

**DRAINAGE ANALYSIS
&
SEDIMENT AND EROSION
CONTROL PLAN**

Prepared for:
**MIDNIGHT LEASING, LLC
COMMERCIAL SITE PLAN**

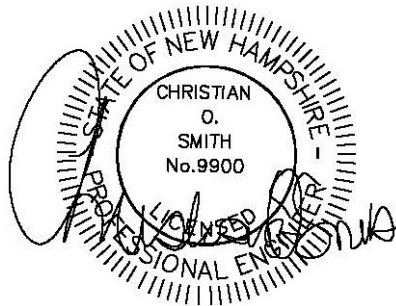
Prepared by:

**BEALS ASSOCIATES, PLLC
70 PORTSMOUTH AVENUE
STRATHAM, NH 03885**

Project Number:
NH-1485
Bowley Road
East Kingston, New Hampshire

July 24, 2023

Revised September 11, 2023



DESIGN METHOD OBJECTIVES

Midnight Leasing, LLC proposes to construct a commercial site plan to establish a mulch manufacturing business on a 28+/- acre parcel of land located off of Bowley Road in East Kingston NH. A drainage analysis of 13.9 acres of the proposed site improvement was conducted for the purpose of estimating the peak rate of stormwater run-off and to subsequently design adequate drainage structures. Two models were compiled, one for the area in its existing (pre-construction) condition, and a second for its proposed (post-construction) condition. The analysis was conducted using Extreme Precipitation data provided by Cornell University for the 2 Yr – 24 Hr (3.19”), the 10 Yr – 24 Hr (4.87”) and the 50 Yr - 24 Hr (7.48”) storm events (HydroCAD “ponds” were also analyzed at the 100 Yr – 24 Hr (8.99”) storm event) using the USDA SCS TR-20 method within the HydroCAD Stormwater Modeling System environment. The purpose of this analysis is to estimate the peak rates of run-off from the site for detention adequacy purposes, and to compare the peak rate of run-off between the existing and proposed conditions.

<u>ANALYSIS</u>		<u>COMPONENT PEAK RATE of DISCHARGE (CFS)</u>		
		<u>2 YR</u>	<u>10 YR</u>	<u>50 YR</u>
Reach #100 (Ex. Wetland Northwesterly)	Existing	0,63	2.92	8.28
	Proposed	0.41	2.46	7.36
Reach #200 (Ex. Wetland Easterly)	Existing	0.07	1.17	4.82
	Proposed	0.08	1.03	5.21
Reach #300 (Ex. Wetland Southeasterly)	Existing	0.07	0.96	4.03
	Proposed	0.07	0.72	2.74
<u>2-YEAR STORM VOLUME (AF)</u>				
Reach #100 (Ex. Wetland Northwesterly)	Existing	0.176		
	Proposed	0.163		
Reach #200 (Ex. Wetland Easterly)	Existing	0.032		
	Proposed	0.038		
Reach #300 (Ex. Wetland Southeasterly)	Existing	0.022		
	Proposed	0.024		

While a small increase is shown to Reach #200 under the 2-year storm event, this analysis point flows directly to the Powwow River, which is listed as a fifth order stream and there will be no discernable increase to the final receiving water. In addition, this is well within the mathematical error of the stormwater software.

The existing property is located on a parcel consisting of fields and woodlands with wetlands in and adjacent to the site. The existing topography is such that the site analysis is divided into three subcatchments within the area proposed to be improved. Final Reach #100 flows to the existing wetland to the northwest of the proposed improvement area, Final Reach #200 flows to

the east to an existing wetland, and Reach #300 flows to an existing wetland to the southeast. All three reaches ultimately flow to the Powwow River.

The proposed mulch manufacturing area includes extending the gravel roadway further into the site and with a loop to provide access for trucks. The proposed improvement area includes three different subcatchments. The peak rate of run-off in the proposed conditions is decreased from that of the existing conditions in all conditions except the 50-year storm event for Reach #100, due to the addition of a wet detention pond, a bioretention pond, and altering a subcatchment to reduce the runoff. All gravel roadway runoff receives treatment from either the forebay and wet detention pond or a forebay and bioretention pond prior to discharging overland towards the adjacent wetlands. In addition, the potential for increased erosion and sedimentation is handled by way of an erosion control mix berm surrounding the disturbed areas. The use of Best Management Practices per the Rockingham Conservation District / NHDES Handbook have been applied to the design of these structures and will be observed during all stages of construction. All land disturbed during construction will be stabilized within 30 days of groundbreaking. Existing wetlands and abutters will suffer no adverse effects resulting from this proposed development.

Table of Contents

Design Method Objectives

USGS Quadrangle

1.0	Rainfall Characteristics	Page 1
2.0	Existing Conditions Analysis	Page 1
3.0	Proposed Subdivision Analysis	Pages 2
4.0	Sediment & Erosion Control, BMP's	Pages 2-5
5.0	Conclusion	Page 5

Appendix I - Existing Conditions Analysis

2 Yr – 24 Hr Summary

10 Yr – 24 Hr Complete

50 Yr - 24 Hr Summary

Appendix II - Proposed Conditions Analysis

2 Yr – 24 Hr Summary

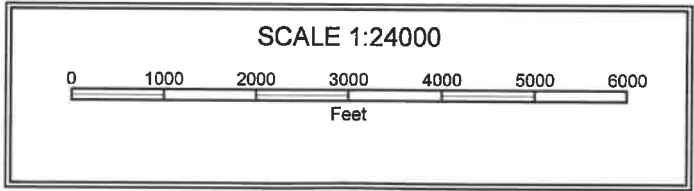
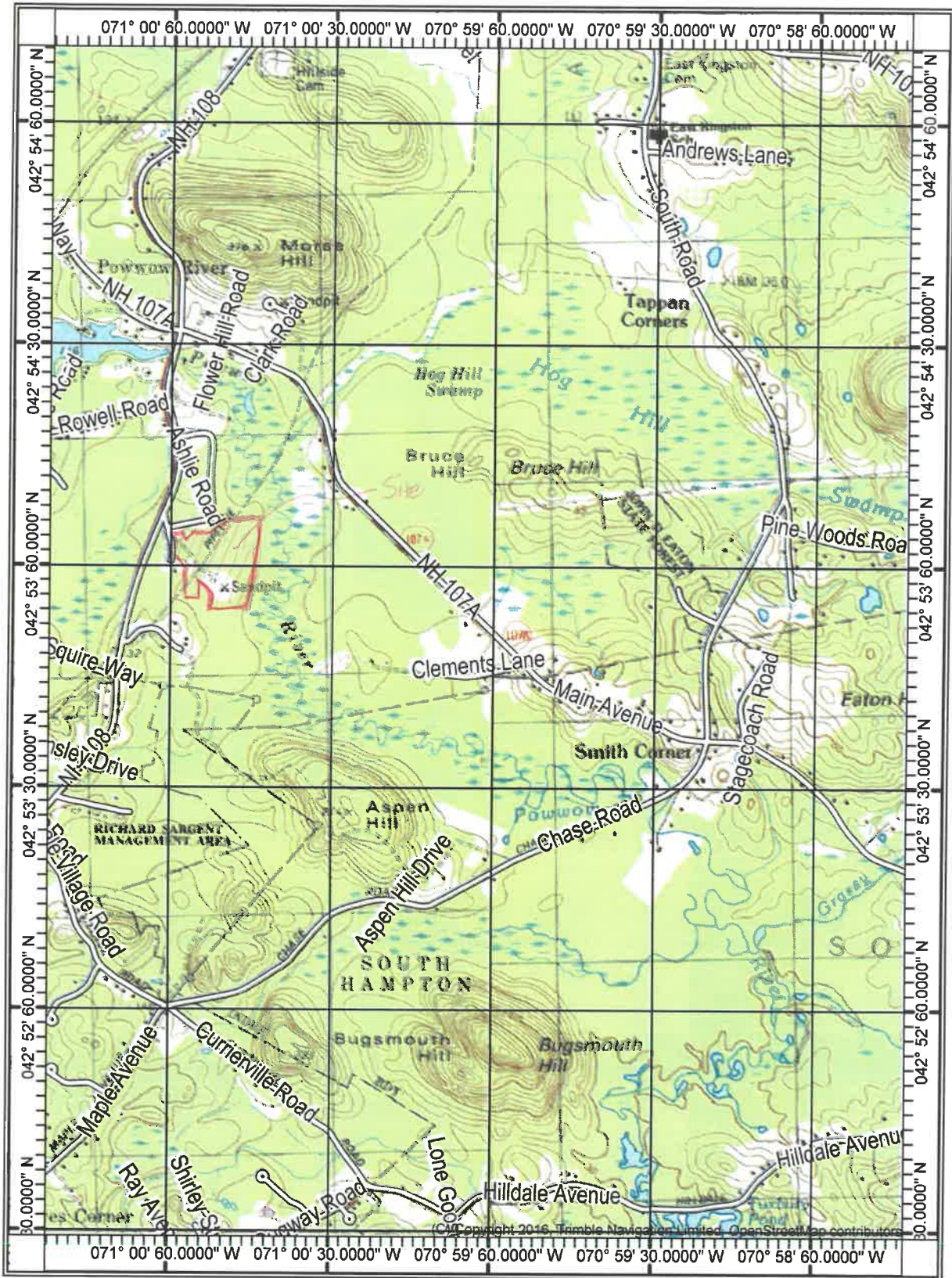
10 Yr – 24 Hr Complete

50 Yr - 24 Hr Summary

100 Yr - 24 Hr Summary (Ponds Only)

Appendix III - Charts, Graphs, and Calculations

Enclosed: Sheet W-1 Existing Conditions Watershed Plan
 Sheet W-2 Proposed Conditions Watershed Plan



1.0 RAINFALL CHARACTERISTICS

This drainage report includes an existing conditions analysis of the area involved in the proposed development, as well as proposed conditions, or post-construction analysis of the same location. Two models were compiled, one for the area in its existing (pre-construction) condition, and a second for its proposed (post-construction) condition. The analysis was conducted using Extreme Precipitation data provided by Cornell University for the 2 Yr – 24 Hr (3.19”), the 10 Yr – 24 Hr (4.87”) and the 50 Yr - 24 Hr (7.48”) storm events (HydroCAD “ponds” were also analyzed at the 100 Yr – 24 Hr (8.99”) storm event) using the USDA SCS TR-20 method within the HydroCAD Stormwater Modeling System environment. The purpose of this analysis is to estimate the peak rates of run-off from the site for detention adequacy purposes, and to compare the peak rate of run-off between the existing and proposed conditions.

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	Proposed	0.024		

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2.0 EXISTING CONDITIONS

Reference: Sheet W-1, Existing Conditions Watershed Plan (Enclosed)

Existing Conditions Plans

The existing property is located on a parcel consisting of fields and woodlands with wetlands in and adjacent to the site. The existing topography is such that the site analysis is divided into three subcatchments within the area of proposed improvements. Final Reach #100 flows to the existing wetland to the northwest of the proposed improvement area, Final Reach #200 flows to the east to an existing wetland, and Reach #300 flows to an existing wetland to the southeast. All three reaches ultimately flow to the Powwow River.

Classified by a Site-Specific Soil Mapping, the land of the site is composed of relatively flat slopes and soils categorized into the Hydrologic Soil Groups (HSG) B and C (See appendix for HISS/HSG designations).

3.0 PROPOSED CONDITIONS

Reference: Sheet W-2 Proposed Conditions Watershed Plan (Enclosed)
C Sheets Proposed Conditions Plans

The addition of the impervious area from the gravel roadway and the proposed material storage areas causes an increase in the curve number (Cn) and a decrease in the time of concentration (Tc), the net result being a potential increase in peak rates of run-off from the site. The proposed development area divides the site into 3 different post-construction subcatchments. The run-off is directed to the wetlands through HydroCAD “reaches” and “ponds”. These consist of a constructed wet detention pond and bioretention pond, each with a forebay.

In an effort to prevent the sedimentation of adjacent wetlands or abutting property, the gravel roadway and material storage areas will be graded to flow into one of two forebays prior to flowing into either the wet detention pond or bioretention pond. During construction, appropriate BMP's will be applied so as to negate the potential for sediment-laden run-off to discharge into wetlands prior to the final stabilization of the proposed grading. The structures outlined in this proposal provide for adequate treatment of stormwater run-off for sediment control. Based on NHDES pollutant removal efficiencies, the combination of the sediment forebay and wet pond will result in a reduction of TSS of over 80%, TN of over 75% & TP of over 70%. The combination of the sediment forebay and bioretention pond will result in a reduction of TSS of over 90%, TN of over 95% & TP of over 80%.

4.0 SEDIMENT & EROSION CONTROL PLANS **BEST MANAGEMENT PRACTICES (BMP's)**

Reference: C Sheets Proposed Conditions Plan
E Sheet Erosion & Sediment Control Details

The proposed site development is protected from erosion and the roadways and abutting properties are protected from sediment by the use of Best Management Practices as outlined in the NH Stormwater Manual. Any area disturbed by construction will be re-stabilized within 30

days and abutting properties and wetlands will not be adversely affected by this development. All swales and drainage structures will be constructed and stabilized prior to having run-off directed to them.

4.1 Erosion Control Mix Berm / Construction Fence

The plan set demonstrates the location of erosion control mix berms for sediment control. In areas where the limits of construction need to be emphasized to operators, construction fence for added visibility will be installed. Sheet E-1, Erosion and Sediment Control Details, has the specifications for installation and maintenance of the erosion control mix berm. Orange construction fence will be VISI Perimeter Fence by Conwed Plastic Fencing, or equal. The four-foot fencing to be installed using six-foot posts at least two feet in the ground with spacing of six to eight feet.

4.2 Vegetated Stabilization

All areas that are disturbed during construction will be stabilized with vegetated material within 30 days of breaking ground. Construction will be managed in such a manner that erosion is prevented and that no abutter's property will be subjected to any siltation, unless otherwise permitted. All areas to be planted with grass for long-term cover will follow the specification and on Sheet E-1 using seeding mixture C, as follows:

Mixture	Pounds per Acre	Pounds per 1,000 Sq. Ft.
Tall Fescue	20	0.45
Creeping Red Fescue	20	0.45
Birdsfoot Trefoil	<u>8</u>	<u>0.20</u>
Total	48	1.10

4.3 Stabilized Construction Entrance

A temporary gravel construction entrance provides an area where mud can be dislodged from tires before the vehicle leaves the construction site to reduce the amount of mud and sediment transported onto paved municipal and state roads. The stone size for the pad should be between 1 and 2-inch coarse aggregate, and the pad itself constructed to a minimum length of 50' for the full width of the access road. The aggregate should be placed at least six inches thick. A plan view and profile are shown on Sheet E1 - Sediment and Erosion Control Detail Plan.

4.4 Environmental Dust Control

Dust will be controlled on the site by the use of multiple Best Management Practices. Mulching and temporary seeding will be the first line of protection to be utilized where problems occur. If dust problems are not solved by these applications, the use of water and calcium chloride can be applied. Calcium chloride will be applied at a rate that will keep the surface moist but not cause pollution.

4.5 Construction Sequence

1. Cut and remove trees in construction areas as directed or required.
2. Construct and/or install temporary and permanent sediment erosion and detention control facilities, as required. Erosion, sediment and facilities shall be installed and stabilized prior to any earth moving operation, and prior to directing run-off to them.
3. Clear, cut, grub, and dispose of debris in approved facilities.
4. Excavate and stockpile topsoil / loam. All disturbed areas shall be stabilized immediately after grading.
5. Construct the roadway and its associated drainage structures.
6. Begin permanent and temporary seeding and mulching. All cut and fill slopes and disturbed areas shall be seeded and mulched as required, or directed.
7. Daily, or as required, construct temporary berms, drainage ditches, sediment traps, etc. to prevent erosion on the site and prevent any siltation of abutting waters or property.
8. Inspect and maintain all erosion and sediment control measures during construction.
9. Complete permanent seeding and landscaping.
10. Remove temporary erosion control measures after seeding areas have established themselves and site improvements are complete. Smooth and re-vegetate all disturbed areas.
11. All swales and drainage structures will be constructed and stabilized prior to having run-off being directed to them.
12. Finish graveling all roadways and material storage areas.

4.10 Temporary Erosion Control Measures

1. The smallest practical area of land shall be exposed at any one time.
2. Erosion, sediment control measures shall be installed as shown on the plans and at locations as required, or directed by the engineer.

3. All disturbed areas shall be returned to original grades and elevations. Disturbed areas shall be loamed with a minimum of 4" of loam and seeded with not less than 1.10 pound of seed per 1,000 square feet (48 pounds per acre) of area.
4. Erosion control mix berms and other barriers shall be inspected periodically and after every rainstorm during the life of the project. All damaged areas shall be repaired, sediment deposits shall periodically be removed and properly disposed of.
5. After all disturbed areas have been stabilized, the temporary erosion control measures are to be removed and the area disturbed by the removal smoothed and revegetated.
6. Areas must be seeded and mulched within 5 days of final grading, permanently stabilized within 15 days of final grading, or temporarily stabilized within 30 days of initial disturbance of soil.

4.11 Inspection and Maintenance Schedule

Fencing will be inspected during and after storm events to ensure that the fence still has integrity and is not allowing sediment to pass.

5.0 CONCLUSION

This proposed site development off Bowley Road in East Kingston, NH will have no adverse effect on the abutting property owners by way of storm water run-off or siltation. The post-construction peak rates of run-off for the site will be lower than the existing conditions for the storm events, as shown in the tables above. Appropriate steps will be taken to eliminate erosion and sedimentation; these will be accomplished through the construction of a drainage system consisting of forebays, a wet detention pond, and a bioretention pond. The Best Management Practices developed by the State of New Hampshire have been utilized in the design of this system and these applications will be enforced throughout the construction process.

An Alteration of Terrain Permit (RSA 485: A-17) is not required for this project due to the area of disturbance being less than 100,000 square feet.

Respectfully Submitted,

BEALS ASSOCIATES, *PLLC*.

Christian O. Smith

Christian O Smith, PE
Principal

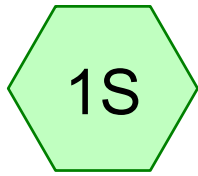
APPENDIX I

Existing Conditions Drainage Analysis

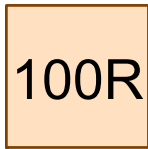
Summary 2 YR - 24 HR rainfall = 3.19"

Complete 10 YR - 24 HR rainfall = 4.87"

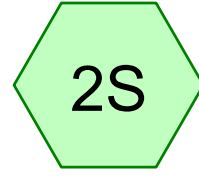
Summary 50 YR - 24 HR rainfall = 7.48"



Phase 1 Northwest



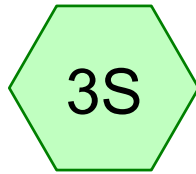
Wetlands Reach #100



Phase 1 East



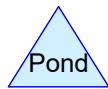
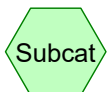
Wetlands Reach #200



Phase 1 Southeast



Wetlands Reach #300



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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.767	48	Brush, Good, HSG B (1S, 2S, 3S)
0.199	65	Brush, Good, HSG C (1S, 3S)
0.154	77	Brush, Poor, HSG C (1S)
0.568	96	Gravel surface, HSG C (1S, 3S)
6.855	55	Woods, Good, HSG B (1S, 2S, 3S)
0.366	70	Woods, Good, HSG C (1S)
13.909	55	TOTAL AREA

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Page 3

Soil Listing (all nodes)

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

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Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	5.767	0.199	0.000	0.000	5.966	Brush, Good	1S, 2S, 3S
0.000	0.000	0.154	0.000	0.000	0.154	Brush, Poor	1S
0.000	0.000	0.568	0.000	0.000	0.568	Gravel surface	1S, 3S
0.000	6.855	0.366	0.000	0.000	7.221	Woods, Good	1S, 2S, 3S
0.000	12.622	1.287	0.000	0.000	13.909	TOTAL AREA	

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Type III 24-hr 2 YR Rainfall=3.19"

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Page 5

Time span=5.00-20.00 hrs, dt=0.01 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Phase 1 Northwest Runoff Area=334,650 sf 0.00% Impervious Runoff Depth>0.27"
Flow Length=642' Slope=0.0031 '/' Tc=72.9 min CN=58 Runoff=0.63 cfs 0.176 af

Subcatchment 2S: Phase 1 East Runoff Area=174,052 sf 0.00% Impervious Runoff Depth>0.10"
Flow Length=456' Slope=0.0197 '/' Tc=26.9 min CN=50 Runoff=0.07 cfs 0.032 af

Subcatchment 3S: Phase 1 Southeast Runoff Area=97,166 sf 0.00% Impervious Runoff Depth>0.12"
Flow Length=352' Slope=0.0710 '/' Tc=11.2 min CN=51 Runoff=0.07 cfs 0.022 af

Reach 100R: Wetlands Reach #100 Inflow=0.63 cfs 0.176 af
Outflow=0.63 cfs 0.176 af

Reach 200R: Wetlands Reach #200 Inflow=0.07 cfs 0.032 af
Outflow=0.07 cfs 0.032 af

Reach 300R: Wetlands Reach #300 Inflow=0.07 cfs 0.022 af
Outflow=0.07 cfs 0.022 af

Total Runoff Area = 13.909 ac Runoff Volume = 0.230 af Average Runoff Depth = 0.20"
100.00% Pervious = 13.909 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 10 YR Rainfall=4.87"

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Page 1

Time span=5.00-20.00 hrs, dt=0.01 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Phase 1 Northwest Runoff Area=334,650 sf 0.00% Impervious Runoff Depth>0.95"
Flow Length=642' Slope=0.0031 '/' Tc=72.9 min CN=58 Runoff=2.92 cfs 0.607 af

Subcatchment 2S: Phase 1 East Runoff Area=174,052 sf 0.00% Impervious Runoff Depth>0.55"
Flow Length=456' Slope=0.0197 '/' Tc=26.9 min CN=50 Runoff=1.17 cfs 0.183 af

Subcatchment 3S: Phase 1 Southeast Runoff Area=97,166 sf 0.00% Impervious Runoff Depth>0.60"
Flow Length=352' Slope=0.0710 '/' Tc=11.2 min CN=51 Runoff=0.96 cfs 0.112 af

Reach 100R: Wetlands Reach #100 Inflow=2.92 cfs 0.607 af
Outflow=2.92 cfs 0.607 af

Reach 200R: Wetlands Reach #200 Inflow=1.17 cfs 0.183 af
Outflow=1.17 cfs 0.183 af

Reach 300R: Wetlands Reach #300 Inflow=0.96 cfs 0.112 af
Outflow=0.96 cfs 0.112 af

Total Runoff Area = 13.909 ac Runoff Volume = 0.902 af Average Runoff Depth = 0.78"
100.00% Pervious = 13.909 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 10 YR Rainfall=4.87"

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Page 2

Summary for Subcatchment 1S: Phase 1 Northwest

Runoff = 2.92 cfs @ 13.12 hrs, Volume= 0.607 af, Depth> 0.95"
 Routed to Reach 100R : Wetlands Reach #100

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR Rainfall=4.87"

Area (sf)	CN	Description
64,480	48	Brush, Good, HSG B
221,846	55	Woods, Good, HSG B
23,127	96	Gravel surface, HSG C
15,948	70	Woods, Good, HSG C
2,552	65	Brush, Good, HSG C
6,697	77	Brush, Poor, HSG C
334,650	58	Weighted Average
334,650		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
72.9	642	0.0031	0.15		Lag/CN Method, Total Flow

Summary for Subcatchment 2S: Phase 1 East

Runoff = 1.17 cfs @ 12.52 hrs, Volume= 0.183 af, Depth> 0.55"
 Routed to Reach 200R : Wetlands Reach #200

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR Rainfall=4.87"

Area (sf)	CN	Description
112,302	48	Brush, Good, HSG B
61,750	55	Woods, Good, HSG B
174,052	50	Weighted Average
174,052		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.9	456	0.0197	0.28		Lag/CN Method, Total Flow

Summary for Subcatchment 3S: Phase 1 Southeast

Runoff = 0.96 cfs @ 12.21 hrs, Volume= 0.112 af, Depth> 0.60"
 Routed to Reach 300R : Wetlands Reach #300

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR Rainfall=4.87"

NH-1485 East Kingston-Existing

Type III 24-hr 10 YR Rainfall=4.87"

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Page 3

Area (sf)	CN	Description
74,436	48	Brush, Good, HSG B
15,010	55	Woods, Good, HSG B
6,104	65	Brush, Good, HSG C
1,616	96	Gravel surface, HSG C
97,166	51	Weighted Average
97,166		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.2	352	0.0710	0.52		Lag/CN Method, Total Flow

Summary for Reach 100R: Wetlands Reach #100

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

Inflow Area = 7.683 ac, 0.00% Impervious, Inflow Depth > 0.95" for 10 YR event
 Inflow = 2.92 cfs @ 13.12 hrs, Volume= 0.607 af
 Outflow = 2.92 cfs @ 13.12 hrs, Volume= 0.607 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.01 hrs

Summary for Reach 200R: Wetlands Reach #200

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

Inflow Area = 3.996 ac, 0.00% Impervious, Inflow Depth > 0.55" for 10 YR event
 Inflow = 1.17 cfs @ 12.52 hrs, Volume= 0.183 af
 Outflow = 1.17 cfs @ 12.52 hrs, Volume= 0.183 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.01 hrs

Summary for Reach 300R: Wetlands Reach #300

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

Inflow Area = 2.231 ac, 0.00% Impervious, Inflow Depth > 0.60" for 10 YR event
 Inflow = 0.96 cfs @ 12.21 hrs, Volume= 0.112 af
 Outflow = 0.96 cfs @ 12.21 hrs, Volume= 0.112 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.01 hrs

NH-1485 East Kingston-Existing

Type III 24-hr 50 YR Rainfall=7.48"

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Page 1

Time span=5.00-20.00 hrs, dt=0.01 hrs, 1501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Phase 1 Northwest Runoff Area=334,650 sf 0.00% Impervious Runoff Depth>2.44"
Flow Length=642' Slope=0.0031 '/' Tc=72.9 min CN=58 Runoff=8.28 cfs 1.560 af

Subcatchment 2S: Phase 1 East Runoff Area=174,052 sf 0.00% Impervious Runoff Depth>1.73"
Flow Length=456' Slope=0.0197 '/' Tc=26.9 min CN=50 Runoff=4.82 cfs 0.577 af

Subcatchment 3S: Phase 1 Southeast Runoff Area=97,166 sf 0.00% Impervious Runoff Depth>1.84"
Flow Length=352' Slope=0.0710 '/' Tc=11.2 min CN=51 Runoff=4.03 cfs 0.342 af

Reach 100R: Wetlands Reach #100 Inflow=8.28 cfs 1.560 af
Outflow=8.28 cfs 1.560 af

Reach 200R: Wetlands Reach #200 Inflow=4.82 cfs 0.577 af
Outflow=4.82 cfs 0.577 af

Reach 300R: Wetlands Reach #300 Inflow=4.03 cfs 0.342 af
Outflow=4.03 cfs 0.342 af

Total Runoff Area = 13.909 ac Runoff Volume = 2.478 af Average Runoff Depth = 2.14"
100.00% Pervious = 13.909 ac 0.00% Impervious = 0.000 ac

APPENDIX II

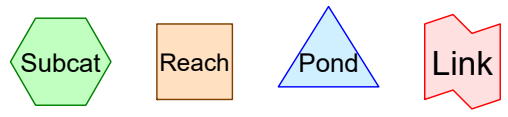
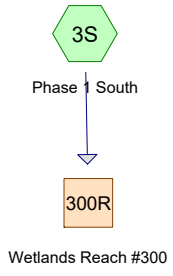
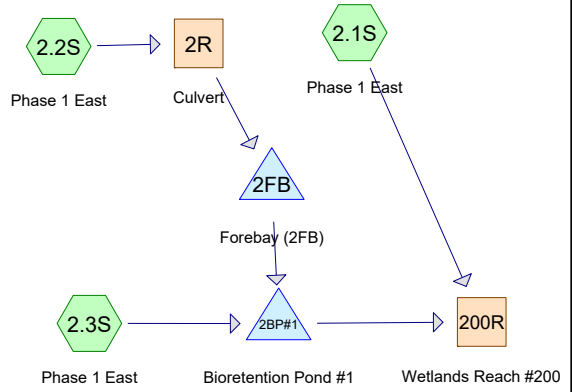
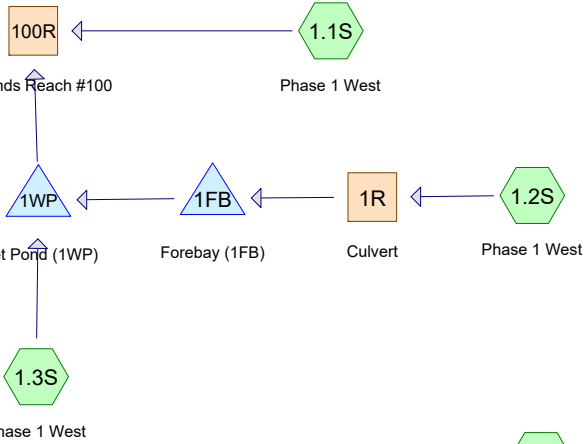
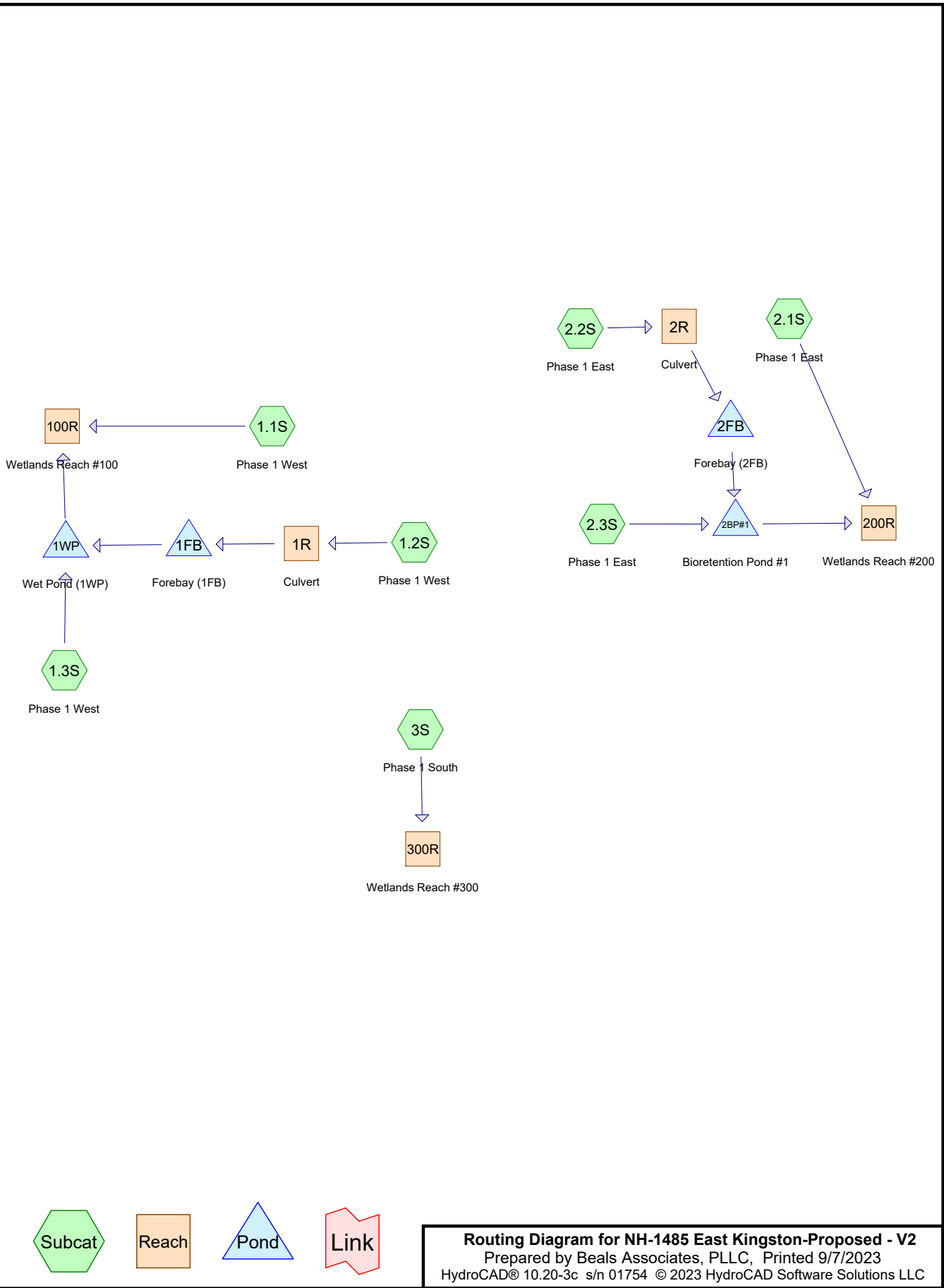
Proposed Conditions Drainage Analysis

Summary 2 YR - 24 HR rainfall = 3.19"

Complete 10 YR – 24 HR rainfall = 4.87"

Summary 50 YR - 24 HR rainfall = 7.48"

Summary 100 YR – 24 HR rainfall = 8.99" (Ponds only)



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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.361	61	>75% Grass cover, Good, HSG B (1.1S, 1.2S, 1.3S, 2.3S, 3S)
0.059	74	>75% Grass cover, Good, HSG C (1.2S, 3S)
4.215	48	Brush, Good, HSG B (1.1S, 2.1S, 3S)
0.170	65	Brush, Good, HSG C (3S)
1.406	96	Gravel surface, HSG B (1.1S, 1.2S, 2.2S)
0.668	96	Gravel surface, HSG C (1.1S, 1.2S)
6.641	55	Woods, Good, HSG B (1.1S, 2.1S, 3S)
0.390	70	Woods, Good, HSG C (1.1S)
13.909	60	TOTAL AREA

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Page 3

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
12.622	HSG B	1.1S, 1.2S, 1.3S, 2.1S, 2.2S, 2.3S, 3S
1.287	HSG C	1.1S, 1.2S, 3S
0.000	HSG D	
0.000	Other	
13.909		TOTAL AREA

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Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.361	0.059	0.000	0.000	0.420	>75% Grass cover, Good	1.1S, 1.2S, 1.3S, 2.3S, 3S
0.000	4.215	0.170	0.000	0.000	4.385	Brush, Good	1.1S, 2.1S, 3S
0.000	1.406	0.668	0.000	0.000	2.074	Gravel surface	1.1S, 1.2S, 2.2S
0.000	6.641	0.390	0.000	0.000	7.030	Woods, Good	1.1S, 2.1S, 3S
0.000	12.622	1.287	0.000	0.000	13.909	TOTAL AREA	

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Type III 24-hr 2 YR Rainfall=3.19"

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Page 5

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1S: Phase 1 West Runoff Area=308,782 sf 0.00% Impervious Runoff Depth=0.28"
 Flow Length=642' Slope=0.0031 '/' Tc=76.7 min CN=56 Runoff=0.41 cfs 0.163 af

Subcatchment 1.2S: Phase 1 West Runoff Area=34,888 sf 0.00% Impervious Runoff Depth=2.44"
 Flow Length=246' Slope=0.0070 '/' Tc=7.6 min CN=93 Runoff=2.10 cfs 0.163 af

Subcatchment 1.3S: Phase 1 West Runoff Area=4,616 sf 0.00% Impervious Runoff Depth=0.44"
 Flow Length=104' Slope=0.0050 '/' Tc=12.4 min CN=61 Runoff=0.03 cfs 0.004 af

Subcatchment 2.1S: Phase 1 East Runoff Area=133,875 sf 0.00% Impervious Runoff Depth=0.15"
 Flow Length=456' Slope=0.0197 '/' Tc=26.2 min CN=51 Runoff=0.08 cfs 0.038 af

Subcatchment 2.2S: Phase 1 East Runoff Area=45,597 sf 0.00% Impervious Runoff Depth=2.74"
 Flow Length=222' Slope=0.0050 '/' Tc=7.2 min CN=96 Runoff=3.01 cfs 0.239 af

Subcatchment 2.3S: Phase 1 East Runoff Area=3,948 sf 0.00% Impervious Runoff Depth=0.44"
 Flow Length=76' Slope=0.0104 '/' Tc=6.7 min CN=61 Runoff=0.03 cfs 0.003 af

Subcatchment 3S: Phase 1 South Runoff Area=74,169 sf 0.00% Impervious Runoff Depth=0.17"
 Flow Length=297' Slope=0.0202 '/' Tc=17.9 min CN=52 Runoff=0.07 cfs 0.024 af

Reach 1R: Culvert Avg. Flow Depth=0.50' Max Vel=5.36 fps Inflow=2.10 cfs 0.163 af
 12.0" Round Pipe n=0.011 L=50.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=2.09 cfs 0.163 af

Reach 2R: Culvert Avg. Flow Depth=0.71' Max Vel=5.03 fps Inflow=3.01 cfs 0.239 af
 12.0" Round Pipe n=0.011 L=43.0' S=0.0070 '/' Capacity=3.52 cfs Outflow=3.00 cfs 0.239 af

Reach 100R: Wetlands Reach #100 Inflow=0.41 cfs 0.163 af
 Outflow=0.41 cfs 0.163 af

Reach 200R: Wetlands Reach #200 Inflow=0.08 cfs 0.038 af
 Outflow=0.08 cfs 0.038 af

Reach 300R: Wetlands Reach #300 Inflow=0.07 cfs 0.024 af
 Outflow=0.07 cfs 0.024 af

Pond 1FB: Forebay (1FB) Peak Elev=109.69' Storage=564 cf Inflow=2.09 cfs 0.163 af
 Outflow=2.09 cfs 0.152 af

Pond 1WP: Wet Pond (1WP) Peak Elev=110.33' Storage=14,742 cf Inflow=2.10 cfs 0.155 af
 Outflow=0.00 cfs 0.000 af

Pond 2BP#1: Bioretention Pond #1 Peak Elev=108.61' Storage=2,909 cf Inflow=3.01 cfs 0.202 af
 Discarded=0.54 cfs 0.202 af Primary=0.00 cfs 0.000 af Outflow=0.54 cfs 0.202 af

Pond 2FB: Forebay (2FB) Peak Elev=110.24' Storage=1,882 cf Inflow=3.00 cfs 0.239 af
 Outflow=2.99 cfs 0.199 af

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Type III 24-hr 2 YR Rainfall=3.19"

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Page 6

Total Runoff Area = 13.909 ac Runoff Volume = 0.634 af Average Runoff Depth = 0.55"
100.00% Pervious = 13.909 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 10 YR Rainfall=4.87"

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Page 1

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1S: Phase 1 West Runoff Area=308,782 sf 0.00% Impervious Runoff Depth=0.98"
 Flow Length=642' Slope=0.0031 '/' Tc=76.7 min CN=56 Runoff=2.22 cfs 0.576 af

Subcatchment 1.2S: Phase 1 West Runoff Area=34,888 sf 0.00% Impervious Runoff Depth=4.07"
 Flow Length=246' Slope=0.0070 '/' Tc=7.6 min CN=93 Runoff=3.41 cfs 0.272 af

Subcatchment 1.3S: Phase 1 West Runoff Area=4,616 sf 0.00% Impervious Runoff Depth=1.29"
 Flow Length=104' Slope=0.0050 '/' Tc=12.4 min CN=61 Runoff=0.12 cfs 0.011 af

Subcatchment 2.1S: Phase 1 East Runoff Area=133,875 sf 0.00% Impervious Runoff Depth=0.69"
 Flow Length=456' Slope=0.0197 '/' Tc=26.2 min CN=51 Runoff=1.03 cfs 0.177 af

Subcatchment 2.2S: Phase 1 East Runoff Area=45,597 sf 0.00% Impervious Runoff Depth=4.40"
 Flow Length=222' Slope=0.0050 '/' Tc=7.2 min CN=96 Runoff=4.71 cfs 0.384 af

Subcatchment 2.3S: Phase 1 East Runoff Area=3,948 sf 0.00% Impervious Runoff Depth=1.29"
 Flow Length=76' Slope=0.0104 '/' Tc=6.7 min CN=61 Runoff=0.12 cfs 0.010 af

Subcatchment 3S: Phase 1 South Runoff Area=74,169 sf 0.00% Impervious Runoff Depth=0.75"
 Flow Length=297' Slope=0.0202 '/' Tc=17.9 min CN=52 Runoff=0.72 cfs 0.106 af

Reach 1R: Culvert Avg. Flow Depth=0.68' Max Vel=5.97 fps Inflow=3.41 cfs 0.272 af
 12.0" Round Pipe n=0.011 L=50.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=3.40 cfs 0.272 af

Reach 2R: Culvert Avg. Flow Depth=1.00' Max Vel=5.10 fps Inflow=4.71 cfs 0.384 af
 12.0" Round Pipe n=0.011 L=43.0' S=0.0070 '/' Capacity=3.52 cfs Outflow=3.63 cfs 0.384 af

Reach 100R: Wetlands Reach #100 Inflow=2.46 cfs 0.670 af
 Outflow=2.46 cfs 0.670 af

Reach 200R: Wetlands Reach #200 Inflow=1.03 cfs 0.177 af
 Outflow=1.03 cfs 0.177 af

Reach 300R: Wetlands Reach #300 Inflow=0.72 cfs 0.106 af
 Outflow=0.72 cfs 0.106 af

Pond 1FB: Forebay (1FB) Peak Elev=109.75' Storage=597 cf Inflow=3.40 cfs 0.272 af
 Outflow=3.40 cfs 0.261 af

Pond 1WP: Wet Pond (1WP) Peak Elev=110.54' Storage=15,989 cf Inflow=3.49 cfs 0.272 af
 Outflow=0.26 cfs 0.094 af

Pond 2BP#1: Bioretention Pond #1 Peak Elev=109.61' Storage=5,510 cf Inflow=3.64 cfs 0.354 af
 Discarded=0.67 cfs 0.354 af Primary=0.00 cfs 0.000 af Outflow=0.67 cfs 0.354 af

Pond 2FB: Forebay (2FB) Peak Elev=110.25' Storage=1,899 cf Inflow=3.63 cfs 0.384 af
 Outflow=3.54 cfs 0.344 af

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Type III 24-hr 10 YR Rainfall=4.87"

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Page 2

Total Runoff Area = 13.909 ac Runoff Volume = 1.536 af Average Runoff Depth = 1.33"
100.00% Pervious = 13.909 ac 0.00% Impervious = 0.000 ac

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Type III 24-hr 10 YR Rainfall=4.87"

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Page 3

Summary for Subcatchment 1.1S: Phase 1 West

Runoff = 2.22 cfs @ 13.21 hrs, Volume= 0.576 af, Depth= 0.98"
Routed to Reach 100R : Wetlands Reach #100

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.87"

Area (sf)	CN	Description
61,874	48	Brush, Good, HSG B
213,179	55	Woods, Good, HSG B
2,835	61	>75% Grass cover, Good, HSG B
561	96	Gravel surface, HSG B
16,978	70	Woods, Good, HSG C
13,355	96	Gravel surface, HSG C
308,782	56	Weighted Average
308,782		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
76.7	642	0.0031	0.14		Lag/CN Method, Total Flow

Summary for Subcatchment 1.2S: Phase 1 West

Runoff = 3.41 cfs @ 12.10 hrs, Volume= 0.272 af, Depth= 4.07"
Routed to Reach 1R : Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.87"

Area (sf)	CN	Description
1,992	61	>75% Grass cover, Good, HSG B
15,098	96	Gravel surface, HSG B
2,047	74	>75% Grass cover, Good, HSG C
15,751	96	Gravel surface, HSG C
34,888	93	Weighted Average
34,888		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	246	0.0070	0.54		Lag/CN Method, Total Flow

Summary for Subcatchment 1.3S: Phase 1 West

Runoff = 0.12 cfs @ 12.19 hrs, Volume= 0.011 af, Depth= 1.29"
Routed to Pond 1WP : Wet Pond (1WP)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=4.87"

NH-1485 East Kingston-Proposed - V2

Type III 24-hr 10 YR Rainfall=4.87"

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Page 4

Area (sf)	CN	Description
4,616	61	>75% Grass cover, Good, HSG B
4,616		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	104	0.0050	0.14		Lag/CN Method, Total Flow

Summary for Subcatchment 2.1S: Phase 1 East

Runoff = 1.03 cfs @ 12.49 hrs, Volume= 0.177 af, Depth= 0.69"
 Routed to Reach 200R : Wetlands Reach #200

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR Rainfall=4.87"

Area (sf)	CN	Description
72,121	48	Brush, Good, HSG B
61,754	55	Woods, Good, HSG B
133,875	51	Weighted Average
133,875		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.2	456	0.0197	0.29		Lag/CN Method, Total Flow

Summary for Subcatchment 2.2S: Phase 1 East

Runoff = 4.71 cfs @ 12.10 hrs, Volume= 0.384 af, Depth= 4.40"
 Routed to Reach 2R : Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR Rainfall=4.87"

Area (sf)	CN	Description
45,597	96	Gravel surface, HSG B
45,597		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	222	0.0050	0.52		Lag/CN Method, Total Flow

Summary for Subcatchment 2.3S: Phase 1 East

Runoff = 0.12 cfs @ 12.11 hrs, Volume= 0.010 af, Depth= 1.29"
 Routed to Pond 2BP#1 : Bioretention Pond #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR Rainfall=4.87"

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Type III 24-hr 10 YR Rainfall=4.87"

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Page 5

Area (sf)	CN	Description
3,948	61	>75% Grass cover, Good, HSG B
3,948		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	76	0.0104	0.19		Lag/CN Method, Total Flow

Summary for Subcatchment 3S: Phase 1 South

Runoff = 0.72 cfs @ 12.34 hrs, Volume= 0.106 af, Depth= 0.75"
 Routed to Reach 300R : Wetlands Reach #300

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Type III 24-hr 10 YR Rainfall=4.87"

Area (sf)	CN	Description
49,610	48	Brush, Good, HSG B
14,332	55	Woods, Good, HSG B
2,313	61	>75% Grass cover, Good, HSG B
7,387	65	Brush, Good, HSG C
527	74	>75% Grass cover, Good, HSG C
74,169	52	Weighted Average
74,169		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	297	0.0202	0.28		Lag/CN Method, Total Flow

Summary for Reach 1R: Culvert

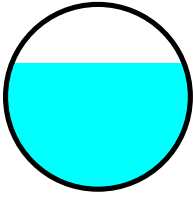
[52] Hint: Inlet/Outlet conditions not evaluated

Inflow Area = 0.801 ac, 0.00% Impervious, Inflow Depth = 4.07" for 10 YR event
 Inflow = 3.41 cfs @ 12.10 hrs, Volume= 0.272 af
 Outflow = 3.40 cfs @ 12.11 hrs, Volume= 0.272 af, Atten= 0%, Lag= 0.3 min
 Routed to Pond 1FB : Forebay (1FB)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Max. Velocity= 5.97 fps, Min. Travel Time= 0.1 min
 Avg. Velocity = 2.09 fps, Avg. Travel Time= 0.4 min

Peak Storage= 29 cf @ 12.11 hrs
 Average Depth at Peak Storage= 0.68' , Surface Width= 0.93'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.21 cfs

12.0" Round Pipe
 n= 0.011 Concrete pipe, straight & clean
 Length= 50.0' Slope= 0.0100 '
 Inlet Invert= 109.50', Outlet Invert= 109.00'



Summary for Reach 2R: Culvert

[52] Hint: Inlet/Outlet conditions not evaluated

[55] Hint: Peak inflow is 134% of Manning's capacity

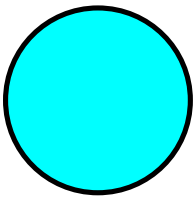
[76] Warning: Detained 0.009 af (Pond w/culvert advised)

Inflow Area = 1.047 ac, 0.00% Impervious, Inflow Depth = 4.40" for 10 YR event
 Inflow = 4.71 cfs @ 12.10 hrs, Volume= 0.384 af
 Outflow = 3.63 cfs @ 12.04 hrs, Volume= 0.384 af, Atten= 23%, Lag= 0.0 min
 Routed to Pond 2FB : Forebay (2FB)

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Max. Velocity= 5.10 fps, Min. Travel Time= 0.1 min
 Avg. Velocity = 2.01 fps, Avg. Travel Time= 0.4 min

Peak Storage= 34 cf @ 12.05 hrs
 Average Depth at Peak Storage= 1.00'
 Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.52 cfs

12.0" Round Pipe
 n= 0.011 Concrete pipe, straight & clean
 Length= 43.0' Slope= 0.0070 '/'
 Inlet Invert= 106.90', Outlet Invert= 106.60'



Summary for Reach 100R: Wetlands Reach #100

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

Inflow Area = 7.996 ac, 0.00% Impervious, Inflow Depth = 1.01" for 10 YR event
 Inflow = 2.46 cfs @ 13.21 hrs, Volume= 0.670 af
 Outflow = 2.46 cfs @ 13.21 hrs, Volume= 0.670 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Reach 200R: Wetlands Reach #200

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

Inflow Area = 4.211 ac, 0.00% Impervious, Inflow Depth = 0.51" for 10 YR event
 Inflow = 1.03 cfs @ 12.49 hrs, Volume= 0.177 af
 Outflow = 1.03 cfs @ 12.49 hrs, Volume= 0.177 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Reach 300R: Wetlands Reach #300

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

Inflow Area = 1.703 ac, 0.00% Impervious, Inflow Depth = 0.75" for 10 YR event
 Inflow = 0.72 cfs @ 12.34 hrs, Volume= 0.106 af
 Outflow = 0.72 cfs @ 12.34 hrs, Volume= 0.106 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Pond 1FB: Forebay (1FB)

[62] Hint: Exceeded Reach 1R OUTLET depth by 0.50' @ 25.16 hrs

Inflow Area = 0.801 ac, 0.00% Impervious, Inflow Depth = 4.07" for 10 YR event
 Inflow = 3.40 cfs @ 12.11 hrs, Volume= 0.272 af
 Outflow = 3.40 cfs @ 12.12 hrs, Volume= 0.261 af, Atten= 0%, Lag= 0.4 min
 Primary = 3.40 cfs @ 12.12 hrs, Volume= 0.261 af
 Routed to Pond 1WP : Wet Pond (1WP)

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 109.75' @ 12.12 hrs Surf.Area= 487 sf Storage= 597 cf
 Flood Elev= 111.00' Surf.Area= 773 sf Storage= 1,373 cf

Plug-Flow detention time= 40.3 min calculated for 0.261 af (96% of inflow)
 Center-of-Mass det. time= 16.7 min (797.6 - 781.0)

Volume	Invert	Avail.Storage	Storage Description
#1	108.00'	1,373 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
108.00	194	0	0
110.00	528	722	722
111.00	773	651	1,373

Device	Routing	Invert	Outlet Devices
#1	Primary	109.50'	11.0' 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

Primary OutFlow Max=3.38 cfs @ 12.12 hrs HW=109.75' (Free Discharge)
 ↑1=**Broad-Crested Rectangular Weir** (Weir Controls 3.38 cfs @ 1.21 fps)

Summary for Pond 1WP: Wet Pond (1WP)

[81] Warning: Exceeded Pond 1FB by 1.00' @ 24.23 hrs

Inflow Area = 0.907 ac, 0.00% Impervious, Inflow Depth = 3.60" for 10 YR event
 Inflow = 3.49 cfs @ 12.12 hrs, Volume= 0.272 af
 Outflow = 0.26 cfs @ 13.50 hrs, Volume= 0.094 af, Atten= 92%, Lag= 82.7 min
 Primary = 0.26 cfs @ 13.50 hrs, Volume= 0.094 af
 Routed to Reach 100R : Wetlands Reach #100

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Starting Elev= 109.00' Surf.Area= 4,275 sf Storage= 7,970 cf
 Peak Elev= 110.54' @ 13.50 hrs Surf.Area= 5,873 sf Storage= 15,989 cf (8,019 cf above start)
 Flood Elev= 111.00' Surf.Area= 6,150 sf Storage= 18,724 cf (10,755 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= 198.2 min (999.3 - 801.1)

Volume	Invert	Avail.Storage	Storage Description
#1	106.00'	18,724 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
106.00	1,320	0	0
108.00	3,008	4,328	4,328
110.00	5,542	8,550	12,878
111.00	6,150	5,846	18,724

Device	Routing	Invert	Outlet Devices
#1	Primary	110.50'	11.0' 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

Primary OutFlow Max=0.25 cfs @ 13.50 hrs HW=110.54' (Free Discharge)
 ↑1=**Broad-Crested Rectangular Weir** (Weir Controls 0.25 cfs @ 0.50 fps)

Summary for Pond 2BP#1: Bioretention Pond #1

Inflow Area = 1.137 ac, 0.00% Impervious, Inflow Depth = 3.73" for 10 YR event
 Inflow = 3.64 cfs @ 12.11 hrs, Volume= 0.354 af
 Outflow = 0.67 cfs @ 12.65 hrs, Volume= 0.354 af, Atten= 82%, Lag= 32.5 min
 Discarded = 0.67 cfs @ 12.65 hrs, Volume= 0.354 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Reach 200R : Wetlands Reach #200

NH-1485 East Kingston-Proposed - V2

Type III 24-hr 10 YR Rainfall=4.87"

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Page 9

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 109.61' @ 12.65 hrs Surf.Area= 2,900 sf Storage= 5,510 cf
 Flood Elev= 111.10' Surf.Area= 3,759 sf Storage= 10,478 cf

Plug-Flow detention time= 67.0 min calculated for 0.354 af (100% of inflow)
 Center-of-Mass det. time= 67.0 min (872.0 - 805.0)

Volume	Invert	Avail.Storage	Storage Description			
#1	105.60'	10,478 cf	Custom Stage Data (Conic) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
105.60	2,082	0.0	0	0	2,082	
106.60	2,082	40.0	833	833	2,244	
108.10	2,082	30.0	937	1,770	2,486	
110.00	3,135	100.0	4,922	6,692	3,594	
111.10	3,759	100.0	3,787	10,478	4,258	

Device	Routing	Invert	Outlet Devices									
#1	Primary	110.35'	4.0' long x 12.0' breadth Broad-Crested Rectangular Weir									
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60									
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64									
#2	Discarded	105.60'	10.000 in/hr Exfiltration over Surface area									

Discarded OutFlow Max=0.67 cfs @ 12.65 hrs HW=109.61' (Free Discharge)
 ↳2=Exfiltration (Exfiltration Controls 0.67 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=105.60' (Free Discharge)
 ↳1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 2FB: Forebay (2FB)

[63] Warning: Exceeded Reach 2R INLET depth by 3.20' @ 25.17 hrs

Inflow Area = 1.047 ac, 0.00% Impervious, Inflow Depth = 4.40" for 10 YR event
 Inflow = 3.63 cfs @ 12.04 hrs, Volume= 0.384 af
 Outflow = 3.54 cfs @ 12.29 hrs, Volume= 0.344 af, Atten= 2%, Lag= 14.8 min
 Primary = 3.54 cfs @ 12.29 hrs, Volume= 0.344 af
 Routed to Pond 2BP#1 : Bioretention Pond #1

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
 Peak Elev= 110.25' @ 12.29 hrs Surf.Area= 990 sf Storage= 1,899 cf
 Flood Elev= 111.10' Surf.Area= 1,210 sf Storage= 2,830 cf

Plug-Flow detention time= 89.0 min calculated for 0.344 af (90% of inflow)
 Center-of-Mass det. time= 38.3 min (803.0 - 764.7)

Volume	Invert	Avail.Storage	Storage Description			
#1	107.10'	2,830 cf	Custom Stage Data (Conic) Listed below (Recalc)			

NH-1485 East Kingston-Proposed - V2

Type III 24-hr 10 YR Rainfall=4.87"

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Page 10

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
107.10	242	0	0	242
108.00	450	307	307	458
110.00	929	1,350	1,657	971
111.10	1,210	1,173	2,830	1,279

Device	Routing	Invert	Outlet Devices
#1	Primary	110.10'	25.0' long x 4.0' 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) 2.38 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=3.53 cfs @ 12.29 hrs HW=110.25' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 3.53 cfs @ 0.93 fps)

NH-1485 East Kingston-Proposed - V2

Type III 24-hr 50 YR Rainfall=7.48"

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Page 1

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1.1S: Phase 1 West Runoff Area=308,782 sf 0.00% Impervious Runoff Depth=2.54"
 Flow Length=642' Slope=0.0031 '/' Tc=76.7 min CN=56 Runoff=6.72 cfs 1.498 af

Subcatchment 1.2S: Phase 1 West Runoff Area=34,888 sf 0.00% Impervious Runoff Depth=6.65"
 Flow Length=246' Slope=0.0070 '/' Tc=7.6 min CN=93 Runoff=5.42 cfs 0.444 af

Subcatchment 1.3S: Phase 1 West Runoff Area=4,616 sf 0.00% Impervious Runoff Depth=3.05"
 Flow Length=104' Slope=0.0050 '/' Tc=12.4 min CN=61 Runoff=0.30 cfs 0.027 af

Subcatchment 2.1S: Phase 1 East Runoff Area=133,875 sf 0.00% Impervious Runoff Depth=2.04"
 Flow Length=456' Slope=0.0197 '/' Tc=26.2 min CN=51 Runoff=3.99 cfs 0.522 af

Subcatchment 2.2S: Phase 1 East Runoff Area=45,597 sf 0.00% Impervious Runoff Depth=7.00"
 Flow Length=222' Slope=0.0050 '/' Tc=7.2 min CN=96 Runoff=7.32 cfs 0.611 af

Subcatchment 2.3S: Phase 1 East Runoff Area=3,948 sf 0.00% Impervious Runoff Depth=3.05"
 Flow Length=76' Slope=0.0104 '/' Tc=6.7 min CN=61 Runoff=0.31 cfs 0.023 af

Subcatchment 3S: Phase 1 South Runoff Area=74,169 sf 0.00% Impervious Runoff Depth=2.14"
 Flow Length=297' Slope=0.0202 '/' Tc=17.9 min CN=52 Runoff=2.74 cfs 0.303 af

Reach 1R: Culvert Avg. Flow Depth=1.00' Max Vel=6.11 fps Inflow=5.42 cfs 0.444 af
 12.0" Round Pipe n=0.011 L=50.0' S=0.0100 '/' Capacity=4.21 cfs Outflow=4.37 cfs 0.444 af

Reach 2R: Culvert Avg. Flow Depth=1.00' Max Vel=5.10 fps Inflow=7.32 cfs 0.611 af
 12.0" Round Pipe n=0.011 L=43.0' S=0.0070 '/' Capacity=3.52 cfs Outflow=3.67 cfs 0.611 af

Reach 100R: Wetlands Reach #100 Inflow=7.36 cfs 1.780 af
 Outflow=7.36 cfs 1.780 af

Reach 200R: Wetlands Reach #200 Inflow=5.21 cfs 0.572 af
 Outflow=5.21 cfs 0.572 af

Reach 300R: Wetlands Reach #300 Inflow=2.74 cfs 0.303 af
 Outflow=2.74 cfs 0.303 af

Pond 1FB: Forebay (1FB) Peak Elev=109.79' Storage=617 cf Inflow=4.37 cfs 0.444 af
 Outflow=4.30 cfs 0.433 af

Pond 1WP: Wet Pond (1WP) Peak Elev=110.77' Storage=17,315 cf Inflow=4.51 cfs 0.460 af
 Outflow=3.71 cfs 0.282 af

Pond 2BP#1: Bioretention Pond #1 Peak Elev=110.71' Storage=9,044 cf Inflow=3.83 cfs 0.594 af
 Discarded=0.82 cfs 0.543 af Primary=2.22 cfs 0.050 af Outflow=3.04 cfs 0.594 af

Pond 2FB: Forebay (2FB) Peak Elev=110.25' Storage=1,900 cf Inflow=3.67 cfs 0.611 af
 Outflow=3.59 cfs 0.571 af

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Type III 24-hr 50 YR Rainfall=7.48"

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Page 2

Total Runoff Area = 13.909 ac Runoff Volume = 3.427 af Average Runoff Depth = 2.96"
100.00% Pervious = 13.909 ac 0.00% Impervious = 0.000 ac

NH-1485 East Kingston-Proposed - V2

Type III 24-hr 100 YR Rainfall=8.99"

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Page 1

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond 1WP: Wet Pond (1WP)

Peak Elev=110.80' Storage=17,522 cf Inflow=4.63 cfs 0.570 af
Outflow=4.48 cfs 0.392 af

Pond 2BP#1: Bioretention Pond #1

Peak Elev=110.76' Storage=9,225 cf Inflow=3.95 cfs 0.734 af
Discarded=0.82 cfs 0.611 af Primary=2.73 cfs 0.123 af Outflow=3.56 cfs 0.734 af