Seeds, Plant Fragments
  </td><td>Prior to fruit/seed ripening
Seedlings and small plants
▪ Pull or cut and leave on site with roots exposed. No special care needed.
Larger plants
▪ Make a brush pile.
▪ Burn.</td></tr>
<tr><td>After fruit/seed is ripe
Don't remove from site.
▪ Burn.
▪ Make a covered brush pile.
▪ Chip – only after material has fully dried (1 year) and all fruit has dropped from branches. Leave resulting chips on site and monitor.</td></tr>
</table>

Non-Woody Plants	Method of Reproducing	Methods of Disposal
garlic mustard *(Alliaria petiolata)* spotted knapweed *(Centaurea maculosa)* ▪ Sap of related knapweed can cause skin irritation and tumors. Wear gloves when handling. black swallow-wort *(Cynanchum nigrum)* ▪ May cause skin rash. Wear gloves and long sleeves when handling. pale swallow-wort *(Cynanchum rossicum)* giant hogweed *(Heracleum mantegazzianum)* ▪ Can cause major skin rash. Wear gloves and long sleeves when handling. dame's rocket *(Hesperis matronalis)* perennial pepperweed *(Lepidium latifolium)* purple loosestrife *(Lythrum salicaria)* Japanese stilt grass *(Microstegium vimineum)* mile-a-minute weed *(Polygonum perfoliatum)*	**Fruits and Seeds** 	**Prior to flowering** Depends on scale of infestation Small infestation ▪ Pull or cut plant and leave on site with roots exposed. Large infestation ▪ Pull or cut plant and pile. (You can pile onto or cover with plastic sheeting). ▪ Monitor. Remove any re-sprouting material. **During and following flowering** Do nothing until the following year or remove flowering heads and bag and let rot. Small infestation ▪ Pull or cut plant and leave on site with roots exposed. Large infestation ▪ Pull or cut plant and pile remaining material. (You can pile onto plastic or cover with plastic sheeting). ▪ Monitor. Remove any re-sprouting material.
common reed (*Phragmites australis*) Japanese knotweed *(Polygonum cuspidatum)* Bohemian knotweed *(Polygonum x bohemicum)*	**Fruits, Seeds, Plant Fragments** Primary means of spread in these species is by plant parts. Although all care should be given to preventing the dispersal of seed during control activities, the presence of seed doesn't materially influence disposal activities.	**Small infestation** ▪ Bag all plant material and let rot. ▪ Never pile and use resulting material as compost. ▪ Burn. **Large infestation** ▪ Remove material to unsuitable habitat (dry, hot and sunny or dry and shaded location) and scatter or pile. ▪ Monitor and remove any sprouting material. ▪ Pile, let dry, and burn.

January 2010