STORMWATER MANAGEMENT REPORT

Proposed Parker Street Affordable Housing Development

99 Parker Street,
Acton, Massachusetts

Prepared for:
Red Acre Development Corporation
P.O. Box 992
Acton, Massachusetts 01720

RECEIVED
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ACTON CONSERVATION COMMISSION

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August 6, 2009

COMMONWEALTH OF MASSACHUSETTS
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REPORT SUMMARY:

Calculation Objectives:

The objective of these calculations is to demonstrate design compliance of the Parker Street Affordable Housing project Stormwater Management system for water quantity and water quality objectives of the DEP's Stormwater Management regulations and the Massachusetts Stormwater Handbook. Since the project consists of a total of five residential units that do not discharge to a "critical area", the project must comply with the DEP Stormwater regulations only to the "maximum extent practicable". The only exceptions to full compliance are noted herein. The analysis is separated into existing and proposed conditions for ease of comparison. Drainage area maps have been incorporated into this report to depict existing and proposed watershed areas.

Calculation Methods:

- TR55/TR20 methodology utilizing HydroCAD software by Applied Microcomputer Systems.
- US Army Corps of Engineers Method for Apron Design
- DEP Stormwater Management Handbook for Water Quality Calculations / TSS Removal

Sources of Data:

- Technical Report No. 20
- Technical Report No. 55
- Technical Paper No. 40
- Field Survey by Meridian Associates, Inc. (MAI) .
- "Middlesex County Soil Survey" by the Natural Resources Conservation Service (NRCS).
- "Massachusetts Stormwater Handbook" – Revised February 2008, by the Massachusetts Department of Environmental Protection (MADEP).

Soil Descriptions:

Existing soil conditions have been characterized by the Middlesex County Soil Survey Report. The soils have been assigned a Hydrologic Soil Grouping (HSG) by NRCS. The soil boundaries are depicted on the watershed maps.

NRCS Soil Map Unit	Hydrologic Soil Group (HSG) Rating	NRCS Soil Map Unit Name
6A	D	Scarboro Mucky Fine Sandy Loam, 0 to 3% slopes
103B	B	Charlton-Hollis Rock Outcrop Complex, 3 to 8% slopes
253B	A	Hinckley Loamy Sand, 3 to 8% slopes
255C	A	Windsor Loamy Sand, 8 to 15% slopes
626B	A	Merrimac-Urban Land Complex, 0 to 8% slopes

For the purpose of designing stormwater infiltration facilities, MAI utilized the exfiltration rates listed in Table 2.3.3 "1982 Rawls Rates" established by the DEP "Massachusetts Stormwater Handbook" – Volume 3: Documenting Compliance with the Massachusetts Stormwater Management Standards. This table specifies infiltration rates (inches per hour) based on soil texture. The DEP infiltration rate for loamy sand (2.41 in/hr) was utilized for the design of Rain Garden No. 1 and 2, (RG1) and (RG2) in the HSG-A area and a rate for sandy loam (1.02 in/hr) was used for the design of Rain Garden (RG3) in the HSG-B area.

Selection of Storm Events:

The storm events have been compiled from the Soil Conservation Service Technical Report No. 55 and the U.S. Department of Commerce Technical Paper No. 40. The 2-year, 10-year and 100-year storm events have been utilized for hydrology calculations pursuant to DEP Policy. The 25-year storm event is also analyzed in accordance with the Town of Acton Zoning By-Law. The rainfall data for the Type III, 24-hour storm events follow:

Frequency (Years)	Rainfall (Inches)
2	3.10
10	4.55
25	5.35
100	6.50

Existing Conditions Overview:

The project site is located at 99 Parker Street and contains approximately 1.42 acres of land in the Residence 4 (R-4) zoning district. Presently, the site contains a single family home with an access drive from Parker Street. The site is bounded by a single family residential lot to the north, south, and west, and by Parker Street to the east. Approximately one hundred feet to the north of the site are railroad tracks owned by the MBTA. A wetland area bisects the central portion of the site and contains a swale that carries intermittent flows from south to north to an existing stone headwall containing a 15" corrugated metal pipe at the northerly property line.

The site topography is characterized by sloping terrain from the outer limits of the site at a higher elevation to the centrally located low lying wetland area. The high points of the site are along the western property line (elevation 186) and the southeastern corner of the site (elevation 183). The low point is within the wetland swale which runs from south (elevation 171.5) to the north (elevation 165.6 at the existing headwall). Along the frontage (approximately 185 feet) the topography slopes from within the site down to the pavement within Parker Street. The project site contains slopes of less than 10% in the vicinity of the existing single family dwelling. Outside the single family dwelling vicinity, the slopes are of a much steeper grade and in some cases approach 40% (western portion of site), with an average slope of roughly 15%-20%.

The site is divided into three (3) subcatchment areas and three (3) design points for analysis:

- The majority of the site, subcatchment E-1, collects surface flow from the high points within the site and drain to and through the wetland swale. Approximately 57,120 s.f. of surface area is directed to the existing stone headwall at the northerly property line via the wetland swale. The existing stone headwall is Design Point 1 (DP-1).
- Additionally, subcatchment E-2 flows overland along the easterly portion of the site to a low point at the site driveway adjacent the easterly property line along Parker Street. Overflow from E-2 contains approximately 3,500 s.f. of surface area and is directed to Design Point 2 (DP-2) which is Parker Street.
- Subcatchment E-3 contains approximately 750 s.f. of surface area and flows overland from the northerly portion of the existing single family structure to Design Point 3 (DP-3) at the adjacent property line. This overland flow continues to flow northwesterly for approximately fifty feet and then back onto the site property to the existing stone headwall (DP-1).

Existing Subcatchments:

The following is a summary of pre-development subcatchment watershed areas that drain from the site:

Description	Comments
E-1	Overland flow to and through the wetland (DP-1).
E-2	Overland flow to Parker Street (DP-2)
E-3	Overland flow to Abutting Property along Parker Street to North (DP-3)

Proposed Conditions Overview:

The project includes the construction of five single family units with associated parking, landscaping and appurtenances. The stormwater management system will provide on-site mitigation of runoff increases from impervious surfaces by recharging a significant portion of the resulting runoff. These systems have been carefully designed to meet, or exceed, the DEP's Stormwater Management regulations. The systems will reduce peak flow rates below existing levels to abutting properties and Parker Street.

The only exception to full compliance with the DEP Stormwater regulations and Massachusetts Stormwater Handbook recommendations is relative to the amount of impervious area that is directed to recharge components. The handbook suggest that 65 percent of proposed impervious areas be directed to recharge BMP's to ensure that infiltration of the full recharge volume can be achieved. It this case, about 35 percent of the impervious area, that is the roof areas, is directed to the three rain gardens, which function as the "formal" recharge basins. However, this figure is very conservative in that no recharge is allowed for in the pocket wetlands. If recharge within the pocket wetlands was considered, the percentage of impervious areas directed to recharge BMP's would total 96 percent.

The site has been divided into six subcatchment areas and three design points for analysis:

- Subcatchment Area P-1-1 located at the southeastern portion of the site consists of roof runoff from building units 2 and 3 as well as surface flow from pavement and landscaped areas. The roof-top areas from units 2 and 3 will be conveyed via closed piping and directed to Rain Garden 1 (RG1) for storage and infiltration. Subsequent routing of any overflow will be directed to the larger, southerly "cell" of Pocket Wetland No. 1 (PW1) over vegetated areas. A vegetated filter strip will be constructed at the low point along the edge of pavement adjacent to PW1 to treat surface flow arriving via pavement. Any overflow from PW1 will be directed to DP1.
- Subcatchment Area P-1-2 located immediately to the north of P-1-1 consists of roof runoff from building unit 1 as well as surface flows from a small amount of pavement and landscaped areas. The roof-top area from units 1 will be conveyed via closed underground piping and directed to RG2 for storage and infiltration. Subsequent routing of any overflow will be directed to the smaller, northerly cell of Pocket Wetland No. 1 north (PW1) over vegetated area. Any overflow from PW1 will be directed to DP1.
- Subcatchment Area P-1-3 located at the northwestern portion of the site consists of roof runoff from building units 4 and 5 as well as surface flow from pavement and landscaped areas. The roof-top areas from units 4 and 5 will be conveyed via closed piping and directed to RG3 for storage and infiltration. Subsequent routing of any overflow will be directed to Pocket Wetland No. 2 (PW2) over vegetated areas. A vegetated filter strip will be constructed at the low point along the edge of pavement adjacent to PW1 to treat surface flow arriving via pavement. Any overflow from PW2 will be directed to DP1.
- Subcatchment Area P-1-4 consists primarily of wooded and wetland area on both sides of, and below, the driveway crossing. This area includes a small amount of impervious area immediately adjacent to the grate in the "bridged" crossing. The surface flow from this area enters the existing vegetated wetlands and swale and drains to the existing stone headwall at DP1.
- Subcatchment Area P-2 flows overland along the easterly portion of the site to a low point at the site driveway adjacent to the easterly property line along Parker Street. Overflow from P-2 contains approximately 1,993 s.f. of surface area and is directed to Design Point 2 (DP-2) which is Parker Street.
- Subcatchment P-3 contains approximately 425 s.f. of surface area and flows overland from the northeastern portion of the proposed building unit 1 to Design Point 3 (DP-3) at the adjacent property line. This overland flow continues to flow northwesterly for approximately fifty feet and then back onto the site property to the existing stone headwall (DP-1).

Proposed Subcatchments:

The following is a summary of post-development subcatchment watershed areas from the site:

Description		Comments
Bldg 1 thru Bldg 5		Piped roof flow to RG1, RG2 or RG3 (any overflow to DP-1).
P-1-1		Overland to PW1 from southeast side of site (overflow to DP-1).
P-1-2		Overland to PW1 from northeast side of site (any overflow to DP-1).
P-1-3		Overland to PW2 from northwest side of site (any overflow to DP-1).
P-1-4		Overland flow to and through existing wetland swale to DP1.
P-2		Overland flow to Parker Street (DP2).
P-3		Overland flow to Abutting Property along Parker Street to North (DP3).

Summary of Peak Stormwater Runoff Rates

Design Point	2 Yr. Peak Flow (cfs)		10 Yr. Peak Flow (cfs)		25 Yr. Peak Flow (cfs)		100 Yr. Peak Flow (cfs)	
	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.	Exist.	Prop.
DP-1 (Headwall)	0.30	0.30	0.90	0.90	1.30	1.20	1.90	1.60
DP-2 (Parker St.)	0.00	0.00	0.10	0.00	0.10	0.00	0.20	0.10
DP-3 (Prop. Line)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Conclusion:

The calculations performed for all design storm events indicate that peak flow rates will not exceed those of existing conditions to and through the wetland system to the existing stone headwall, to Parker Street, or to abutting properties with implementation of the stormwater management system as proposed. Secondly, water quality mitigation will be provided in conformance with the MA DEP Stormwater Management regulations. An Operation and Maintenance Plan for stormwater systems is included herein. With implementation of the stormwater management system as designed, substantial compliance with the DEP Stormwater Management regulations and handbook is achieved; with the only (minor) exception being the discussed above.

EXISTING CONDITIONS ANALYSIS

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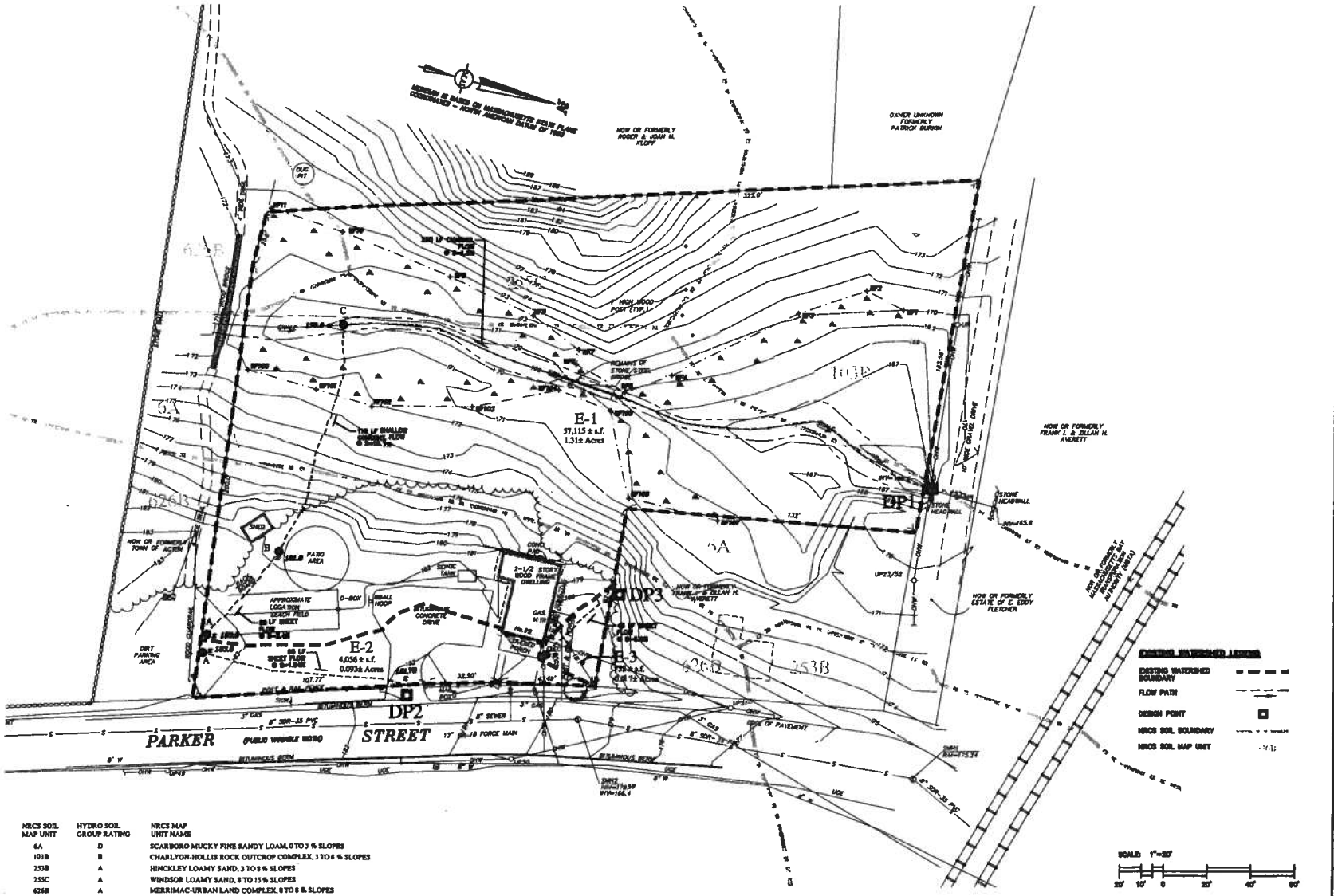


NRCS SOIL MAP UNIT	HYDRO SOIL GROUP RATING	NRCS MAP UNIT NAME
6A	D	SCARBORO MUCKY FINE SANDY LOAM, 0 TO 3 % SLOPES
103B	B	CHARLYON-HOLLIS ROCK OUTCROP COMPLEX, 3 TO 8 % SLOPES
253B	A	HINCKLEY LOAMY SAND, 3 TO 8 % SLOPES
255C	A	WINDSOR LOAMY SAND, 8 TO 15 % SLOPES
626B	A	MERRIMAC-URBAN LAND COMPLEX, 0 TO 8 % SLOPES

DWG No. 8319_PERM1_SNEDS_Prop.dwg

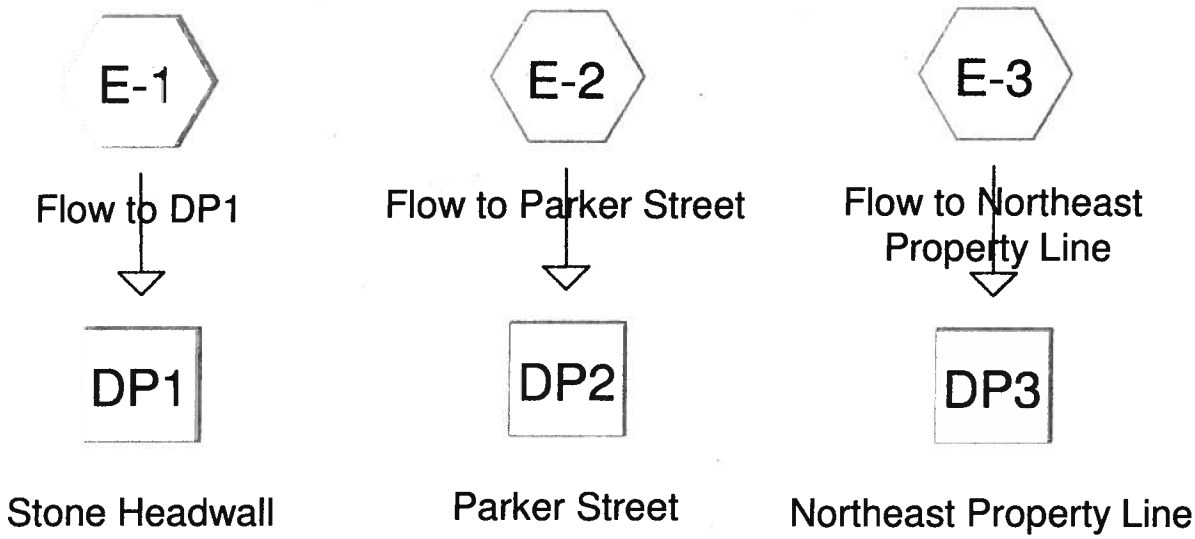
REVISIONS			
NO.	DATE	DESCRIPTION	BY

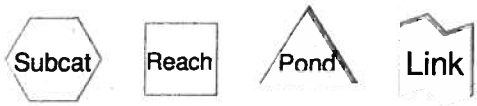
Existing Watershed Plan
Affordable Housing Development
99 Parker Street
Acton, Massachusetts

Prepared For:
Red Acre Development Corp.

MERIDIAN ASSOCIATES

DATE: August 6, 2009
SCALE: 1"= 20'
PROJECT No. 8319
SHEET No. 1 OF 1





Drainage Diagram for 8319_Existing
Prepared by Joseph Maliawco, Project Engineer, Printed 8/10/2009
HydroCAD® 8.50 s/n 005371 © 2007 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.226	30	Woods, Good, HSG A (E-1)
0.240	39	>75% Grass cover, Good, HSG A (E-1,E-2,E-3)
0.167	55	Woods, Good, HSG B (E-1)
0.016	68	<50% Grass cover, Poor, HSG A (E-1)
0.208	77	Woods, Good, HSG D (E-1)
0.490	78	Wetland (E-1)
0.012	80	>75% Grass cover, Good, HSG D (E-1)
0.062	98	Paved parking & roofs (E-1,E-2)

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.483	HSG A	E-1, E-2, E-3
0.167	HSG B	E-1
0.000	HSG C	
0.220	HSG D	E-1
0.552	Other	E-1, E-2

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Flow to DP1 Runoff Area=57,115 sf 2.79% Impervious Runoff Depth=0.44"
Flow Length=450' Tc=33.5 min CN=62 Runoff=0.3 cfs 0.05 af

Subcatchment E-2: Flow to Parker Street Runoff Area=4,056 sf 27.64% Impervious Runoff Depth=0.22"
Tc=6.0 min CN=55 Runoff=0.0 cfs 0.00 af

Subcatchment E-3: Flow to Northeast Property Runoff Area=752 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=43' Slope=0.0580 '/' Tc=6.0 min CN=39 Runoff=0.0 cfs 0.00 af

Reach DP1: Stone Headwall Inflow=0.3 cfs 0.05 af
Outflow=0.3 cfs 0.05 af

Reach DP2: Parker Street Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Reach DP3: Northeast Property Line Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Summary for Subcatchment E-1: Flow to DP1

707 sf area is the Crushed Stone Patio Area

Runoff = 0.3 cfs @ 12.61 hrs, Volume= 0.05 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
	9,839	30	Woods, Good, HSG A
	7,271	55	Woods, Good, HSG B
	9,062	77	Woods, Good, HSG D
*	21,326	78	Wetland
	1,593	98	Paved parking & roofs
	707	68	<50% Grass cover, Poor, HSG A
	6,787	39	>75% Grass cover, Good, HSG A
	530	80	>75% Grass cover, Good, HSG D
	57,115	62	Weighted Average
	55,522		Pervious Area
	1,593		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0340	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.3	110	0.1070	5.3		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
26.5	290	0.0150	0.2	0.91	**Channel Flow, Swale Flow** Area= 5.0 sf Perim= 624.0' r= 0.01' n= 0.040 Earth, cobble bottom, clean sides
33.5	450	Total			

Summary for Subcatchment E-2: Flow to Parker Street

Runoff = 0.0 cfs @ 12.35 hrs, Volume= 0.00 af, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

Area (sf)	CN	Description
2,935	39	>75% Grass cover, Good, HSG A
1,121	98	Paved parking & roofs
4,056	55	Weighted Average
2,935		Pervious Area
1,121		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment E-3: Flow to Northeast Property Line

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	43	0.0580	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	43	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach DP1: Stone Headwall

Inflow Area = 1.311 ac, 2.79% Impervious, Inflow Depth = 0.44" for 2 Yr event
Inflow = 0.3 cfs @ 12.61 hrs, Volume= 0.05 af
Outflow = 0.3 cfs @ 12.61 hrs, Volume= 0.05 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Parker Street

Inflow Area = 0.093 ac, 27.64% Impervious, Inflow Depth = 0.22" for 2 Yr event
Inflow = 0.0 cfs @ 12.35 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 12.35 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: Northeast Property Line

Inflow Area = 0.017 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2 Yr event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Flow to DP1 Runoff Area=57,115 sf 2.79% Impervious Runoff Depth=1.17"
Flow Length=450' Tc=33.5 min CN=62 Runoff=0.9 cfs 0.13 af

Subcatchment E-2: Flow to Parker Street Runoff Area=4,056 sf 27.64% Impervious Runoff Depth=0.77"
Tc=6.0 min CN=55 Runoff=0.1 cfs 0.01 af

Subcatchment E-3: Flow to Northeast Property Runoff Area=752 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=43' Slope=0.0580 '/' Tc=6.0 min CN=39 Runoff=0.0 cfs 0.00 af

Reach DP1: Stone Headwall Inflow=0.9 cfs 0.13 af
Outflow=0.9 cfs 0.13 af

Reach DP2: Parker Street Inflow=0.1 cfs 0.01 af
Outflow=0.1 cfs 0.01 af

Reach DP3: Northeast Property Line Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Summary for Subcatchment E-1: Flow to DP1

707 sf area is the Crushed Stone Patio Area

Runoff = 0.9 cfs @ 12.53 hrs, Volume= 0.13 af, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
	9,839	30	Woods, Good, HSG A
	7,271	55	Woods, Good, HSG B
	9,062	77	Woods, Good, HSG D
*	21,326	78	Wetland
	1,593	98	Paved parking & roofs
	707	68	<50% Grass cover, Poor, HSG A
	6,787	39	>75% Grass cover, Good, HSG A
	530	80	>75% Grass cover, Good, HSG D
	57,115	62	Weighted Average
	55,522		Pervious Area
	1,593		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0340	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.3	110	0.1070	5.3		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
26.5	290	0.0150	0.2	0.91	**Channel Flow, Swale Flow** Area= 5.0 sf Perim= 624.0' r= 0.01' n= 0.040 Earth, cobble bottom, clean sides
33.5	450	Total			

Summary for Subcatchment E-2: Flow to Parker Street

Runoff = 0.1 cfs @ 12.12 hrs, Volume= 0.01 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (sf)	CN	Description
2,935	39	>75% Grass cover, Good, HSG A
1,121	98	Paved parking & roofs
4,056	55	Weighted Average
2,935		Pervious Area
1,121		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment E-3: Flow to Northeast Property Line

Runoff = 0.0 cfs @ 14.64 hrs, Volume= 0.00 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	43	0.0580	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	43	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach DP1: Stone Headwall

Inflow Area = 1.311 ac, 2.79% Impervious, Inflow Depth = 1.17" for 10 Yr event
Inflow = 0.9 cfs @ 12.53 hrs, Volume= 0.13 af
Outflow = 0.9 cfs @ 12.53 hrs, Volume= 0.13 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Parker Street

Inflow Area = 0.093 ac, 27.64% Impervious, Inflow Depth = 0.77" for 10 Yr event
Inflow = 0.1 cfs @ 12.12 hrs, Volume= 0.01 af
Outflow = 0.1 cfs @ 12.12 hrs, Volume= 0.01 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: Northeast Property Line

Inflow Area = 0.017 ac, 0.00% Impervious, Inflow Depth = 0.12" for 10 Yr event
Inflow = 0.0 cfs @ 14.64 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 14.64 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Flow to DP1 Runoff Area=57,115 sf 2.79% Impervious Runoff Depth=1.66"
Flow Length=450' Tc=33.5 min CN=62 Runoff=1.3 cfs 0.18 af

Subcatchment E-2: Flow to Parker Street Runoff Area=4,056 sf 27.64% Impervious Runoff Depth=1.16"
Tc=6.0 min CN=55 Runoff=0.1 cfs 0.01 af

Subcatchment E-3: Flow to Northeast Property Runoff Area=752 sf 0.00% Impervious Runoff Depth=0.28"
Flow Length=43' Slope=0.0580 '/' Tc=6.0 min CN=39 Runoff=0.0 cfs 0.00 af

Reach DP1: Stone Headwall Inflow=1.3 cfs 0.18 af
Outflow=1.3 cfs 0.18 af

Reach DP2: Parker Street Inflow=0.1 cfs 0.01 af
Outflow=0.1 cfs 0.01 af

Reach DP3: Northeast Property Line Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Summary for Subcatchment E-1: Flow to DP1

707 sf area is the Crushed Stone Patio Area

Runoff = 1.3 cfs @ 12.51 hrs, Volume= 0.18 af, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
	9,839	30	Woods, Good, HSG A
	7,271	55	Woods, Good, HSG B
	9,062	77	Woods, Good, HSG D
*	21,326	78	Wetland
	1,593	98	Paved parking & roofs
	707	68	<50% Grass cover, Poor, HSG A
	6,787	39	>75% Grass cover, Good, HSG A
	530	80	>75% Grass cover, Good, HSG D
	57,115	62	Weighted Average
	55,522		Pervious Area
	1,593		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0340	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.3	110	0.1070	5.3		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
26.5	290	0.0150	0.2	0.91	**Channel Flow, Swale Flow** Area= 5.0 sf Perim= 624.0' r= 0.01' n= 0.040 Earth, cobble bottom, clean sides
33.5	450	Total			

Summary for Subcatchment E-2: Flow to Parker Street

Runoff = 0.1 cfs @ 12.11 hrs, Volume= 0.01 af, Depth= 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

Area (sf)	CN	Description
2,935	39	>75% Grass cover, Good, HSG A
1,121	98	Paved parking & roofs
4,056	55	Weighted Average
2,935		Pervious Area
1,121		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment E-3: Flow to Northeast Property Line

Runoff = 0.0 cfs @ 12.42 hrs, Volume= 0.00 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	43	0.0580	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	43	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach DP1: Stone Headwall

Inflow Area = 1.311 ac, 2.79% Impervious, Inflow Depth = 1.66" for 25 Yr event
Inflow = 1.3 cfs @ 12.51 hrs, Volume= 0.18 af
Outflow = 1.3 cfs @ 12.51 hrs, Volume= 0.18 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Parker Street

Inflow Area = 0.093 ac, 27.64% Impervious, Inflow Depth = 1.16" for 25 Yr event
Inflow = 0.1 cfs @ 12.11 hrs, Volume= 0.01 af
Outflow = 0.1 cfs @ 12.11 hrs, Volume= 0.01 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: Northeast Property Line

Inflow Area = 0.017 ac, 0.00% Impervious, Inflow Depth = 0.28" for 25 Yr event
Inflow = 0.0 cfs @ 12.42 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 12.42 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Flow to DP1 Runoff Area=57,115 sf 2.79% Impervious Runoff Depth=2.44"
Flow Length=450' Tc=33.5 min CN=62 Runoff=1.9 cfs 0.27 af

Subcatchment E-2: Flow to Parker Street Runoff Area=4,056 sf 27.64% Impervious Runoff Depth=1.81"
Tc=6.0 min CN=55 Runoff=0.2 cfs 0.01 af

Subcatchment E-3: Flow to Northeast Property Runoff Area=752 sf 0.00% Impervious Runoff Depth=0.60"
Flow Length=43' Slope=0.0580 '/' Tc=6.0 min CN=39 Runoff=0.0 cfs 0.00 af

Reach DP1: Stone Headwall Inflow=1.9 cfs 0.27 af
Outflow=1.9 cfs 0.27 af

Reach DP2: Parker Street Inflow=0.2 cfs 0.01 af
Outflow=0.2 cfs 0.01 af

Reach DP3: Northeast Property Line Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Summary for Subcatchment E-1: Flow to DP1

707 sf area is the Crushed Stone Patio Area

Runoff = 1.9 cfs @ 12.50 hrs, Volume= 0.27 af, Depth= 2.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
	9,839	30	Woods, Good, HSG A
	7,271	55	Woods, Good, HSG B
	9,062	77	Woods, Good, HSG D
*	21,326	78	Wetland
	1,593	98	Paved parking & roofs
	707	68	<50% Grass cover, Poor, HSG A
	6,787	39	>75% Grass cover, Good, HSG A
	530	80	>75% Grass cover, Good, HSG D
	57,115	62	Weighted Average
	55,522		Pervious Area
	1,593		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0340	0.1		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
0.3	110	0.1070	5.3		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
26.5	290	0.0150	0.2	0.91	**Channel Flow, Swale Flow** Area= 5.0 sf Perim= 624.0' r= 0.01' n= 0.040 Earth, cobble bottom, clean sides
33.5	450	Total			

Summary for Subcatchment E-2: Flow to Parker Street

Runoff = 0.2 cfs @ 12.10 hrs, Volume= 0.01 af, Depth= 1.81"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

Area (sf)	CN	Description
2,935	39	>75% Grass cover, Good, HSG A
1,121	98	Paved parking & roofs
4,056	55	Weighted Average
2,935		Pervious Area
1,121		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment E-3: Flow to Northeast Property Line

Runoff = 0.0 cfs @ 12.29 hrs, Volume= 0.00 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

Area (sf)	CN	Description
752	39	>75% Grass cover, Good, HSG A
752		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	43	0.0580	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	43	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach DP1: Stone Headwall

Inflow Area = 1.311 ac, 2.79% Impervious, Inflow Depth = 2.44" for 100 Yr event
Inflow = 1.9 cfs @ 12.50 hrs, Volume= 0.27 af
Outflow = 1.9 cfs @ 12.50 hrs, Volume= 0.27 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Parker Street

Inflow Area = 0.093 ac, 27.64% Impervious, Inflow Depth = 1.81" for 100 Yr event
Inflow = 0.2 cfs @ 12.10 hrs, Volume= 0.01 af
Outflow = 0.2 cfs @ 12.10 hrs, Volume= 0.01 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: Northeast Property Line

Inflow Area = 0.017 ac, 0.00% Impervious, Inflow Depth = 0.60" for 100 Yr event
Inflow = 0.0 cfs @ 12.29 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 12.29 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

PROPOSED CONDITIONS ANALYSIS

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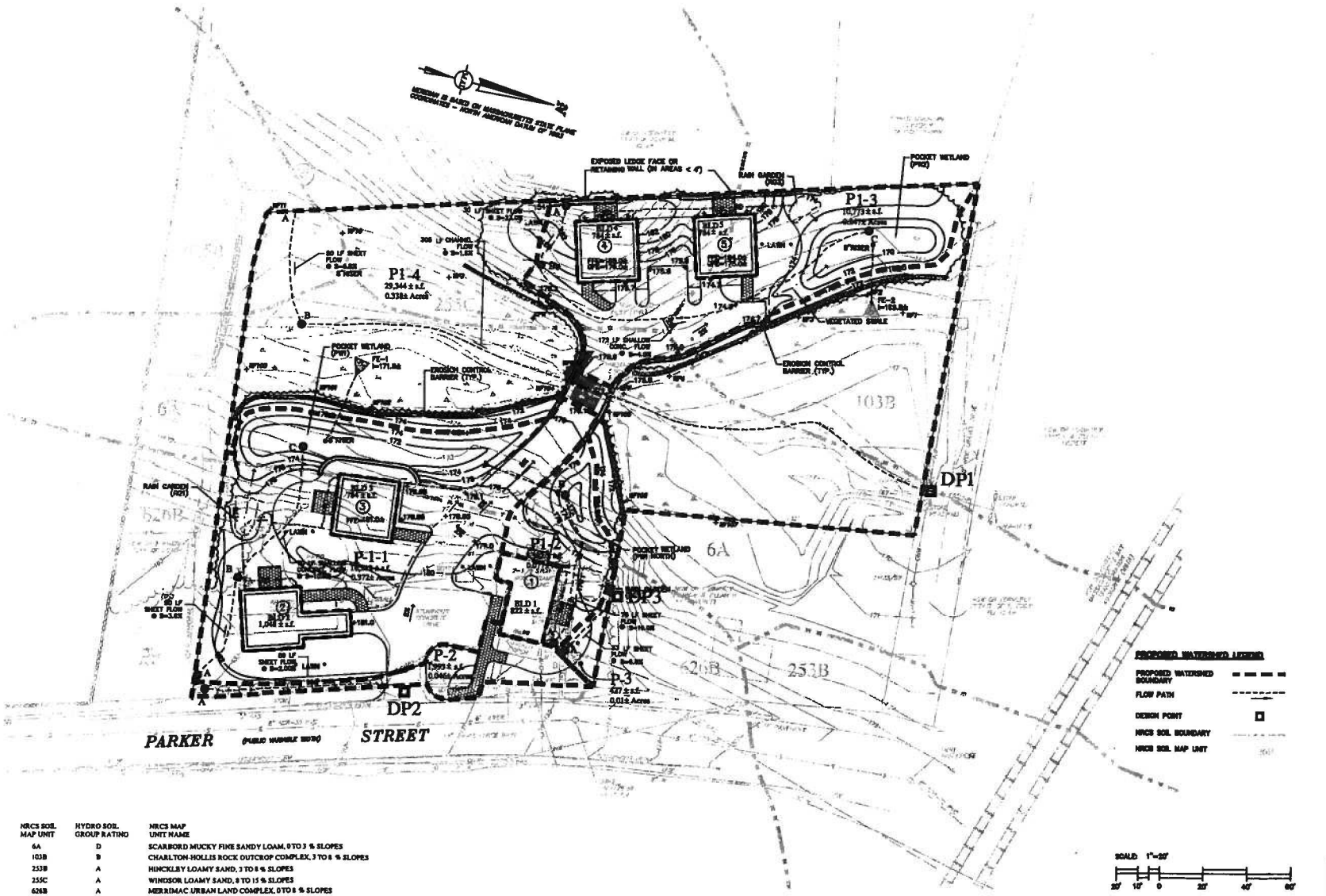

NRCS SOIL MAP UNIT	HYDRO SOIL GROUP RATING	NRCS MAP UNIT NAME
6A	D	SCARBORO MUCKY FINE SANDY LOAM, 0 TO 3 % SLOPES
103B	B	CHARLTON-HOLLIS ROCK OUTCROP COMPLEX, 3 TO 8 % SLOPES
253B	A	HINCKLEY LOAMY SAND, 3 TO 8 % SLOPES
255C	A	WINDSOR LOAMY SAND, 8 TO 15 % SLOPES
626B	A	MERRIMAC URBAN LAND COMPLEX, 0 TO 8 % SLOPES

DWG No. 8319_PERM1_SEEDR_Prep.dwg

REVISIONS			
NO.	DATE	REVISION	BY

Proposed Watershed Plan
Affordable Housing Development
99 Parker Street
Acton, Massachusetts

Prepared For:
Red Acre Development Corp.

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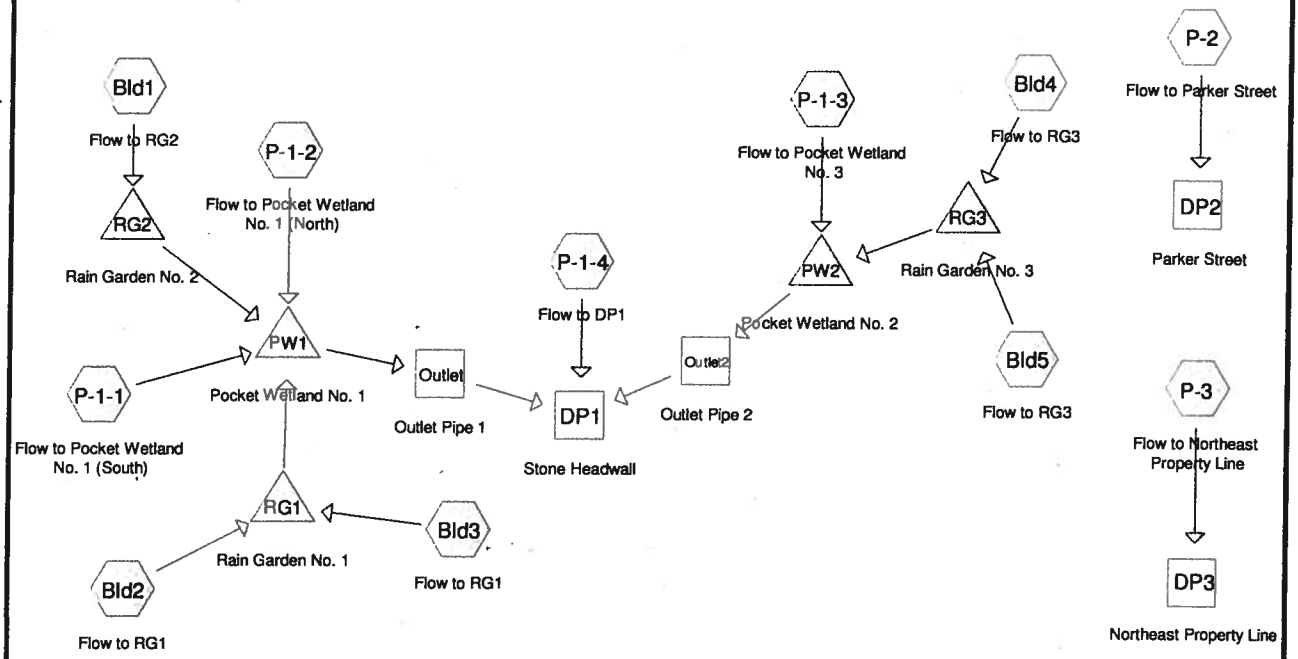
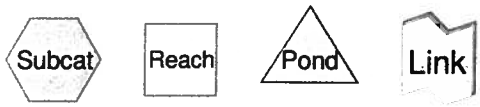
DATE: August 6, 2009
SCALE: 1"= 20'
PROJECT No. 8319
SHEET No. 1 OF 1





Drainage Diagram for 8319_Proposed
Prepared by Joseph Maliawco, Project Engineer, Printed 8/11/2009
HydroCAD® 8.50 s/n 005371 © 2007 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.040	30	Woods, Good, HSG A (P-1-1,P-1-4)
0.197	39	>75% Grass cover, Good, HSG A (P-1-1,P-1-2,P-1-3,P-1-4,P-2,P-3)
0.018	55	Woods, Good, HSG B (P-1-3,P-1-4)
0.230	61	>75% Grass cover, Good, HSG B (P-1-1,P-1-3,P-1-4)
0.011	76	Gravel roads, HSG A (P-1-3)
0.008	77	Woods, Good, HSG D (P-1-4)
0.038	78	Pocket Wetland 1 (P-1-1,P-1-2)
0.030	78	Pocket Wetland 2 (P-1-3)
0.491	78	Wetland (P-1-4)
0.085	80	>75% Grass cover, Good, HSG D (P-1-1,P-1-2,P-1-4)
0.001	98	Paved area around crossing grate (P-1-4)
0.161	98	Paved driveway, parking & sidewalks (P-1-1,P-1-3)
0.009	98	Paved parking & Sidewalk (P-1-2)
0.010	98	Paved parking sidewalks & Porch Roof (P-2)
0.018	98	Roff Area (Bld3)
0.079	98	Roof Area (Bld1,Bld2,Bld4,Bld5)

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.248	HSG A	P-1-1, P-1-2, P-1-3, P-1-4, P-2, P-3
0.247	HSG B	P-1-1, P-1-3, P-1-4
0.000	HSG C	
0.092	HSG D	P-1-1, P-1-2, P-1-4
0.837	Other	Bld1, Bld2, Bld3, Bld4, Bld5, P-1-1, P-1-2, P-1-3, P-1-4, P-2

Time span=0.00-35.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Bld1: Flow to RG2 Runoff Area=822 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.00 af

Subcatchment Bld2: Flow to RG1 Runoff Area=1,048 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld3: Flow to RG1 Runoff Area=784 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.00 af

Subcatchment Bld4: Flow to RG3 Runoff Area=784 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.00 af

Subcatchment Bld5: Flow to RG3 Runoff Area=784 sf 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.00 af

Subcatchment P-1-1: Flow to Pocket Runoff Area=14,380 sf 31.90% Impervious Runoff Depth=0.87"
Tc=6.0 min CN=72 Runoff=0.3 cfs 0.02 af

Subcatchment P-1-2: Flow to Pocket Runoff Area=2,510 sf 16.25% Impervious Runoff Depth=0.59"
Tc=6.0 min CN=66 Runoff=0.0 cfs 0.00 af

Subcatchment P-1-3: Flow to Pocket Runoff Area=9,205 sf 26.24% Impervious Runoff Depth=0.72"
Flow Length=202' Tc=6.0 min CN=69 Runoff=0.2 cfs 0.01 af

Subcatchment P-1-4: Flow to DP1 Runoff Area=29,344 sf 0.22% Impervious Runoff Depth=0.87"
Flow Length=355' Tc=33.5 min CN=72 Runoff=0.3 cfs 0.05 af

Subcatchment P-2: Flow to Parker Street Runoff Area=1,993 sf 20.87% Impervious Runoff Depth=0.13"
Tc=6.0 min CN=51 Runoff=0.0 cfs 0.00 af

Subcatchment P-3: Flow to Northeast Property Runoff Area=427 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=43' Slope=0.0580 '/' Tc=6.0 min CN=39 Runoff=0.0 cfs 0.00 af

Reach DP1: Stone Headwall Inflow=0.3 cfs 0.06 af
Outflow=0.3 cfs 0.06 af

Reach DP2: Parker Street Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Reach DP3: Northeast Property Line Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Reach Outlet: Outlet Pipe 1 Avg. Depth=0.06' Max Vel=1.2 fps Inflow=0.0 cfs 0.01 af
D=8.0" n=0.013 L=25.0' S=0.0080 '/' Capacity=1.1 cfs Outflow=0.0 cfs 0.01 af

Reach Outlet2: Outlet Pipe 2 Avg. Depth=0.03' Max Vel=0.8 fps Inflow=0.0 cfs 0.00 af
D=8.0" n=0.013 L=40.0' S=0.0075 '/' Capacity=1.0 cfs Outflow=0.0 cfs 0.00 af

Pond PW1: Pocket Wetland No. 1 Peak Elev=172.57' Storage=740 cf Inflow=0.3 cfs 0.03 af
Outflow=0.0 cfs 0.01 af

Pond PW2: Pocket Wetland No. 2 Peak Elev=171.03' Storage=454 cf Inflow=0.2 cfs 0.01 af
Outflow=0.0 cfs 0.00 af

Pond RG1: Rain Garden No. 1 Peak Elev=177.88' Storage=155 cf Inflow=0.1 cfs 0.01 af
Discarded=0.0 cfs 0.01 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.01 af

Pond RG2: Rain Garden No. 2 Peak Elev=177.48' Storage=59 cf Inflow=0.1 cfs 0.00 af
Discarded=0.0 cfs 0.00 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.00 af

Pond RG3: Rain Garden No. 3 Peak Elev=173.90' Storage=159 cf Inflow=0.1 cfs 0.01 af
Discarded=0.0 cfs 0.01 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.01 af

Summary for Subcatchment Bld1: Flow to RG2

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.00 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
*	822	98	Roof Area
	822		Impervious Area

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

Summary for Subcatchment Bld2: Flow to RG1

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
*	1,048	98	Roof Area
	1,048		Impervious Area

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

Summary for Subcatchment Bld3: Flow to RG1

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.00 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
*	784	98	Roff Area
	784		Impervious Area

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

Summary for Subcatchment Bld4: Flow to RG3

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.00 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
*	784	98	Roof Area
	784		Impervious Area

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

Summary for Subcatchment Bld5: Flow to RG3

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.00 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
*	784	98	Roof Area
	784		Impervious Area

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

Summary for Subcatchment P-1-1: Flow to Pocket Wetland No. 1 (South)

Runoff = 0.3 cfs @ 12.10 hrs, Volume= 0.02 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
*	4,587	98	Paved driveway, parking & sidewalks
	239	30	Woods, Good, HSG A
	464	80	>75% Grass cover, Good, HSG D
	6,091	61	>75% Grass cover, Good, HSG B
	1,700	39	>75% Grass cover, Good, HSG A
*	1,299	78	Pocket Wetland 1
	14,380	72	Weighted Average
	9,793		Pervious Area
	4,587		Impervious Area

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

Summary for Subcatchment P-1-2: Flow to Pocket Wetland No. 1 (North)

Runoff = 0.0 cfs @ 12.11 hrs, Volume= 0.00 af, Depth= 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
	993	39	>75% Grass cover, Good, HSG A
	736	80	>75% Grass cover, Good, HSG D
*	408	98	Paved parking & Sidewalk
*	373	78	Pocket Wetland 1
	2,510	66	Weighted Average
	2,102		Pervious Area
	408		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment P-1-3: Flow to Pocket Wetland No. 3

Runoff = 0.2 cfs @ 12.11 hrs, Volume= 0.01 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
	469	76	Gravel roads, HSG A
*	2,415	98	Paved driveway, parking & sidewalks
	2,781	61	>75% Grass cover, Good, HSG B
	2,093	39	>75% Grass cover, Good, HSG A
*	1,322	78	Pocket Wetland 2
	125	55	Woods, Good, HSG B
	9,205	69	Weighted Average
	6,790		Pervious Area
	2,415		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	30	0.2300	0.2		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	115	0.0400	4.1		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	57	0.0400	3.2		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.9	202	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment P-1-4: Flow to DP1

Runoff = 0.3 cfs @ 12.52 hrs, Volume= 0.05 af, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
	1,802	39	>75% Grass cover, Good, HSG A
	1,502	30	Woods, Good, HSG A
	338	77	Woods, Good, HSG D
*	21,368	78	Wetland
	2,491	80	>75% Grass cover, Good, HSG D
	646	55	Woods, Good, HSG B
	1,133	61	>75% Grass cover, Good, HSG B
*	64	98	Paved area around crossing grate
	29,344	72	Weighted Average
	29,280		Pervious Area
	64		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0580	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
28.1	305	0.0150	0.2	0.91	**Channel Flow, Swale Flow** Area= 5.0 sf Perim= 630.0' r= 0.01' n= 0.040 Winding stream, pools & shoals
33.5	355	Total			

Summary for Subcatchment P-2: Flow to Parker Street

Runoff = 0.0 cfs @ 12.47 hrs, Volume= 0.00 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

	Area (sf)	CN	Description
	1,577	39	>75% Grass cover, Good, HSG A
*	416	98	Paved parking sidewalks & Porch Roof
	1,993	51	Weighted Average
	1,577		Pervious Area
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment P-3: Flow to Northeast Property Line

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Yr Rainfall=3.10"

Area (sf)	CN	Description
427	39	>75% Grass cover, Good, HSG A
427		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	43	0.0580	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	43	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach DP1: Stone Headwall

Inflow Area = 1.370 ac, 19.60% Impervious, Inflow Depth > 0.56" for 2 Yr event
Inflow = 0.3 cfs @ 12.52 hrs, Volume= 0.06 af
Outflow = 0.3 cfs @ 12.52 hrs, Volume= 0.06 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Parker Street

Inflow Area = 0.046 ac, 20.87% Impervious, Inflow Depth = 0.13" for 2 Yr event
Inflow = 0.0 cfs @ 12.47 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 12.47 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: Northeast Property Line

Inflow Area = 0.010 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2 Yr event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach Outlet: Outlet Pipe 1

Inflow Area = 0.449 ac, 39.14% Impervious, Inflow Depth > 0.32" for 2 Yr event
Inflow = 0.0 cfs @ 15.59 hrs, Volume= 0.01 af
Outflow = 0.0 cfs @ 15.60 hrs, Volume= 0.01 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.2 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 0.6 min

Peak Storage= 0 cf @ 15.60 hrs, Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.1 cfs

8.0" Diameter Pipe, n= 0.013 Corrugated PE, smooth interior
Length= 25.0' Slope= 0.0080 '/'
Inlet Invert= 172.00', Outlet Invert= 171.80'

Summary for Reach Outlet2: Outlet Pipe 2

Inflow Area = 0.247 ac, 36.97% Impervious, Inflow Depth > 0.15" for 2 Yr event
Inflow = 0.0 cfs @ 18.87 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 18.89 hrs, Volume= 0.00 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.8 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 0.5 fps, Avg. Travel Time= 1.3 min

Peak Storage= 0 cf @ 18.88 hrs, Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.0 cfs

8.0" Diameter Pipe, n= 0.013 Corrugated PE, smooth interior
Length= 40.0' Slope= 0.0075 '/'
Inlet Invert= 170.50', Outlet Invert= 170.20'

Summary for Pond PW1: Pocket Wetland No. 1

Inflow Area = 0.449 ac, 39.14% Impervious, Inflow Depth = 0.72" for 2 Yr event
Inflow = 0.3 cfs @ 12.10 hrs, Volume= 0.03 af
Outflow = 0.0 cfs @ 15.59 hrs, Volume= 0.01 af, Atten= 94%, Lag= 209.4 min
Primary = 0.0 cfs @ 15.59 hrs, Volume= 0.01 af

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 172.57' @ 15.59 hrs Surf.Area= 1,427 sf Storage= 740 cf
Flood Elev= 174.50' Surf.Area= 3,064 sf Storage= 4,701 cf

Plug-Flow detention time= 393.9 min calculated for 0.01 af (45% of inflow)
Center-of-Mass det. time= 254.4 min (1,127.8 - 873.4)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	4,701 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
172.00	1,153	274.0	0	0	1,153
173.00	1,649	301.0	1,394	1,394	2,421
174.00	2,307	376.0	1,969	3,362	6,476
174.50	3,064	401.0	1,338	4,701	8,034

Device	Routing	Invert	Outlet Devices
#1	Primary	174.00'	**6.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	172.50'	**0.8" Vert. Riser Perforations X 6.00** C= 0.600
#3	Primary	173.80'	**8.0" Horiz. Perf 8" Riser w/ Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.0 cfs @ 15.59 hrs HW=172.57' (Free Discharge)
- **1=Grass Spillway** (Controls 0.0 cfs)
- **2=Riser Perforations** (Orifice Controls 0.0 cfs @ 1.0 fps)
- **3=Perf 8" Riser w/ Grate** (Controls 0.0 cfs)

Summary for Pond PW2: Pocket Wetland No. 2

Inflow Area = 0.247 ac, 36.97% Impervious, Inflow Depth = 0.63" for 2 Yr event
Inflow = 0.2 cfs @ 12.11 hrs, Volume= 0.01 af
Outflow = 0.0 cfs @ 18.87 hrs, Volume= 0.00 af, Atten= 97%, Lag= 405.7 min
Primary = 0.0 cfs @ 18.87 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 171.03' @ 18.87 hrs Surf.Area= 1,009 sf Storage= 454 cf
Flood Elev= 172.50' Surf.Area= 1,862 sf Storage= 2,376 cf

Plug-Flow detention time= 551.9 min calculated for 0.00 af (24% of inflow)
Center-of-Mass det. time= 397.7 min (1,277.8 - 880.1)

Volume	Invert	Avail.Storage	Storage Description
#1	170.50'	2,376 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.50	711	133.0	0	0	711
171.00	1,001	149.0	426	426	1,077
172.00	1,322	163.0	1,158	1,584	1,458
172.50	1,862	185.0	792	2,376	2,073

Device	Routing	Invert	Outlet Devices
#1	Primary	172.00'	**6.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	171.00'	**0.8" Vert. Riser Perforations X 6.00** C= 0.600
#3	Primary	171.80'	**8.0" Vert. 8" Perf. Riser w/ 8" Grate** C= 0.600

Primary OutFlow Max=0.0 cfs @ 18.87 hrs HW=171.03' (Free Discharge)
- **1=Grass Spillway** (Controls 0.0 cfs)
- **2=Riser Perforations** (Orifice Controls 0.0 cfs @ 0.6 fps)
- **3=8" Perf. Riser w/ 8" Grate** (Controls 0.0 cfs)

Summary for Pond RG1: Rain Garden No. 1

Inflow Area = 0.042 ac,100.00% Impervious, Inflow Depth = 2.87" for 2 Yr event
Inflow = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af
Outflow = 0.0 cfs @ 12.67 hrs, Volume= 0.01 af, Atten= 88%, Lag= 35.0 min
Discarded = 0.0 cfs @ 12.67 hrs, Volume= 0.01 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 177.88' @ 12.67 hrs Surf.Area= 203 sf Storage= 155 cf
Flood Elev= 178.50' Surf.Area= 211 sf Storage= 179 cf

Plug-Flow detention time= 83.9 min calculated for 0.01 af (100% of inflow)

Center-of-Mass det. time= 83.8 min (840.8 - 757.1)

Volume	Invert	Avail.Storage	Storage Description
#1	177.00'	179 cf	**Rain Garden No. 1 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	148	41.0	0	0	148
178.00	211	58.0	179	179	291

Device	Routing	Invert	Outlet Devices
#1	Discarded	177.00'	**0.003300 fpm Exfiltration over Wetted area**
#2	Primary	177.90'	**10.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.67 hrs HW=177.88' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=177.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond RG2: Rain Garden No. 2

Inflow Area =	0.019 ac,100.00% Impervious,	Inflow Depth =	2.87"	for 2 Yr event	
Inflow =	0.1 cfs @	12.09 hrs, Volume=	0.00 af		
Outflow =	0.0 cfs @	12.57 hrs, Volume=	0.00 af,	Atten= 85%,	Lag= 29.1 min
Discarded =	0.0 cfs @	12.57 hrs, Volume=	0.00 af		
Primary =	0.0 cfs @	0.00 hrs, Volume=	0.00 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 177.48' @ 12.57 hrs Surf.Area= 134 sf Storage= 59 cf
Flood Elev= 178.30' Surf.Area= 160 sf Storage= 135 cf

Plug-Flow detention time= 46.3 min calculated for 0.00 af (100% of inflow)
Center-of-Mass det. time= 46.4 min (803.5 - 757.1)

Volume	Invert	Avail.Storage	Storage Description
#1	177.00'	135 cf	**Rain Garden No. 2 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	112	34.0	0	0	112
178.00	160	48.0	135	135	212

Device	Routing	Invert	Outlet Devices
#1	Discarded	177.00'	**0.003300 fpm Exfiltration over Wetted area**
#2	Primary	177.90'	**10.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.57 hrs HW=177.48' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=177.00' (Free Discharge)
└─**2=Grass Spillway** (Controls 0.0 cfs)

Summary for Pond RG3: Rain Garden No. 3

Inflow Area =	0.036 ac,100.00% Impervious,	Inflow Depth =	2.87"	for 2 Yr event	
Inflow =	0.1 cfs @	12.09 hrs, Volume=	0.01 af		
Outflow =	0.0 cfs @	12.52 hrs, Volume=	0.01 af,	Atten= 81%,	Lag= 26.3 min
Discarded =	0.0 cfs @	12.50 hrs, Volume=	0.01 af		
Primary =	0.0 cfs @	12.52 hrs, Volume=	0.00 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 173.90' @ 12.50 hrs Surf.Area= 206 sf Storage= 159 cf
Flood Elev= 174.50' Surf.Area= 213 sf Storage= 180 cf

Plug-Flow detention time= 183.2 min calculated for 0.01 af (100% of inflow)
Center-of-Mass det. time= 183.8 min (940.9 - 757.1)

Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	180 cf	**Rain Garden No. 3 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
173.00	149	55.0	0	0	149
174.00	213	78.0	180	180	401

Device	Routing	Invert	Outlet Devices
#1	Primary	173.90'	**20.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	173.00'	**0.001400 fpm Exfiltration over Wetted area**

Discarded OutFlow Max=0.0 cfs @ 12.50 hrs HW=173.90' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 12.52 hrs HW=173.90' (Free Discharge)
└─**1=Grass Spillway** (Weir Controls 0.0 cfs @ 0.1 fps)

Time span=0.00-35.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Bld1: Flow to RG2 Runoff Area=822 sf 100.00% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld2: Flow to RG1 Runoff Area=1,048 sf 100.00% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld3: Flow to RG1 Runoff Area=784 sf 100.00% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld4: Flow to RG3 Runoff Area=784 sf 100.00% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld5: Flow to RG3 Runoff Area=784 sf 100.00% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment P-1-1: Flow to Pocket Runoff Area=14,380 sf 31.90% Impervious Runoff Depth=1.86"
Tc=6.0 min CN=72 Runoff=0.7 cfs 0.05 af

Subcatchment P-1-2: Flow to Pocket Runoff Area=2,510 sf 16.25% Impervious Runoff Depth=1.43"
Tc=6.0 min CN=66 Runoff=0.1 cfs 0.01 af

Subcatchment P-1-3: Flow to Pocket Runoff Area=9,205 sf 26.24% Impervious Runoff Depth=1.64"
Flow Length=202' Tc=6.0 min CN=69 Runoff=0.4 cfs 0.03 af

Subcatchment P-1-4: Flow to DP1 Runoff Area=29,344 sf 0.22% Impervious Runoff Depth=1.86"
Flow Length=355' Tc=33.5 min CN=72 Runoff=0.8 cfs 0.10 af

Subcatchment P-2: Flow to Parker Street Runoff Area=1,993 sf 20.87% Impervious Runoff Depth=0.56"
Tc=6.0 min CN=51 Runoff=0.0 cfs 0.00 af

Subcatchment P-3: Flow to Northeast Property Runoff Area=427 sf 0.00% Impervious Runoff Depth=0.12"
Flow Length=43' Slope=0.0580 '/' Tc=6.0 min CN=39 Runoff=0.0 cfs 0.00 af

Reach DP1: Stone Headwall Inflow=0.9 cfs 0.17 af
Outflow=0.9 cfs 0.17 af

Reach DP2: Parker Street Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Reach DP3: Northeast Property Line Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Reach Outlet: Outlet Pipe 1 Avg. Depth=0.11' Max Vel=1.7 fps Inflow=0.1 cfs 0.05 af
D=8.0" n=0.013 L=25.0' S=0.0080 '/' Capacity=1.1 cfs Outflow=0.1 cfs 0.05 af

Reach Outlet2: Outlet Pipe 2 Avg. Depth=0.10' Max Vel=1.5 fps Inflow=0.0 cfs 0.02 af
D=8.0" n=0.013 L=40.0' S=0.0075 '/' Capacity=1.0 cfs Outflow=0.0 cfs 0.02 af

Pond PW1: Pocket Wetland No. 1 Peak Elev=172.98' Storage=1,357 cf Inflow=0.8 cfs 0.06 af
Outflow=0.1 cfs 0.05 af

Pond PW2: Pocket Wetland No. 2 Peak Elev=171.25' Storage=689 cf Inflow=0.5 cfs 0.03 af
Outflow=0.0 cfs 0.02 af

Pond RG1: Rain Garden No. 1 Peak Elev=177.94' Storage=165 cf Inflow=0.2 cfs 0.02 af
Discarded=0.0 cfs 0.01 af Primary=0.1 cfs 0.00 af Outflow=0.2 cfs 0.02 af

Pond RG2: Rain Garden No. 2 Peak Elev=177.77' Storage=100 cf Inflow=0.1 cfs 0.01 af
Discarded=0.0 cfs 0.01 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.01 af

Pond RG3: Rain Garden No. 3 Peak Elev=173.92' Storage=163 cf Inflow=0.2 cfs 0.01 af
Discarded=0.0 cfs 0.01 af Primary=0.1 cfs 0.00 af Outflow=0.2 cfs 0.01 af

Summary for Subcatchment Bld1: Flow to RG2

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
*	822	98	Roof Area
	822		Impervious Area

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

Summary for Subcatchment Bld2: Flow to RG1

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
*	1,048	98	Roof Area
	1,048		Impervious Area

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

Summary for Subcatchment Bld3: Flow to RG1

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
*	784	98	Roff Area
	784		Impervious Area

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

Summary for Subcatchment Bld4: Flow to RG3

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
*	784	98	Roof Area
	784		Impervious Area

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

Summary for Subcatchment Bld5: Flow to RG3

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
*	784	98	Roof Area
	784		Impervious Area

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

Summary for Subcatchment P-1-1: Flow to Pocket Wetland No. 1 (South)

Runoff = 0.7 cfs @ 12.10 hrs, Volume= 0.05 af, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
*	4,587	98	Paved driveway, parking & sidewalks
	239	30	Woods, Good, HSG A
	464	80	>75% Grass cover, Good, HSG D
	6,091	61	>75% Grass cover, Good, HSG B
	1,700	39	>75% Grass cover, Good, HSG A
*	1,299	78	Pocket Wetland 1
	14,380	72	Weighted Average
	9,793		Pervious Area
	4,587		Impervious Area

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

Summary for Subcatchment P-1-2: Flow to Pocket Wetland No. 1 (North)

Runoff = 0.1 cfs @ 12.10 hrs, Volume= 0.01 af, Depth= 1.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
	993	39	>75% Grass cover, Good, HSG A
	736	80	>75% Grass cover, Good, HSG D
*	408	98	Paved parking & Sidewalk
*	373	78	Pocket Wetland 1
	2,510	66	Weighted Average
	2,102		Pervious Area
	408		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment P-1-3: Flow to Pocket Wetland No. 3

Runoff = 0.4 cfs @ 12.10 hrs, Volume= 0.03 af, Depth= 1.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
	469	76	Gravel roads, HSG A
*	2,415	98	Paved driveway, parking & sidewalks
	2,781	61	>75% Grass cover, Good, HSG B
	2,093	39	>75% Grass cover, Good, HSG A
*	1,322	78	Pocket Wetland 2
	125	55	Woods, Good, HSG B
	9,205	69	Weighted Average
	6,790		Pervious Area
	2,415		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	30	0.2300	0.2		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	115	0.0400	4.1		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	57	0.0400	3.2		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.9	202	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment P-1-4: Flow to DP1

Runoff = 0.8 cfs @ 12.49 hrs, Volume= 0.10 af, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
	1,802	39	>75% Grass cover, Good, HSG A
	1,502	30	Woods, Good, HSG A
	338	77	Woods, Good, HSG D
*	21,368	78	Wetland
	2,491	80	>75% Grass cover, Good, HSG D
	646	55	Woods, Good, HSG B
	1,133	61	>75% Grass cover, Good, HSG B
*	64	98	Paved area around crossing grate
	29,344	72	Weighted Average
	29,280		Pervious Area
	64		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0580	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
28.1	305	0.0150	0.2	0.91	**Channel Flow, Swale Flow** Area= 5.0 sf Perim= 630.0' r= 0.01' n= 0.040 Winding stream, pools & shoals
33.5	355	Total			

Summary for Subcatchment P-2: Flow to Parker Street

Runoff = 0.0 cfs @ 12.15 hrs, Volume= 0.00 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
	1,577	39	>75% Grass cover, Good, HSG A
*	416	98	Paved parking sidewalks & Porch Roof
	1,993	51	Weighted Average
	1,577		Pervious Area
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment P-3: Flow to Northeast Property Line

Runoff = 0.0 cfs @ 14.64 hrs, Volume= 0.00 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Yr Rainfall=4.55"

	Area (sf)	CN	Description
	427	39	>75% Grass cover, Good, HSG A
	427		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	43	0.0580	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	43	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach DP1: Stone Headwall

Inflow Area = 1.370 ac, 19.60% Impervious, Inflow Depth > 1.51" for 10 Yr event
Inflow = 0.9 cfs @ 12.50 hrs, Volume= 0.17 af
Outflow = 0.9 cfs @ 12.50 hrs, Volume= 0.17 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Parker Street

Inflow Area = 0.046 ac, 20.87% Impervious, Inflow Depth = 0.56" for 10 Yr event
Inflow = 0.0 cfs @ 12.15 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 12.15 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: Northeast Property Line

Inflow Area = 0.010 ac, 0.00% Impervious, Inflow Depth = 0.12" for 10 Yr event
Inflow = 0.0 cfs @ 14.64 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 14.64 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

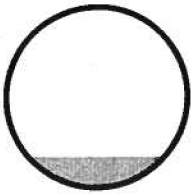
Summary for Reach Outlet: Outlet Pipe 1

Inflow Area = 0.449 ac, 39.14% Impervious, Inflow Depth > 1.22" for 10 Yr event
Inflow = 0.1 cfs @ 13.70 hrs, Volume= 0.05 af
Outflow = 0.1 cfs @ 13.71 hrs, Volume= 0.05 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.7 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 0.4 min

Peak Storage= 1 cf @ 13.70 hrs, Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.1 cfs

8.0" Diameter Pipe, n= 0.013 Corrugated PE, smooth interior
Length= 25.0' Slope= 0.0080 '/'
Inlet Invert= 172.00', Outlet Invert= 171.80'



Summary for Reach Outlet2: Outlet Pipe 2

Inflow Area = 0.247 ac, 36.97% Impervious, Inflow Depth > 1.07" for 10 Yr event
Inflow = 0.0 cfs @ 13.07 hrs, Volume= 0.02 af
Outflow = 0.0 cfs @ 13.08 hrs, Volume= 0.02 af, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.5 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.8 fps, Avg. Travel Time= 0.9 min

Peak Storage= 1 cf @ 13.08 hrs, Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.0 cfs

8.0" Diameter Pipe, n= 0.013 Corrugated PE, smooth interior
Length= 40.0' Slope= 0.0075 '/'
Inlet Invert= 170.50', Outlet Invert= 170.20'

Summary for Pond PW1: Pocket Wetland No. 1

Inflow Area =	0.449 ac,	39.14% Impervious,	Inflow Depth =	1.61"	for 10 Yr event
Inflow =	0.8 cfs @	12.13 hrs, Volume=	0.06 af		
Outflow =	0.1 cfs @	13.70 hrs, Volume=	0.05 af,	Atten= 92%,	Lag= 94.6 min
Primary =	0.1 cfs @	13.70 hrs, Volume=	0.05 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 172.98' @ 13.70 hrs Surf.Area= 1,637 sf Storage= 1,357 cf
Flood Elev= 174.50' Surf.Area= 3,064 sf Storage= 4,701 cf

Plug-Flow detention time= 273.1 min calculated for 0.05 af (76% of inflow)
Center-of-Mass det. time= 185.5 min (1,030.5 - 845.0)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	4,701 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
172.00	1,153	274.0	0	0	1,153
173.00	1,649	301.0	1,394	1,394	2,421
174.00	2,307	376.0	1,969	3,362	6,476
174.50	3,064	401.0	1,338	4,701	8,034

Device	Routing	Invert	Outlet Devices
#1	Primary	174.00'	**6.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	172.50'	**0.8" Vert. Riser Perforations X 6.00** C= 0.600
#3	Primary	173.80'	**8.0" Horiz. Perf 8" Riser w/ Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.1 cfs @ 13.70 hrs HW=172.98' (Free Discharge)
- **1=Grass Spillway** (Controls 0.0 cfs)
- **2=Riser Perforations** (Orifice Controls 0.1 cfs @ 3.2 fps)
- **3=Perf 8" Riser w/ Grate** (Controls 0.0 cfs)

Summary for Pond PW2: Pocket Wetland No. 2

Inflow Area = 0.247 ac, 36.97% Impervious, Inflow Depth = 1.55" for 10 Yr event
Inflow = 0.5 cfs @ 12.11 hrs, Volume= 0.03 af
Outflow = 0.0 cfs @ 13.07 hrs, Volume= 0.02 af, Atten= 91%, Lag= 57.4 min
Primary = 0.0 cfs @ 13.07 hrs, Volume= 0.02 af

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 171.25' @ 13.07 hrs Surf.Area= 1,078 sf Storage= 689 cf
Flood Elev= 172.50' Surf.Area= 1,862 sf Storage= 2,376 cf

Plug-Flow detention time= 235.0 min calculated for 0.02 af (69% of inflow)
Center-of-Mass det. time= 135.7 min (980.4 - 844.7)

Volume	Invert	Avail.Storage	Storage Description
#1	170.50'	2,376 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.50	711	133.0	0	0	711
171.00	1,001	149.0	426	426	1,077
172.00	1,322	163.0	1,158	1,584	1,458
172.50	1,862	185.0	792	2,376	2,073

Device	Routing	Invert	Outlet Devices
#1	Primary	172.00'	**6.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	171.00'	**0.8" Vert. Riser Perforations X 6.00** C= 0.600
#3	Primary	171.80'	**8.0" Vert. 8" Perf. Riser w/ 8" Grate** C= 0.600

Primary OutFlow Max=0.0 cfs @ 13.07 hrs HW=171.25' (Free Discharge)
- **1=Grass Spillway** (Controls 0.0 cfs)
- **2=Riser Perforations** (Orifice Controls 0.0 cfs @ 2.3 fps)
- **3=8" Perf. Riser w/ 8" Grate** (Controls 0.0 cfs)

Summary for Pond RG1: Rain Garden No. 1

Inflow Area = 0.042 ac,100.00% Impervious, Inflow Depth = 4.31" for 10 Yr event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af
Outflow = 0.2 cfs @ 12.16 hrs, Volume= 0.02 af, Atten= 16%, Lag= 4.7 min
Discarded = 0.0 cfs @ 12.17 hrs, Volume= 0.01 af
Primary = 0.1 cfs @ 12.16 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 177.94' @ 12.17 hrs Surf.Area= 207 sf Storage= 165 cf
Flood Elev= 178.50' Surf.Area= 211 sf Storage= 179 cf

Plug-Flow detention time= 78.9 min calculated for 0.02 af (99% of inflow)

Center-of-Mass det. time= 75.1 min (824.7 - 749.6)

Volume	Invert	Avail.Storage	Storage Description
#1	177.00'	179 cf	**Rain Garden No. 1 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	148	41.0	0	0	148
178.00	211	58.0	179	179	291

Device	Routing	Invert	Outlet Devices
#1	Discarded	177.00'	**0.003300 fpm Exfiltration over Wetted area**
#2	Primary	177.90'	**10.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.17 hrs HW=177.93' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.16 hrs HW=177.93' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.1 cfs @ 0.4 fps)

Summary for Pond RG2: Rain Garden No. 2

Inflow Area =	0.019 ac,100.00% Impervious, Inflow Depth = 4.31" for 10 Yr event				
Inflow =	0.1 cfs @	12.09 hrs,	Volume=	0.01 af	
Outflow =	0.0 cfs @	12.65 hrs,	Volume=	0.01 af,	Atten= 88%, Lag= 33.8 min
Discarded =	0.0 cfs @	12.65 hrs,	Volume=	0.01 af	
Primary =	0.0 cfs @	0.00 hrs,	Volume=	0.00 af	

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 177.77' @ 12.65 hrs Surf.Area= 148 sf Storage= 100 cf
Flood Elev= 178.30' Surf.Area= 160 sf Storage= 135 cf

Plug-Flow detention time= 73.9 min calculated for 0.01 af (100% of inflow)
Center-of-Mass det. time= 73.9 min (823.5 - 749.6)

Volume	Invert	Avail.Storage	Storage Description
#1	177.00'	135 cf	**Rain Garden No. 2 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	112	34.0	0	0	112
178.00	160	48.0	135	135	212

Device	Routing	Invert	Outlet Devices
#1	Discarded	177.00'	**0.003300 fpm Exfiltration over Wetted area**
#2	Primary	177.90'	**10.0' long x 5.0' breadth Grass Spillway**
			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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.65 hrs HW=177.77' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=177.00' (Free Discharge)
└**2=Grass Spillway** (Controls 0.0 cfs)

Summary for Pond RG3: Rain Garden No. 3

Inflow Area =	0.036 ac,100.00% Impervious,	Inflow Depth =	4.31"	for 10 Yr event	
Inflow =	0.2 cfs @	12.09 hrs, Volume=	0.01 af		
Outflow =	0.2 cfs @	12.12 hrs, Volume=	0.01 af,	Atten= 2%,	Lag= 2.0 min
Discarded =	0.0 cfs @	12.10 hrs, Volume=	0.01 af		
Primary =	0.1 cfs @	12.12 hrs, Volume=	0.00 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 173.92' @ 12.10 hrs Surf.Area= 207 sf Storage= 163 cf
Flood Elev= 174.50' Surf.Area= 213 sf Storage= 180 cf

Plug-Flow detention time= 144.1 min calculated for 0.01 af (100% of inflow)
Center-of-Mass det. time= 151.7 min (901.3 - 749.6)

Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	180 cf	**Rain Garden No. 3 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
173.00	149	55.0	0	0	149
174.00	213	78.0	180	180	401

Device	Routing	Invert	Outlet Devices
#1	Primary	173.90'	**20.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	173.00'	**0.001400 fpm Exfiltration over Wetted area**

Discarded OutFlow Max=0.0 cfs @ 12.10 hrs HW=173.92' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.12 hrs HW=173.92' (Free Discharge)
└**1=Grass Spillway** (Weir Controls 0.1 cfs @ 0.3 fps)

Time span=0.00-35.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Bld1: Flow to RG2 Runoff Area=822 sf 100.00% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld2: Flow to RG1 Runoff Area=1,048 sf 100.00% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld3: Flow to RG1 Runoff Area=784 sf 100.00% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld4: Flow to RG3 Runoff Area=784 sf 100.00% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld5: Flow to RG3 Runoff Area=784 sf 100.00% Impervious Runoff Depth=5.11"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment P-1-1: Flow to Pocket Runoff Area=14,380 sf 31.90% Impervious Runoff Depth=2.47"
Tc=6.0 min CN=72 Runoff=0.9 cfs 0.07 af

Subcatchment P-1-2: Flow to Pocket Runoff Area=2,510 sf 16.25% Impervious Runoff Depth=1.97"
Tc=6.0 min CN=66 Runoff=0.1 cfs 0.01 af

Subcatchment P-1-3: Flow to Pocket Runoff Area=9,205 sf 26.24% Impervious Runoff Depth=2.22"
Flow Length=202' Tc=6.0 min CN=69 Runoff=0.5 cfs 0.04 af

Subcatchment P-1-4: Flow to DP1 Runoff Area=29,344 sf 0.22% Impervious Runoff Depth=2.47"
Flow Length=355' Tc=33.5 min CN=72 Runoff=1.0 cfs 0.14 af

Subcatchment P-2: Flow to Parker Street Runoff Area=1,993 sf 20.87% Impervious Runoff Depth=0.90"
Tc=6.0 min CN=51 Runoff=0.0 cfs 0.00 af

Subcatchment P-3: Flow to Northeast Property Runoff Area=427 sf 0.00% Impervious Runoff Depth=0.28"
Flow Length=43' Slope=0.0580 '/' Tc=6.0 min CN=39 Runoff=0.0 cfs 0.00 af

Reach DP1: Stone Headwall Inflow=1.2 cfs 0.24 af
Outflow=1.2 cfs 0.24 af

Reach DP2: Parker Street Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Reach DP3: Northeast Property Line Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Reach Outlet: Outlet Pipe 1 Avg. Depth=0.13' Max Vel=1.9 fps Inflow=0.1 cfs 0.07 af
D=8.0" n=0.013 L=25.0' S=0.0080 '/' Capacity=1.1 cfs Outflow=0.1 cfs 0.07 af

Reach Outlet2: Outlet Pipe 2 Avg. Depth=0.12' Max Vel=1.7 fps Inflow=0.1 cfs 0.03 af
D=8.0" n=0.013 L=40.0' S=0.0075 '/' Capacity=1.0 cfs Outflow=0.1 cfs 0.03 af

Pond PW1: Pocket Wetland No. 1 Peak Elev=173.29' Storage=1,896 cf Inflow=1.3 cfs 0.08 af
Outflow=0.1 cfs 0.07 af

Pond PW2: Pocket Wetland No. 2 Peak Elev=171.49' Storage=949 cf Inflow=0.7 cfs 0.04 af
Outflow=0.1 cfs 0.03 af

Pond RG1: Rain Garden No. 1 Peak Elev=177.94' Storage=167 cf Inflow=0.2 cfs 0.02 af
Discarded=0.0 cfs 0.01 af Primary=0.2 cfs 0.00 af Outflow=0.2 cfs 0.02 af

Pond RG2: Rain Garden No. 2 Peak Elev=177.90' Storage=120 cf Inflow=0.1 cfs 0.01 af
Discarded=0.0 cfs 0.01 af Primary=0.0 cfs 0.00 af Outflow=0.0 cfs 0.01 af

Pond RG3: Rain Garden No. 3 Peak Elev=173.92' Storage=164 cf Inflow=0.2 cfs 0.02 af
Discarded=0.0 cfs 0.01 af Primary=0.2 cfs 0.00 af Outflow=0.2 cfs 0.02 af

Summary for Subcatchment Bld1: Flow to RG2

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
*	822	98	Roof Area
	822		Impervious Area

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

Summary for Subcatchment Bld2: Flow to RG1

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
*	1,048	98	Roof Area
	1,048		Impervious Area

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

Summary for Subcatchment Bld3: Flow to RG1

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
*	784	98	Roff Area
	784		Impervious Area

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

Summary for Subcatchment Bld4: Flow to RG3

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
*	784	98	Roof Area
	784		Impervious Area

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

Summary for Subcatchment Bld5: Flow to RG3

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
*	784	98	Roof Area
	784		Impervious Area

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

Summary for Subcatchment P-1-1: Flow to Pocket Wetland No. 1 (South)

Runoff = 0.9 cfs @ 12.10 hrs, Volume= 0.07 af, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
*	4,587	98	Paved driveway, parking & sidewalks
	239	30	Woods, Good, HSG A
	464	80	>75% Grass cover, Good, HSG D
	6,091	61	>75% Grass cover, Good, HSG B
	1,700	39	>75% Grass cover, Good, HSG A
*	1,299	78	Pocket Wetland 1
	14,380	72	Weighted Average
	9,793		Pervious Area
	4,587		Impervious Area

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

Summary for Subcatchment P-1-2: Flow to Pocket Wetland No. 1 (North)

Runoff = 0.1 cfs @ 12.10 hrs, Volume= 0.01 af, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
	993	39	>75% Grass cover, Good, HSG A
	736	80	>75% Grass cover, Good, HSG D
*	408	98	Paved parking & Sidewalk
*	373	78	Pocket Wetland 1
	2,510	66	Weighted Average
	2,102		Pervious Area
	408		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment P-1-3: Flow to Pocket Wetland No. 3

Runoff = 0.5 cfs @ 12.10 hrs, Volume= 0.04 af, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
	469	76	Gravel roads, HSG A
*	2,415	98	Paved driveway, parking & sidewalks
	2,781	61	>75% Grass cover, Good, HSG B
	2,093	39	>75% Grass cover, Good, HSG A
*	1,322	78	Pocket Wetland 2
	125	55	Woods, Good, HSG B
	9,205	69	Weighted Average
	6,790		Pervious Area
	2,415		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	30	0.2300	0.2		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	115	0.0400	4.1		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	57	0.0400	3.2		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.9	202	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment P-1-4: Flow to DP1

Runoff = 1.0 cfs @ 12.48 hrs, Volume= 0.14 af, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
	1,802	39	>75% Grass cover, Good, HSG A
	1,502	30	Woods, Good, HSG A
	338	77	Woods, Good, HSG D
*	21,368	78	Wetland
	2,491	80	>75% Grass cover, Good, HSG D
	646	55	Woods, Good, HSG B
	1,133	61	>75% Grass cover, Good, HSG B
*	64	98	Paved area around crossing grate
	29,344	72	Weighted Average
	29,280		Pervious Area
	64		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0580	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
28.1	305	0.0150	0.2	0.91	**Channel Flow, Swale Flow** Area= 5.0 sf Perim= 630.0' r= 0.01' n= 0.040 Winding stream, pools & shoals
33.5	355	Total			

Summary for Subcatchment P-2: Flow to Parker Street

Runoff = 0.0 cfs @ 12.12 hrs, Volume= 0.00 af, Depth= 0.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

	Area (sf)	CN	Description
	1,577	39	>75% Grass cover, Good, HSG A
*	416	98	Paved parking sidewalks & Porch Roof
	1,993	51	Weighted Average
	1,577		Pervious Area
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment P-3: Flow to Northeast Property Line

Runoff = 0.0 cfs @ 12.42 hrs, Volume= 0.00 af, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Yr Rainfall=5.35"

Area (sf)	CN	Description
427	39	>75% Grass cover, Good, HSG A
427		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	43	0.0580	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	43	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach DP1: Stone Headwall

Inflow Area = 1.370 ac, 19.60% Impervious, Inflow Depth > 2.10" for 25 Yr event
Inflow = 1.2 cfs @ 12.49 hrs, Volume= 0.24 af
Outflow = 1.2 cfs @ 12.49 hrs, Volume= 0.24 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Parker Street

Inflow Area = 0.046 ac, 20.87% Impervious, Inflow Depth = 0.90" for 25 Yr event
Inflow = 0.0 cfs @ 12.12 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 12.12 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: Northeast Property Line

Inflow Area = 0.010 ac, 0.00% Impervious, Inflow Depth = 0.28" for 25 Yr event
Inflow = 0.0 cfs @ 12.42 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 12.42 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach Outlet: Outlet Pipe 1

Inflow Area = 0.449 ac, 39.14% Impervious, Inflow Depth > 1.79" for 25 Yr event
Inflow = 0.1 cfs @ 13.65 hrs, Volume= 0.07 af
Outflow = 0.1 cfs @ 13.66 hrs, Volume= 0.07 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.9 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.2 fps, Avg. Travel Time= 0.4 min

Peak Storage= 1 cf @ 13.65 hrs, Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.1 cfs

8.0" Diameter Pipe, n= 0.013 Corrugated PE, smooth interior
Length= 25.0' Slope= 0.0080 '/'
Inlet Invert= 172.00', Outlet Invert= 171.80'

Summary for Reach Outlet2: Outlet Pipe 2

Inflow Area = 0.247 ac, 36.97% Impervious, Inflow Depth > 1.64" for 25 Yr event
Inflow = 0.1 cfs @ 13.00 hrs, Volume= 0.03 af
Outflow = 0.1 cfs @ 13.01 hrs, Volume= 0.03 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.7 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 0.8 min

Peak Storage= 2 cf @ 13.00 hrs, Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.0 cfs

8.0" Diameter Pipe, n= 0.013 Corrugated PE, smooth interior
Length= 40.0' Slope= 0.0075 '/'
Inlet Invert= 170.50', Outlet Invert= 170.20'

Summary for Pond PW1: Pocket Wetland No. 1

Inflow Area =	0.449 ac,	39.14% Impervious,	Inflow Depth =	2.18"	for 25 Yr event
Inflow =	1.3 cfs @	12.10 hrs, Volume=	0.08 af		
Outflow =	0.1 cfs @	13.65 hrs, Volume=	0.07 af,	Atten= 93%,	Lag= 92.7 min
Primary =	0.1 cfs @	13.65 hrs, Volume=	0.07 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 173.29' @ 13.65 hrs Surf.Area= 1,828 sf Storage= 1,896 cf
Flood Elev= 174.50' Surf.Area= 3,064 sf Storage= 4,701 cf

Plug-Flow detention time= 288.8 min calculated for 0.07 af (82% of inflow)
Center-of-Mass det. time= 215.8 min (1,051.7 - 835.9)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	4,701 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
172.00	1,153	274.0	0	0	1,153
173.00	1,649	301.0	1,394	1,394	2,421
174.00	2,307	376.0	1,969	3,362	6,476
174.50	3,064	401.0	1,338	4,701	8,034

Device	Routing	Invert	Outlet Devices
#1	Primary	174.00'	**6.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	172.50'	**0.8" Vert. Riser Perforations X 6.00** C= 0.600
#3	Primary	173.80'	**8.0" Horiz. Perf 8" Riser w/ Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.1 cfs @ 13.65 hrs HW=173.29' (Free Discharge)
- **1=Grass Spillway** (Controls 0.0 cfs)
- **2=Riser Perforations** (Orifice Controls 0.1 cfs @ 4.2 fps)
- **3=Perf 8" Riser w/ Grate** (Controls 0.0 cfs)

Summary for Pond PW2: Pocket Wetland No. 2

Inflow Area = 0.247 ac, 36.97% Impervious, Inflow Depth = 2.11" for 25 Yr event
Inflow = 0.7 cfs @ 12.10 hrs, Volume= 0.04 af
Outflow = 0.1 cfs @ 13.00 hrs, Volume= 0.03 af, Atten= 90%, Lag= 54.0 min
Primary = 0.1 cfs @ 13.00 hrs, Volume= 0.03 af

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 171.49' @ 13.00 hrs Surf.Area= 1,152 sf Storage= 949 cf
Flood Elev= 172.50' Surf.Area= 1,862 sf Storage= 2,376 cf

Plug-Flow detention time= 218.7 min calculated for 0.03 af (78% of inflow)
Center-of-Mass det. time= 136.2 min (971.8 - 835.6)

Volume	Invert	Avail.Storage	Storage Description
#1	170.50'	2,376 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.50	711	133.0	0	0	711
171.00	1,001	149.0	426	426	1,077
172.00	1,322	163.0	1,158	1,584	1,458
172.50	1,862	185.0	792	2,376	2,073

Device	Routing	Invert	Outlet Devices
#1	Primary	172.00'	**6.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	171.00'	**0.8" Vert. Riser Perforations X 6.00** C= 0.600
#3	Primary	171.80'	**8.0" Vert. 8" Perf. Riser w/ 8" Grate** C= 0.600

Primary OutFlow Max=0.1 cfs @ 13.00 hrs HW=171.49' (Free Discharge)
- **1=Grass Spillway** (Controls 0.0 cfs)
- **2=Riser Perforations** (Orifice Controls 0.1 cfs @ 3.2 fps)
- **3=8" Perf. Riser w/ 8" Grate** (Controls 0.0 cfs)

Summary for Pond RG1: Rain Garden No. 1

Inflow Area = 0.042 ac,100.00% Impervious, Inflow Depth = 5.11" for 25 Yr event
Inflow = 0.2 cfs @ 12.09 hrs, Volume= 0.02 af
Outflow = 0.2 cfs @ 12.12 hrs, Volume= 0.02 af, Atten= 0%, Lag= 1.8 min
Discarded = 0.0 cfs @ 12.12 hrs, Volume= 0.01 af
Primary = 0.2 cfs @ 12.12 hrs, Volume= 0.00 af

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 177.94' @ 12.12 hrs Surf.Area= 207 sf Storage= 167 cf
Flood Elev= 178.50' Surf.Area= 211 sf Storage= 179 cf

Plug-Flow detention time= 78.8 min calculated for 0.02 af (99% of inflow)

Center-of-Mass det. time= 72.1 min (819.0 - 746.9)

Volume	Invert	Avail.Storage	Storage Description
#1	177.00'	179 cf	**Rain Garden No. 1 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	148	41.0	0	0	148
178.00	211	58.0	179	179	291

Device	Routing	Invert	Outlet Devices
#1	Discarded	177.00'	**0.003300 fpm Exfiltration over Wetted area**
#2	Primary	177.90'	**10.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.12 hrs HW=177.94' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.12 hrs HW=177.94' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.2 cfs @ 0.5 fps)

Summary for Pond RG2: Rain Garden No. 2

Inflow Area =	0.019 ac,100.00% Impervious,	Inflow Depth =	5.11"	for 25 Yr event	
Inflow =	0.1 cfs @	12.09 hrs, Volume=	0.01 af		
Outflow =	0.0 cfs @	12.51 hrs, Volume=	0.01 af,	Atten= 78%,	Lag= 25.6 min
Discarded =	0.0 cfs @	12.52 hrs, Volume=	0.01 af		
Primary =	0.0 cfs @	12.51 hrs, Volume=	0.00 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 177.90' @ 12.52 hrs Surf.Area= 155 sf Storage= 120 cf
Flood Elev= 178.30' Surf.Area= 160 sf Storage= 135 cf

Plug-Flow detention time= 85.4 min calculated for 0.01 af (100% of inflow)
Center-of-Mass det. time= 85.2 min (832.2 - 746.9)

Volume	Invert	Avail.Storage	Storage Description
#1	177.00'	135 cf	**Rain Garden No. 2 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	112	34.0	0	0	112
178.00	160	48.0	135	135	212

Device	Routing	Invert	Outlet Devices
#1	Discarded	177.00'	**0.003300 fpm Exfiltration over Wetted area**
#2	Primary	177.90'	**10.0' long x 5.0' breadth Grass Spillway**
			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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.52 hrs HW=177.90' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 12.51 hrs HW=177.90' (Free Discharge)
└**2=Grass Spillway** (Weir Controls 0.0 cfs @ 0.1 fps)

Summary for Pond RG3: Rain Garden No. 3

Inflow Area =	0.036 ac,100.00% Impervious, Inflow Depth = 5.11" for 25 Yr event				
Inflow =	0.2 cfs @	12.09 hrs,	Volume=	0.02 af	
Outflow =	0.2 cfs @	12.09 hrs,	Volume=	0.02 af,	Atten= 1%, Lag= 0.3 min
Discarded =	0.0 cfs @	12.09 hrs,	Volume=	0.01 af	
Primary =	0.2 cfs @	12.09 hrs,	Volume=	0.00 af	

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 173.92' @ 12.09 hrs Surf.Area= 208 sf Storage= 164 cf
Flood Elev= 174.50' Surf.Area= 213 sf Storage= 180 cf

Plug-Flow detention time= 141.8 min calculated for 0.02 af (100% of inflow)
Center-of-Mass det. time= 142.7 min (889.6 - 746.9)

Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	180 cf	**Rain Garden No. 3 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
173.00	149	55.0	0	0	149
174.00	213	78.0	180	180	401

Device	Routing	Invert	Outlet Devices
#1	Primary	173.90'	**20.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	173.00'	**0.001400 fpm Exfiltration over Wetted area**

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=173.92' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=173.92' (Free Discharge)
└**1=Grass Spillway** (Weir Controls 0.2 cfs @ 0.4 fps)

Time span=0.00-35.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Bld1: Flow to RG2 Runoff Area=822 sf 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld2: Flow to RG1 Runoff Area=1,048 sf 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld3: Flow to RG1 Runoff Area=784 sf 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld4: Flow to RG3 Runoff Area=784 sf 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment Bld5: Flow to RG3 Runoff Area=784 sf 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=0.1 cfs 0.01 af

Subcatchment P-1-1: Flow to Pocket Runoff Area=14,380 sf 31.90% Impervious Runoff Depth=3.41"
Tc=6.0 min CN=72 Runoff=1.3 cfs 0.09 af

Subcatchment P-1-2: Flow to Pocket Runoff Area=2,510 sf 16.25% Impervious Runoff Depth=2.82"
Tc=6.0 min CN=66 Runoff=0.2 cfs 0.01 af

Subcatchment P-1-3: Flow to Pocket Runoff Area=9,205 sf 26.24% Impervious Runoff Depth=3.11"
Flow Length=202' Tc=6.0 min CN=69 Runoff=0.8 cfs 0.05 af

Subcatchment P-1-4: Flow to DP1 Runoff Area=29,344 sf 0.22% Impervious Runoff Depth=3.41"
Flow Length=355' Tc=33.5 min CN=72 Runoff=1.4 cfs 0.19 af

Subcatchment P-2: Flow to Parker Street Runoff Area=1,993 sf 20.87% Impervious Runoff Depth=1.48"
Tc=6.0 min CN=51 Runoff=0.1 cfs 0.01 af

Subcatchment P-3: Flow to Northeast Property Runoff Area=427 sf 0.00% Impervious Runoff Depth=0.60"
Flow Length=43' Slope=0.0580 '/' Tc=6.0 min CN=39 Runoff=0.0 cfs 0.00 af

Reach DP1: Stone Headwall Inflow=1.6 cfs 0.34 af
Outflow=1.6 cfs 0.34 af

Reach DP2: Parker Street Inflow=0.1 cfs 0.01 af
Outflow=0.1 cfs 0.01 af

Reach DP3: Northeast Property Line Inflow=0.0 cfs 0.00 af
Outflow=0.0 cfs 0.00 af

Reach Outlet: Outlet Pipe 1 Avg. Depth=0.14' Max Vel=2.0 fps Inflow=0.1 cfs 0.10 af
D=8.0" n=0.013 L=25.0' S=0.0080 '/' Capacity=1.1 cfs Outflow=0.1 cfs 0.10 af

Reach Outlet2: Outlet Pipe 2 Avg. Depth=0.14' Max Vel=1.9 fps Inflow=0.1 cfs 0.05 af
D=8.0" n=0.013 L=40.0' S=0.0075 '/' Capacity=1.0 cfs Outflow=0.1 cfs 0.05 af

Pond PW1: Pocket Wetland No. 1 Peak Elev=173.76' Storage=2,831 cf Inflow=1.7 cfs 0.11 af
Outflow=0.1 cfs 0.10 af

Pond PW2: Pocket Wetland No. 2 Peak Elev=171.85' Storage=1,385 cf Inflow=1.0 cfs 0.06 af
Outflow=0.1 cfs 0.05 af

Pond RG1: Rain Garden No. 1 Peak Elev=177.95' Storage=168 cf Inflow=0.3 cfs 0.02 af
Discarded=0.0 cfs 0.02 af Primary=0.2 cfs 0.01 af Outflow=0.3 cfs 0.02 af

Pond RG2: Rain Garden No. 2 Peak Elev=177.92' Storage=122 cf Inflow=0.1 cfs 0.01 af
Discarded=0.0 cfs 0.01 af Primary=0.0 cfs 0.00 af Outflow=0.1 cfs 0.01 af

Pond RG3: Rain Garden No. 3 Peak Elev=173.93' Storage=165 cf Inflow=0.2 cfs 0.02 af
Discarded=0.0 cfs 0.01 af Primary=0.2 cfs 0.01 af Outflow=0.2 cfs 0.02 af

Summary for Subcatchment Bld1: Flow to RG2

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
*	822	98	Roof Area
	822		Impervious Area

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

Summary for Subcatchment Bld2: Flow to RG1

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
*	1,048	98	Roof Area
	1,048		Impervious Area

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

Summary for Subcatchment Bld3: Flow to RG1

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
*	784	98	Roff Area
	784		Impervious Area

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

Summary for Subcatchment Bld4: Flow to RG3

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
*	784	98	Roof Area
	784		Impervious Area

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

Summary for Subcatchment Bld5: Flow to RG3

Runoff = 0.1 cfs @ 12.09 hrs, Volume= 0.01 af, Depth= 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
*	784	98	Roof Area
	784		Impervious Area

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

Summary for Subcatchment P-1-1: Flow to Pocket Wetland No. 1 (South)

Runoff = 1.3 cfs @ 12.09 hrs, Volume= 0.09 af, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
*	4,587	98	Paved driveway, parking & sidewalks
	239	30	Woods, Good, HSG A
	464	80	>75% Grass cover, Good, HSG D
	6,091	61	>75% Grass cover, Good, HSG B
	1,700	39	>75% Grass cover, Good, HSG A
*	1,299	78	Pocket Wetland 1
	14,380	72	Weighted Average
	9,793		Pervious Area
	4,587		Impervious Area

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

Summary for Subcatchment P-1-2: Flow to Pocket Wetland No. 1 (North)

Runoff = 0.2 cfs @ 12.10 hrs, Volume= 0.01 af, Depth= 2.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
	993	39	>75% Grass cover, Good, HSG A
	736	80	>75% Grass cover, Good, HSG D
*	408	98	Paved parking & Sidewalk
*	373	78	Pocket Wetland 1
	2,510	66	Weighted Average
	2,102		Pervious Area
	408		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment P-1-3: Flow to Pocket Wetland No. 3

Runoff = 0.8 cfs @ 12.09 hrs, Volume= 0.05 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
	469	76	Gravel roads, HSG A
*	2,415	98	Paved driveway, parking & sidewalks
	2,781	61	>75% Grass cover, Good, HSG B
	2,093	39	>75% Grass cover, Good, HSG A
*	1,322	78	Pocket Wetland 2
	125	55	Woods, Good, HSG B
	9,205	69	Weighted Average
	6,790		Pervious Area
	2,415		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.1	30	0.2300	0.2		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	115	0.0400	4.1		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	57	0.0400	3.2		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.9	202	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment P-1-4: Flow to DP1

Runoff = 1.4 cfs @ 12.47 hrs, Volume= 0.19 af, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
	1,802	39	>75% Grass cover, Good, HSG A
	1,502	30	Woods, Good, HSG A
	338	77	Woods, Good, HSG D
*	21,368	78	Wetland
	2,491	80	>75% Grass cover, Good, HSG D
	646	55	Woods, Good, HSG B
	1,133	61	>75% Grass cover, Good, HSG B
*	64	98	Paved area around crossing grate
	29,344	72	Weighted Average
	29,280		Pervious Area
	64		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0580	0.2		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.10"
28.1	305	0.0150	0.2	0.91	**Channel Flow, Swale Flow** Area= 5.0 sf Perim= 630.0' r= 0.01' n= 0.040 Winding stream, pools & shoals
33.5	355	Total			

Summary for Subcatchment P-2: Flow to Parker Street

Runoff = 0.1 cfs @ 12.11 hrs, Volume= 0.01 af, Depth= 1.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
	1,577	39	>75% Grass cover, Good, HSG A
*	416	98	Paved parking sidewalks & Porch Roof
	1,993	51	Weighted Average
	1,577		Pervious Area
	416		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, TR-55 Minimum**

Summary for Subcatchment P-3: Flow to Northeast Property Line

Runoff = 0.0 cfs @ 12.29 hrs, Volume= 0.00 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Yr Rainfall=6.50"

	Area (sf)	CN	Description
	427	39	>75% Grass cover, Good, HSG A
	427		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	43	0.0580	0.2		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.3	43	Total, Increased to minimum Tc = 6.0 min			

Summary for Reach DP1: Stone Headwall

Inflow Area = 1.370 ac, 19.60% Impervious, Inflow Depth > 3.01" for 100 Yr event
Inflow = 1.6 cfs @ 12.48 hrs, Volume= 0.34 af
Outflow = 1.6 cfs @ 12.48 hrs, Volume= 0.34 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach DP2: Parker Street

Inflow Area = 0.046 ac, 20.87% Impervious, Inflow Depth = 1.48" for 100 Yr event
Inflow = 0.1 cfs @ 12.11 hrs, Volume= 0.01 af
Outflow = 0.1 cfs @ 12.11 hrs, Volume= 0.01 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach DP3: Northeast Property Line

Inflow Area = 0.010 ac, 0.00% Impervious, Inflow Depth = 0.60" for 100 Yr event
Inflow = 0.0 cfs @ 12.29 hrs, Volume= 0.00 af
Outflow = 0.0 cfs @ 12.29 hrs, Volume= 0.00 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs

Summary for Reach Outlet: Outlet Pipe 1

Inflow Area = 0.449 ac, 39.14% Impervious, Inflow Depth > 2.68" for 100 Yr event
Inflow = 0.1 cfs @ 13.76 hrs, Volume= 0.10 af
Outflow = 0.1 cfs @ 13.77 hrs, Volume= 0.10 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.0 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.4 fps, Avg. Travel Time= 0.3 min

Peak Storage= 1 cf @ 13.76 hrs, Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.1 cfs

8.0" Diameter Pipe, n= 0.013 Corrugated PE, smooth interior
Length= 25.0' Slope= 0.0080 '/'
Inlet Invert= 172.00', Outlet Invert= 171.80'

Summary for Reach Outlet2: Outlet Pipe 2

Inflow Area = 0.247 ac, 36.97% Impervious, Inflow Depth > 2.52" for 100 Yr event
Inflow = 0.1 cfs @ 12.93 hrs, Volume= 0.05 af
Outflow = 0.1 cfs @ 12.94 hrs, Volume= 0.05 af, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.9 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 0.7 min

Peak Storage= 2 cf @ 12.93 hrs, Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 0.67', Capacity at Bank-Full= 1.0 cfs

8.0" Diameter Pipe, n= 0.013 Corrugated PE, smooth interior
Length= 40.0' Slope= 0.0075 '/'
Inlet Invert= 170.50', Outlet Invert= 170.20'

Summary for Pond PW1: Pocket Wetland No. 1

Inflow Area =	0.449 ac,	39.14% Impervious,	Inflow Depth =	3.07"	for 100 Yr event
Inflow =	1.7 cfs @	12.09 hrs, Volume=	0.11 af		
Outflow =	0.1 cfs @	13.76 hrs, Volume=	0.10 af,	Atten= 94%,	Lag= 99.8 min
Primary =	0.1 cfs @	13.76 hrs, Volume=	0.10 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 173.76' @ 13.76 hrs Surf.Area= 2,140 sf Storage= 2,831 cf
Flood Elev= 174.50' Surf.Area= 3,064 sf Storage= 4,701 cf

Plug-Flow detention time= 327.9 min calculated for 0.10 af (87% of inflow)
Center-of-Mass det. time= 270.5 min (1,095.8 - 825.2)

Volume	Invert	Avail.Storage	Storage Description
#1	172.00'	4,701 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
172.00	1,153	274.0	0	0	1,153
173.00	1,649	301.0	1,394	1,394	2,421
174.00	2,307	376.0	1,969	3,362	6,476
174.50	3,064	401.0	1,338	4,701	8,034

Device	Routing	Invert	Outlet Devices
#1	Primary	174.00'	**6.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	172.50'	**0.8" Vert. Riser Perforations X 6.00** C= 0.600
#3	Primary	173.80'	**8.0" Horiz. Perf 8" Riser w/ Grate** Limited to weir flow C= 0.600

Primary OutFlow Max=0.1 cfs @ 13.76 hrs HW=173.76' (Free Discharge)
- **1=Grass Spillway** (Controls 0.0 cfs)
- **2=Riser Perforations** (Orifice Controls 0.1 cfs @ 5.3 fps)
- **3=Perf 8" Riser w/ Grate** (Controls 0.0 cfs)

Summary for Pond PW2: Pocket Wetland No. 2

Inflow Area =	0.247 ac,	36.97% Impervious,	Inflow Depth =	2.99"	for 100 Yr event
Inflow =	1.0 cfs @	12.09 hrs, Volume=	0.06 af		
Outflow =	0.1 cfs @	12.93 hrs, Volume=	0.05 af,	Atten= 90%,	Lag= 50.1 min
Primary =	0.1 cfs @	12.93 hrs, Volume=	0.05 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 171.85' @ 12.93 hrs Surf.Area= 1,270 sf Storage= 1,385 cf
Flood Elev= 172.50' Surf.Area= 1,862 sf Storage= 2,376 cf

Plug-Flow detention time= 219.2 min calculated for 0.05 af (84% of inflow)
Center-of-Mass det. time= 154.4 min (980.4 - 825.9)

Volume	Invert	Avail.Storage	Storage Description
#1	170.50'	2,376 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.50	711	133.0	0	0	711
171.00	1,001	149.0	426	426	1,077
172.00	1,322	163.0	1,158	1,584	1,458
172.50	1,862	185.0	792	2,376	2,073

Device	Routing	Invert	Outlet Devices
#1	Primary	172.00'	**6.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	171.00'	**0.8" Vert. Riser Perforations X 6.00** C= 0.600
#3	Primary	171.80'	**8.0" Vert. 8" Perf. Riser w/ 8" Grate** C= 0.600

Primary OutFlow Max=0.1 cfs @ 12.93 hrs HW=171.85' (Free Discharge)
- **1=Grass Spillway** (Controls 0.0 cfs)
- **2=Riser Perforations** (Orifice Controls 0.1 cfs @ 4.3 fps)
- **3=8" Perf. Riser w/ 8" Grate** (Orifice Controls 0.0 cfs @ 0.7 fps)

Summary for Pond RG1: Rain Garden No. 1

Inflow Area =	0.042 ac,	100.00% Impervious,	Inflow Depth =	6.26"	for 100 Yr event
Inflow =	0.3 cfs @	12.09 hrs, Volume=	0.02 af		
Outflow =	0.3 cfs @	12.09 hrs, Volume=	0.02 af,	Atten= 2%,	Lag= 0.4 min
Discarded =	0.0 cfs @	12.09 hrs, Volume=	0.02 af		
Primary =	0.2 cfs @	12.09 hrs, Volume=	0.01 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 177.95' @ 12.09 hrs Surf.Area= 207 sf Storage= 168 cf
Flood Elev= 178.50' Surf.Area= 211 sf Storage= 179 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)

Center-of-Mass det. time= 67.4 min (811.3 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	177.00'	179 cf	**Rain Garden No. 1 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	148	41.0	0	0	148
178.00	211	58.0	179	179	291

Device	Routing	Invert	Outlet Devices
#1	Discarded	177.00'	**0.003300 fpm Exfiltration over Wetted area**
#2	Primary	177.90'	**10.0' long x 5.0' 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=177.95' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=177.95' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.2 cfs @ 0.5 fps)

Summary for Pond RG2: Rain Garden No. 2

Inflow Area =	0.019 ac,100.00% Impervious,	Inflow Depth =	6.26"	for 100 Yr event	
Inflow =	0.1 cfs @	12.09 hrs, Volume=	0.01 af		
Outflow =	0.1 cfs @	12.24 hrs, Volume=	0.01 af,	Atten= 51%,	Lag= 9.4 min
Discarded =	0.0 cfs @	12.25 hrs, Volume=	0.01 af		
Primary =	0.0 cfs @	12.24 hrs, Volume=	0.00 af		

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 177.92' @ 12.25 hrs Surf.Area= 156 sf Storage= 122 cf
Flood Elev= 178.30' Surf.Area= 160 sf Storage= 135 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 79.1 min (823.1 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	177.00'	135 cf	**Rain Garden No. 2 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
177.00	112	34.0	0	0	112
178.00	160	48.0	135	135	212

Device	Routing	Invert	Outlet Devices
#1	Discarded	177.00'	**0.003300 fpm Exfiltration over Wetted area**
#2	Primary	177.90'	**10.0' long x 5.0' breadth Grass Spillway**
			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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.25 hrs HW=177.92' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.0 cfs @ 12.24 hrs HW=177.91' (Free Discharge)
└─**2=Grass Spillway** (Weir Controls 0.0 cfs @ 0.3 fps)

Summary for Pond RG3: Rain Garden No. 3

Inflow Area =	0.036 ac,100.00% Impervious, Inflow Depth = 6.26" for 100 Yr event				
Inflow =	0.2 cfs @	12.09 hrs,	Volume=	0.02 af	
Outflow =	0.2 cfs @	12.09 hrs,	Volume=	0.02 af,	Atten= 1%, Lag= 0.3 min
Discarded =	0.0 cfs @	12.09 hrs,	Volume=	0.01 af	
Primary =	0.2 cfs @	12.09 hrs,	Volume=	0.01 af	

Routing by Stor-Ind method, Time Span= 0.00-35.00 hrs, dt= 0.05 hrs / 7
Peak Elev= 173.93' @ 12.09 hrs Surf.Area= 208 sf Storage= 165 cf
Flood Elev= 174.50' Surf.Area= 213 sf Storage= 180 cf

Plug-Flow detention time= 133.0 min calculated for 0.02 af (100% of inflow)
Center-of-Mass det. time= 131.2 min (875.2 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	180 cf	**Rain Garden No. 3 (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
173.00	149	55.0	0	0	149
174.00	213	78.0	180	180	401

Device	Routing	Invert	Outlet Devices
#1	Primary	173.90'	**20.0' long x 5.0' breadth Grass Spillway** 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) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	173.00'	**0.001400 fpm Exfiltration over Wetted area**

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=173.93' (Free Discharge)
└─**2=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=173.93' (Free Discharge)
└─**1=Grass Spillway** (Weir Controls 0.2 cfs @ 0.4 fps)

WATER QUALITY

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JOB 8319 - ACTON
SHEET NO. _____ OF _____
CALCULATED BY JJM DATE 08/06/09
CHECKED BY _____ DATE _____
SCALE 99 PARKER STREET

WATER QUALITY VOLUME CALCULATION (WQV)

TO THE POCKET WETLAND SYSTEM

12,328 SF Imp. − 4,222 sf (Rain Gardens) = 8,106 SF

⇒ 8,106 sf − 522 sf Flow offsite − 64 sf (grate) = 7,520 sf

Required: $(7{,}520\ sf)(1/2'')(1''/12''/ft) = 313.33\ CF \approx \underline{\underline{314\ CF}}$

Provided: (See attached) pocket wetland, below orifices

pocket wetland No. 1; storage below Elevation 172.50'
= 311 CF

pocket wetland No. 2; storage below Elevation 171.00'
= 400 CF

Total provided 400 CF + 311 CF = 711 CF > 314 CF

∴ OKAY

Hydrograph for Pond PW1: Pocket Wetland No. 1

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.0	0	172.00	0.0
0.50	0.0	0	172.00	0.0
1.00	0.0	0	172.00	0.0
1.50	0.0	0	172.00	0.0
2.00	0.0	0	172.00	0.0
2.50	0.0	0	172.00	0.0
3.00	0.0	0	172.00	0.0
3.50	0.0	0	172.00	0.0
4.00	0.0	0	172.00	0.0
4.50	0.0	0	172.00	0.0
5.00	0.0	0	172.00	0.0
5.50	0.0	0	172.00	0.0
6.00	0.0	0	172.00	0.0
6.50	0.0	0	172.00	0.0
7.00	0.0	0	172.00	0.0
7.50	0.0	0	172.00	0.0
8.00	0.0	0	172.00	0.0
8.50	0.0	0	172.00	0.0
9.00	0.0	6	172.01	0.0
9.50	0.0	22	172.02	0.0
10.00	0.0	51	172.04	0.0
10.50	0.0	99	172.08	0.0
11.00	0.1	176	172.15	0.0
11.50	0.1	311	172.26	0.0
12.00	**1.0**	903	172.69	0.0
12.50	**0.4**	2,553	173.63	0.1
13.00	0.2	2,776	173.74	0.1
13.50	0.1	**2,825**	**173.76**	**0.1**
14.00	0.1	**2,826**	**173.76**	**0.1**
14.50	0.1	2,793	173.74	0.1
15.00	0.1	2,743	173.72	0.1
15.50	0.1	2,675	173.69	0.1
16.00	0.1	2,590	173.65	0.1
16.50	0.0	2,493	173.60	0.1
17.00	0.0	2,391	173.55	0.1
17.50	0.0	2,285	173.49	0.1
18.00	0.0	2,175	173.44	0.1
18.50	0.0	2,064	173.38	0.1
19.00	0.0	1,955	173.32	0.1
19.50	0.0	1,850	173.26	0.1
20.00	0.0	1,748	173.21	0.1
20.50	0.0	1,650	173.15	0.1
21.00	0.0	1,557	173.10	0.1
21.50	0.0	1,467	173.04	0.1
22.00	0.0	1,383	172.99	0.1
22.50	0.0	1,303	172.94	0.1
23.00	0.0	1,227	172.90	0.1
23.50	0.0	1,157	172.85	0.1
24.00	0.0	1,091	172.81	0.1
24.50	0.0	1,007	172.76	0.0
25.00	0.0	926	172.70	0.0
25.50	0.0	857	172.66	0.0

STORAGE BELOW PERFORATIONS (172.50) = 311 CF

Hydrograph for Pond PW2: Pocket Wetland No. 2

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.0	0	170.50	0.0
0.50	0.0	0	170.50	0.0
1.00	0.0	0	170.50	0.0
1.50	0.0	0	170.50	0.0
2.00	0.0	0	170.50	0.0
2.50	0.0	0	170.50	0.0
3.00	0.0	0	170.50	0.0
3.50	0.0	0	170.50	0.0
4.00	0.0	0	170.50	0.0
4.50	0.0	0	170.50	0.0
5.00	0.0	0	170.50	0.0
5.50	0.0	0	170.50	0.0
6.00	0.0	0	170.50	0.0
6.50	0.0	0	170.50	0.0
7.00	0.0	0	170.50	0.0
7.50	0.0	0	170.50	0.0
8.00	0.0	0	170.50	0.0
8.50	0.0	0	170.50	0.0
9.00	0.0	0	170.50	0.0
9.50	0.0	4	170.51	0.0
10.00	0.0	15	170.52	0.0
10.50	0.0	35	170.55	0.0
11.00	0.0	69	170.59	0.0
11.50	0.0	132	170.67	0.0
12.00	**0.6**	453	171.03	0.0
12.50	**0.2**	**1,325**	**171.80**	**0.1**
13.00	0.1	**1,384**	**171.85**	**0.1**
13.50	0.1	1,353	171.82	0.1
14.00	0.1	1,307	171.78	0.1
14.50	0.0	1,244	171.73	0.1
15.00	0.0	1,175	171.68	0.1
15.50	0.0	1,101	171.62	0.1
16.00	0.0	1,023	171.55	0.1
16.50	0.0	946	171.48	0.1
17.00	0.0	872	171.42	0.1
17.50	0.0	803	171.36	0.1
18.00	0.0	739	171.30	0.1
18.50	0.0	682	171.25	0.0
19.00	0.0	632	171.20	0.0
19.50	0.0	591	171.16	0.0
20.00	0.0	557	171.13	0.0
20.50	0.0	531	171.10	0.0
21.00	0.0	511	171.08	0.0
21.50	0.0	496	171.07	0.0
22.00	0.0	487	171.06	0.0
22.50	0.0	480	171.05	0.0
23.00	0.0	476	171.05	0.0
23.50	0.0	473	171.05	0.0
24.00	0.0	471	171.04	0.0
24.50	0.0	458	171.03	0.0
25.00	0.0	450	171.02	0.0
25.50	0.0	444	171.02	0.0

STORAGE BELOW PERFORATIONS (171.00) SAY 400 CF

MERIDIAN ASSOCIATES, INC.
152 Conant St.
Beverly, MA 01915
(978) 299-0447

69 Milk St., Suite 302
Westborough, MA 01581
(508) 871-7030

JOB 8319
SHEET NO. 1 OF 3
CALCULATED BY JJM DATE 8/06/09
CHECKED BY MEB DATE 8/6/09
SCALE 99 PARKER STREET — ACTON, MA

Recharge Calculations

Impervious	WATERSHED	SOIL TYPE
2,795 sf	P-1-1	A
448 sf	P-1-1	A
1,351 sf	P-1-1	D
408 sf	P-1-2	A
708 SF	P-1-3	D
1,018 SF	P-1-3	A
792 SF	P-1-3	B
64 SF	P-1-4	D
522 SF	P-2	A
1,832 SF	Bldgs 2 & 3 to RG 1	A
822 SF	Bldg. 1 to RG 2	A
1,568 SF	Bldg 4 & 5 to RG 3	B

12,328 sf = 0.28 Acres

Total A soils = 7,845 SF Impervious Area

Total B soils = 2,360 SF Impervious Area

Total D soils = 2,123 SF Impervious Area

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JOB 8319
SHEET NO. 2 OF 3
CALCULATED BY JJM DATE 8/06/09
CHECKED BY MEB DATE 8/6/09
SCALE

Recharge CALCULATIONS → STATIC METHOD

- PROVIDE RECHARGE FOR ALL IMPERVIOUS SURFACES TO THE MAXIMUM EXTENT PRACTICABLE:

⊛ TOTAL SITE IMPERVIOUS = 12,328 SF PROPOSED

Depth factor = F = 0.6" (A soils)
0.35" (B soils)
0.10" (D soils)

Recharge Volume (R_V) = F × Impervious Area

R_V = (0.6")(7,845 SF)(1ft/12") = 392.3 CF ≈ 393 CF "A" soil

R_V = (0.35")(2,360 sf)(1ft/12") = 68.8 CF ≈ 69 CF "B" soil

R_V = (0.1")(2,123 sf)(1ft/12") = 17.7 CF ≈ 18 CF "D" soil

Total Required Recharge Volume = 393 + 69 + 18 = 480 CF

RAIN GARDENS PROVIDE RECHARGE OF 4,222 sf (ROOFS)

⇒ RAIN GARDENS PROVIDE: RG1 179 CF
RG2 135 CF
RG3 180 CF

494 CF of STORAGE
> 480 CF ✓

MERIDIAN ASSOCIATES, INC.
152 Conant St. Beverly, MA 01915 (978) 299-0447
69 Milk St., Suite 302 Westborough, MA 01581 (508) 871-7030

JOB 8319 - ACTON
SHEET NO. 3 OF 3
CALCULATED BY JJM DATE 08/06/09
CHECKED BY MEB DATE 8/6/09
SCALE

* ROUTING OF 65% OF IMPERVIOUS SURFACES TO RECHARGE BASINS RECOMMENDED TO ENSURE ENTIRE RECHARGE VOLUME IS RECHARGED BY BASINS.

"65% RULE" * (Total Impervious AREA)(0.65) = (12,328 sf)(0.65)
⇒ Required to Recharge = 8,013.2 sf

IF INCLUDE POCKET WETS ⇒ 4,222 sf (Rain Gardens) + 11,742 sf (Pocket Wetlands)
= 11,742 sf > 8,013 sf ∴ OKAY BUT,

(*) TO BE CONSERVATIVE, DO NOT INCLUDE POCKET WETLANDS; 11,742 sf − 7,520 sf (NO CREDIT)
= 4,222 sf < 8,013 sf
52% ∴ MAX EXTENT PRACTICABLE

- RAIN GARDEN DRAIN TIME:

DRAIN TIMES FOR ALL RAIN GARDENS GETTING RECHARGE VOLUME ARE LESS THAN 72 HOURS AS REQUIRED (SEE ATTACHED) ∴ OKAY

Hydrograph for Pond RG1: Rain Garden No. 1

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.0	0	177.25	0.0	0.0	0.0
0.50	0.0	0	177.25	0.0	0.0	0.0
1.00	0.0	0	177.25	0.0	0.0	0.0
1.50	0.0	0	177.25	0.0	0.0	0.0
2.00	0.0	0	177.25	0.0	0.0	0.0
2.50	0.0	0	177.25	0.0	0.0	0.0
3.00	0.0	0	177.25	0.0	0.0	0.0
3.50	0.0	1	177.25	0.0	0.0	0.0
4.00	0.0	1	177.25	0.0	0.0	0.0
4.50	0.0	1	177.25	0.0	0.0	0.0
5.00	0.0	1	177.25	0.0	0.0	0.0
5.50	0.0	1	177.26	0.0	0.0	0.0
6.00	0.0	1	177.26	0.0	0.0	0.0
6.50	0.0	1	177.26	0.0	0.0	0.0
7.00	0.0	1	177.26	0.0	0.0	0.0
7.50	0.0	1	177.26	0.0	0.0	0.0
8.00	0.0	1	177.26	0.0	0.0	0.0
8.50	0.0	2	177.26	0.0	0.0	0.0
9.00	0.0	3	177.27	0.0	0.0	0.0
9.50	0.0	6	177.29	0.0	0.0	0.0
10.00	0.0	12	177.33	0.0	0.0	0.0
10.50	0.0	21	177.39	0.0	0.0	0.0
11.00	0.0	35	177.49	0.0	0.0	0.0
11.50	0.0	58	177.67	0.0	0.0	0.0
12.00	**0.2**	**88**	**177.93**	**0.2**	**0.0**	**0.2**
12.50	**0.1**	**86**	**177.91**	**0.1**	**0.0**	**0.0**
13.00	0.0	85	177.90	0.0	0.0	0.0
13.50	0.0	84	177.90	0.0	0.0	0.0
14.00	0.0	84	177.90	0.0	0.0	0.0
14.50	0.0	83	177.89	0.0	0.0	0.0
15.00	0.0	79	177.85	0.0	0.0	0.0
15.50	0.0	72	177.79	0.0	0.0	0.0
16.00	0.0	64	177.72	0.0	0.0	0.0
16.50	0.0	54	177.65	0.0	0.0	0.0
17.00	0.0	45	177.57	0.0	0.0	0.0
17.50	0.0	35	177.50	0.0	0.0	0.0
18.00	0.0	25	177.43	0.0	0.0	0.0
18.50	0.0	16	177.36	0.0	0.0	0.0
19.00	0.0	7	177.30	0.0	0.0	0.0
19.50	0.0	1	177.26	0.0	0.0	0.0
20.00	0.0	1	177.26	0.0	0.0	0.0
20.50	0.0	1	177.26	0.0	0.0	0.0
21.00	0.0	1	177.25	0.0	0.0	0.0
21.50	0.0	1	177.25	0.0	0.0	0.0
22.00	0.0	1	177.25	0.0	0.0	0.0
22.50	0.0	1	177.25	0.0	0.0	0.0
23.00	0.0	1	177.25	0.0	0.0	0.0
23.50	0.0	1	177.25	0.0	0.0	0.0
24.00	0.0	1	177.25	0.0	0.0	0.0
24.50	0.0	0	177.25	0.0	0.0	0.0
25.00	0.0	0	177.25	0.0	0.0	0.0
25.50	0.0	0	177.25	0.0	0.0	0.0

Drains in 24.50 HRS

Hydrograph for Pond RG2: Rain Garden No. 2

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.0	0	177.25	0.0	0.0	0.0
0.50	0.0	0	177.25	0.0	0.0	0.0
1.00	0.0	0	177.25	0.0	0.0	0.0
1.50	0.0	0	177.25	0.0	0.0	0.0
2.00	0.0	0	177.25	0.0	0.0	0.0
2.50	0.0	0	177.25	0.0	0.0	0.0
3.00	0.0	0	177.25	0.0	0.0	0.0
3.50	0.0	0	177.25	0.0	0.0	0.0
4.00	0.0	0	177.25	0.0	0.0	0.0
4.50	0.0	0	177.25	0.0	0.0	0.0
5.00	0.0	0	177.25	0.0	0.0	0.0
5.50	0.0	0	177.25	0.0	0.0	0.0
6.00	0.0	0	177.25	0.0	0.0	0.0
6.50	0.0	0	177.25	0.0	0.0	0.0
7.00	0.0	0	177.25	0.0	0.0	0.0
7.50	0.0	1	177.26	0.0	0.0	0.0
8.00	0.0	1	177.26	0.0	0.0	0.0
8.50	0.0	1	177.26	0.0	0.0	0.0
9.00	0.0	1	177.26	0.0	0.0	0.0
9.50	0.0	1	177.26	0.0	0.0	0.0
10.00	0.0	2	177.27	0.0	0.0	0.0
10.50	0.0	5	177.30	0.0	0.0	0.0
11.00	0.0	10	177.36	0.0	0.0	0.0
11.50	0.0	19	177.46	0.0	0.0	0.0
12.00	**0.1**	**68**	**177.91**	**0.0**	**0.0**	**0.0**
12.50	**0.0**	**68**	**177.91**	**0.0**	**0.0**	**0.0**
13.00	0.0	68	177.90	0.0	0.0	0.0
13.50	0.0	68	177.90	0.0	0.0	0.0
14.00	0.0	67	177.89	0.0	0.0	0.0
14.50	0.0	64	177.87	0.0	0.0	0.0
15.00	0.0	60	177.84	0.0	0.0	0.0
15.50	0.0	55	177.79	0.0	0.0	0.0
16.00	0.0	49	177.74	0.0	0.0	0.0
16.50	0.0	43	177.68	0.0	0.0	0.0
17.00	0.0	36	177.62	0.0	0.0	0.0
17.50	0.0	30	177.56	0.0	0.0	0.0
18.00	0.0	23	177.49	0.0	0.0	0.0
18.50	0.0	16	177.43	0.0	0.0	0.0
19.00	0.0	10	177.36	0.0	0.0	0.0
19.50	0.0	4	177.29	0.0	0.0	0.0
20.00	0.0	0	177.25	0.0	0.0	0.0
20.50	0.0	0	177.25	0.0	0.0	0.0
21.00	0.0	0	177.25	0.0	0.0	0.0
21.50	0.0	0	177.25	0.0	0.0	0.0
22.00	0.0	0	177.25	0.0	0.0	0.0
22.50	0.0	0	177.25	0.0	0.0	0.0
23.00	0.0	0	177.25	0.0	0.0	0.0
23.50	0.0	0	177.25	0.0	0.0	0.0
24.00	0.0	0	177.25	0.0	0.0	0.0
24.50	0.0	0	177.25	0.0	0.0	0.0
25.00	0.0	0	177.25	0.0	0.0	0.0
25.50	0.0	0	177.25	0.0	0.0	0.0

Drains in 20.00 HRS

Hydrograph for Pond RG3: Rain Garden No. 3

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.0	0	173.25	0.0	0.0	0.0
0.75	0.0	0	173.25	0.0	0.0	0.0
1.50	0.0	0	173.25	0.0	0.0	0.0
2.25	0.0	1	173.26	0.0	0.0	0.0
3.00	0.0	1	173.26	0.0	0.0	0.0
3.75	0.0	1	173.26	0.0	0.0	0.0
4.50	0.0	2	173.27	0.0	0.0	0.0
5.25	0.0	3	173.28	0.0	0.0	0.0
6.00	0.0	5	173.30	0.0	0.0	0.0
6.75	0.0	8	173.33	0.0	0.0	0.0
7.50	0.0	14	173.39	0.0	0.0	0.0
8.25	0.0	23	173.48	0.0	0.0	0.0
9.00	0.0	35	173.60	0.0	0.0	0.0
9.75	0.0	53	173.78	0.0	0.0	0.0
10.50	0.0	65	173.90	0.0	0.0	0.0
11.25	0.0	65	173.90	0.0	0.0	0.0
12.00	**0.1**	**67**	**173.92**	**0.1**	**0.0**	**0.1**
12.75	**0.0**	**65**	**173.90**	**0.0**	**0.0**	**0.0**
13.50	0.0	65	173.90	0.0	0.0	0.0
14.25	0.0	65	173.90	0.0	0.0	0.0
15.00	0.0	65	173.90	0.0	0.0	0.0
15.75	0.0	65	173.90	0.0	0.0	0.0
16.50	0.0	65	173.90	0.0	0.0	0.0
17.25	0.0	65	173.90	0.0	0.0	0.0
18.00	0.0	65	173.90	0.0	0.0	0.0
18.75	0.0	65	173.90	0.0	0.0	0.0
19.50	0.0	65	173.90	0.0	0.0	0.0
20.25	0.0	65	173.90	0.0	0.0	0.0
21.00	0.0	65	173.90	0.0	0.0	0.0
21.75	0.0	64	173.89	0.0	0.0	0.0
22.50	0.0	63	173.88	0.0	0.0	0.0
23.25	0.0	62	173.87	0.0	0.0	0.0
24.00	0.0	60	173.85	0.0	0.0	0.0
24.75	0.0	53	173.78	0.0	0.0	0.0
25.50	0.0	45	173.70	0.0	0.0	0.0
26.25	0.0	38	173.63	0.0	0.0	0.0
27.00	0.0	30	173.55	0.0	0.0	0.0
27.75	0.0	24	173.49	0.0	0.0	0.0
28.50	0.0	17	173.42	0.0	0.0	0.0
29.25	0.0	10	173.35	0.0	0.0	0.0
30.00	0.0	4	173.29	0.0	0.0	0.0
30.75	0.0	0	173.25	0.0	0.0	0.0
31.50	0.0	0	173.25	0.0	0.0	0.0
32.25	0.0	0	173.25	0.0	0.0	0.0
33.00	0.0	0	173.25	0.0	0.0	0.0
33.75	0.0	0	173.25	0.0	0.0	0.0
34.50	0.0	0	173.25	0.0	0.0	0.0

Drains in 30.75 HRS

TOTAL SUSPENDED SOLIDS (TSS) REMOVAL

BMP	TSS Removal Rate*	Starting TSS Load	TSS Removed*	Remaining Load*
Flow to Bioretention/Rain Garden:				
Rain Garden	90%	1.00	0.90	0.10
Pocket Wetland with Veg. Filter Strip	80%	0.10	0.08	0.02
	Subtotal TSS Removal:		**98.0%**	
Flow to Pocket Wetlands:				
Street Sweeping **	0%	1.00	0.00	1.00
Pocket Wetland with Veg. Filter Strip	80%	1.00	0.80	0.20
	Subtotal TSS Removal:		**80.0%**	

Drainage Area	Impervious Area (square feet)	Fraction of Total Area	TSS removal	Weighted % TSS Removal
Proposed Bioretention/Rain Garden Flow	4,222	0.361	98.0%	35.4%
Flow to Pocket Wetand with Veg.Filter Strip	7,474	0.639	80.0%	51.1%
	11,696	1.0	TSS removal:	**86.5%**

Exceeds 80 % as required for new development

* Note: TSS Removal Rates Per DEP Stormwater Management Interim Handbook, Jan. 08

** Street sweeping recommended for source reduction but not required to meet TSS removal goals

CLIENT	Red Acre Development Corporation	MEI JOB NO.	8319	CHECKED BY	MEB
PROJECT	99 Parker Street Affordable Housing	COMPUTED BY	JJM	DATE	8/6/2009
FILE	8319TSS.xls	DATE	8/6/2009	PAGE NO.	1 of 1

Meridian Associates, Inc. 69 Milk Street, Westborough, Massachusetts 01581

Rip Rap Apron Design

FE-1

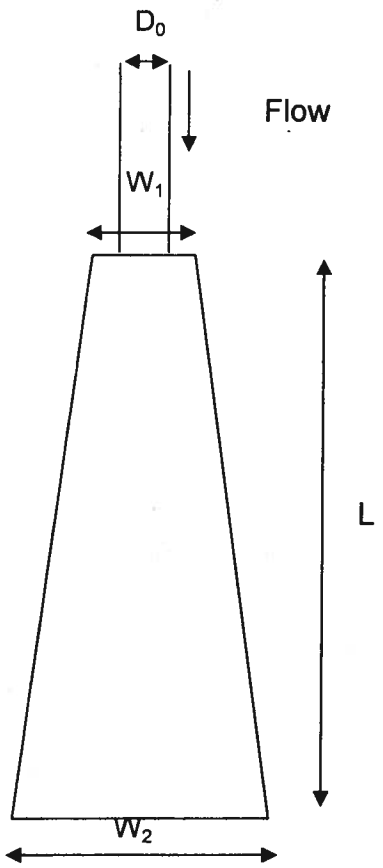
MAI Job# 8319 Date 8/6/09

100 Year Flow =	0.1	CFS
Inlet Pipe Size =	8	Inches
L =	6	Feet
W_1 =	2	Feet
W_2 =	4	Feet

Median Stone Size (If T_w<0.5D_0)

Assume Tailwater =	0.05	Feet
D_{50} =	0.03	Feet
Required Stone Size of	0	Inches

Use a Stone Size of 6 inches



		MAI Job No.	8319	CHECKED BY	MEB
CLIENT	Red Acre Development Corp	Computed By	JJM	DATE	8/6/2009
PROJECT	Parker Affordable Housing	Date	8/6/2009	PAGE NO.	1 of 2
FILE	8319_Rip Rap Apron.xls	Revised			

Meridian Associates, Inc. 69 Milk Street, Westborough, Massachusetts 01581

Rip Rap Apron Design

FE-2

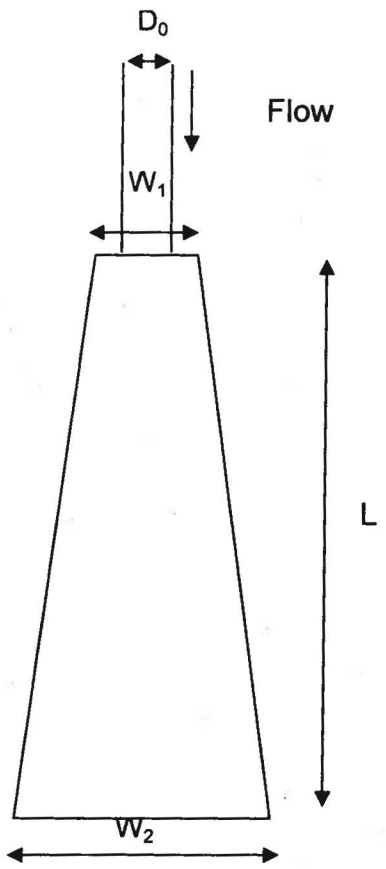
MAI Job# 8319 Date 8/6/09

100 Year Flow =	0.1	CFS
Inlet Pipe Size =	8	Inches
L =	6	Feet
W_1 =	2	Feet
W_2 =	4	Feet

Median Stone Size (If $T_w<0.5D_0$)

Assume Tailwater =	0.5	Feet
D_{50} =	0.00	Feet
Required Stone Size of	0	Inches

Use a Stone Size of 6 inches



		MAI Job No.	8319	CHECKED BY	MEB
CLIENT	Red Acre Development Corp	Computed By	JJM	DATE	8/6/2009
PROJECT	Parker Affordable Housing	Date	8/6/2009	PAGE NO.	2 of 2
FILE	8319_Rip Rap Apron.xls	Revised			

OPERATION & MAINTENANCE PLAN

Stormwater Management Operation and Maintenance Plan

Maintenance Agreement

Proposed Parker Street Affordable Housing, Acton, Massachusetts

In accordance with Standard 9 of the Massachusetts Department of Environmental Protection Stormwater Handbook (February 2008), the attached on-site maintenance program for the proposed stormwater management system has been developed to ensure the Best Management Practices (BMP's) in place will remain functioning as designed. The Plan contains both construction period operations and maintenance as well as post construction responsibilities that shall "run" with the property if ownership is transferred.

Owner/Operator:

Red Acre Development Corporation
Attn: Mark Starr
P.O. Box 992
Acton, Massachusetts 01720
Phone: 1-978-263-0795
Email: markstarrvball@verizon.net

_____ _____

Mark Starr Date

Stormwater Management Operation and Maintenance Plan

Parker Street Affordable Housing
99 Parker Street, Acton, MA
August 6, 2009

The following on-site maintenance program for the stormwater management systems is proposed in order to keep the stormwater management systems functioning properly. These measures will also help to minimize potential environmental impacts to the wetland resource area and adjacent properties, such as erosion or sedimentation. Operation and maintenance of these systems will be the responsibility of the site contractor initially, then Red Acre Development Corporation, and finally the pending Homeowner Association. The basis of the on-site plan follows:

Erosion and Sedimentation Control Measures During Construction Activities

Responsible Party during Construction:
Contractor for the Site
Attn: Red Acre Development Corporation
PO Box 992
Acton, Massachusetts 01720

Erosion Control Barriers:
Staked hay bales with siltation fence, shall be installed where indicated on the plans and in other appropriate locations where warranted. These barriers shall be installed prior to the commencement of any work on site and in accordance with the construction plans. A supply of haybales and silt fence shall be kept on site to replace and/or repair barriers that are damaged or degraded. The barriers shall be observed and maintained as necessary on a weekly basis during construction.

Drain Inlet Protection:
Temporary inlet protection barriers consisting of filter bags will be placed around all constructed drainage inlets. The purpose of the filter is to prevent the inflow of sediments into the constructed drainage systems, infiltration systems in particular. The barriers shall remain in place until a permanent cover is established or diversions away from the inlets are constructed. The barriers shall be observed and maintained as necessary on a weekly basis during construction.

Check Dams:
Temporary check dams shall be used in swales or channels to slow the velocity of concentrated water flows subsequently reducing erosion. The check dams shall be constructed out of gravel, rock, sandbags, logs or treated lumber. Although used historically as check dams, straw bales have been determined by the US EPA to be ineffective at reducing erosion in drainage

channels, swales, etc. because if a straw bale structure is installed across the channel it reduces the cross-sectional area resulting in increased velocity of stormwater flow. Therefore, straw bales should only be used in limited circumstances.

Temporary Diversion Dikes:
Earthen perimeter control consisting of a dike or a combination dike and channel constructed along the perimeter of and within the disturbed part of the site. The purpose of the diversion dike is to prevent surface flow from entering the disturbed construction site. It should be placed upslope to intercept sheet flow from traveling across the disturbed areas such as cut or fill slopes and thereby lessening erosion of the site. The location of the diversions dikes shall be determined in the field by the contractor as warranted.

Sediment Traps:
Temporary sediment traps are small impoundments that allow sediment to settle out of construction runoff. Accumulated sediment shall be periodically removed to ensure effectiveness. Remove sediments when the basin reaches about 50% sediment capacity. Inspect the sediment trap after each rainfall event to ensure that the trap is draining properly. Also check the structure for damage from erosion. Check the depth of the spillway and maintain it at a minimum of 1.5 feet below the low point of the trap embankment. The locations of the sediment traps shall be determined in the field by the contractor as warranted.

Bio-Retention Basins (Rain Gardens):
During construction, the bio-retention basins shall be inspected during and after all storm events to ensure there is no sediment accumulation or degradation of surfaces.

Vegetated Filter Strips:
During construction, the vegetated filter strips shall be observed during and after all storm events to ensure there is no sediment accumulation or degradation of surfaces. Implement soil stabilization measures until permanent vegetation is established. Protect the filter strip by using upstream sediment traps.

Pocket Wetlands:
Stabilize the vegetation in all areas above the normal pool elevation during the standing period (typically by hydroseeding). During construction, the pocket wetlands shall be inspected during and after all storm events to ensure there is no sediment accumulation or degradation of vegetation. Apply erosion controls during the standing and planting periods.

Surface Stabilization:
The surface of all disturbed areas shall be stabilized during and after construction. Temporary measures shall be taken during construction to prevent erosion and siltation. All finished surfaces shall be stabilized with finish materials or permanent vegetative cover. Temporary

stabilization shall be performed in areas where the following conditions exist for more than 14 days:

1. The vegetative cover has been removed.
2. The exposed soil is prone to erosion due to its granular makeup and/or topography.

Temporary stabilization shall be performed, regardless of the length of time, in areas where an imminent or likely erosion problem will occur which could affect an area subject to protection under the Wetlands Protection Act.

Temporary stabilization shall consist of hydro-seeding. The seed mixtures contained in the following table shall be utilized and the application of matting where specified below.

PROPOSED TEMPORARY SEEDING		
Species	Lbs/acre	Seeding Dates
Annual Ryegrass	40	4/1 to 6/1 or 8/15 to 9/15
Millet	30	5/1 to 6/30
Winter Rye	120	8/15 to 10/15

If project schedule requires that areas will remain un-vegetated between October 15 and March 31, the Annual Ryegrass mixture shall be applied to all exposed soils. Wood cellulose fiber mulch shall be hydraulically applied at a rate of 1,400 lbs/acre. If utilized, straw or hay mulch should be applied over seeding sites at a rate of 90 bales per acre.

Any areas which have a temporary slope equal to or steeper three (3) horizontal to one (1) vertical (3:1) up to slopes of two (2) horizontal to one (1) vertical (2:1) shall be covered with jute matting following hydro-seeding. Jute matting shall be installed according to manufacturer guidelines. Precautions shall be taken to minimize disturbance of the hydro-seed when installing the jute matting.

Any areas which have a temporary slope equal to or steeper than two (2) horizontal to one (1) vertical (2:1) shall be covered with erosion control blankets immediately after the hydro-seeding is completed. The blankets shall be stapled in place per manufacturer guidelines. Precautions shall be taken to minimize disturbance of the hydro-seed when installing the erosion control blankets.

Spill Control:
A contingency plan to address the spillage/release of petroleum products and any hazardous materials will be implemented for the site during construction. The plan will include the following measures:

- Equipment necessary to quickly attend to inadvertent spills or leaks shall be maintained on-site in a secure but accessible location. Such equipment will include, but not be limited to, the following: urethane drain cover seals (mats), a spill containment kit

which includes sand and shovels, suitable absorbent materials, storage containers, safety goggles, chemically resistant gloves and overshoe boots, water and chemical fire extinguishers, and first aid equipment.

- Spills or leaks will be treated properly according to material type, volume of spillage and location of spill. Mitigation will include preventing further spillage, containing the spill material in the smallest practical area, removing spilled material in a safe and environmentally friendly manner, and remediating any damage to the environment.
- The contractor shall be familiar with the reporting requirements of the Massachusetts Contingency Plan (310 CMR 40.00) as issued by the Massachusetts Department of Environmental Protection (DEP); specifically Subpart C Notification of Releases and Threats of Release of Oil and Hazardous Materials and Subpart D Preliminary Response Activities and Risk Reduction Measures.
- For any large spills, Massachusetts DEP Hazardous Waste Incident Response Group will be notified immediately at (617) 792-7653 and an emergency response contractor will be called in.

Post-Construction Operation and Maintenance Plan

Responsible Party Post Construction:
Contractor for the Site
Attn: Red Acre Development Corporation
PO Box 992
Acton, Massachusetts 01720

The responsibilities outlined in this Operation and Maintenance Plan shall be "run" with the property if ownership is transferred.

Pavement Sweeping:
Sweeping has been shown to be an effective initial treatment for reducing contaminants in stormwater runoff. Sweeping is not required to meet TSS removal goals in this case, but should be performed in the spring to remove winter accumulations.

Bio-Retention Basins (Rain Gardens):
Premature failure of bio-retention areas is a significant issue caused by the lack of regular maintenance. The following long-term maintenance schedule will ensure that adequate pretreatment is provided prior to exfiltration. The bio-retention basins shall be inspected and all trash shall be removed on a monthly basis. Annual spring time maintenance within the basin shall include; re-mulching void areas, removing / replacing any dead vegetation and pruning / fertilizing established vegetation. Mulch shall be replaced every two years. Snow shall not be stored in the bio-retention basins. If snow is plowed into the either of the basins, runoff may bypass the cell and drain to downgradient wetlands without first receiving the required water quality treatment, and without recharging the groundwater.

Vegetated Filter Strips:
Conduct semi annual inspections during the first year (and annually thereafter). Inspect the level spreader for sediment buildup and the vegetation for signs of erosion, bare spots, and overall health. Regular, frequent mowing of the grass is required. Remove sediment from the toe of slope or level spreader, and reseed bare spots as necessary. Periodically, remove sediment that accumulates near the top of the strip to maintain the appropriate slope and prevent formation of a "berm" that could impede the distribution of runoff as sheet flow.

Pocket Wetlands:
Constructed stormwater wetlands require small-scale maintenance at regular intervals to evaluate the health and composition of the plant species. Proponents must carefully observe the constructed stormwater wetland system over time. In the first three years after construction, inspect the constructed stormwater wetlands twice a year during both the growing and non-growing seasons. The following information shall be recorded and mapped during the inspections:

- The types and distribution of the dominant wetland plants in the marsh.
- The presence and distribution of planted wetland species.
- The presence and distribution of invasive wetland species (invasives must be removed.)
- Indications that other species are replacing the planted wetland species.
- Significant areas of standing water.
- Stability of the earthen berms and any need for re-vegetation and stabilization.

Drainage Swales:
Inspect the channels to make sure vegetation is adequate and for signs of rilling and gullying. Repair rills or gullies and replace dead vegetation the first few months after construction and twice a year thereafter. The grass height shall not exceed 6-inches or be cut shorter than 3-inches. All accumulated sediment and debris manually at least once per year. Re-seed the channel periodically to maintain a dense growth of grass vegetation. The use of road salts or other deicers during the winter will necessitate yearly seeding in the spring.

Snow Removal:
Snow that is removed from roadway surfaces shall not be stored in rain gardens, pocket wetland areas or wetlands. Plowed snow shall be stored in other vegetated upland areas of the site. When capacity of these areas is exceeded, snow shall be removed from the site in accordance with DEP snow removal policy.

De-icing:
The use of Sodium Chloride ("rock salt") for de-icing of paved surfaces will be limited. Sand will be the primary icing control agent.

Fertilizer:
Slow release organic fertilizers will be used in landscape areas to limit nutrient transport to groundwater and wetland areas in the vicinity. Application will be limited to 3 lbs. per 1000 square feet of lawn area.

Waste Management:
Solid waste will be contained within waste receptacles for pick up by a privately contracted waste hauler. Waste deposition in these receptacles will be consistent with state and local permits. The covers and doors of trash containers will be kept closed to limit rainwater and pest intrusion.

Spill Control:
A contingency plan to address the spillage/release of petroleum products and any hazardous materials will be implemented for the facility. The plan will include the following measures:

- Spills or leaks will be treated properly according to material type, volume of spillage and location of spill. Mitigation will include preventing further spillage, containing the spilled material in the smallest practical area, removing spilled material in a safe and environmentally friendly manner, and remediating any damage to the environment.
- In the event of any hazardous material spill, clean up shall occur immediately by a licensed liquid waste hauler.
- The owner shall be familiar with the reporting requirements of the Massachusetts Contingency Plan (310 CMR 40.00) as issued by the Massachusetts Department of Environmental Protection (DEP); specifically Subpart C Notification of Releases and Threats of Release of Oil and Hazardous Materials and Subpart D Preliminary Response Activities and Risk Reduction Measures.
- For any large spills, Massachusetts DEP Hazardous Waste Incident Response Group will be notified immediately at (617) 792-7653 and an emergency response contractor will be called in.

Long-Term Operation and Maintenance Budget
Consistent with Standard 9 of the Massachusetts Department of Environmental Protection Stormwater Handbook (February 2008) the approximate cost of inspections and maintenance based on the abovementioned post-construction activities and frequencies is as follows;

- Pavement Sweeping – Recommended but not required to meet TSS removal requirements. Estimated $500 per year based on annual sweepings.
- Drainage Swales (2 total) – Inspection/Removal - $500 per yearly inspection and accumulated sediment/debris removal. Mowing/re-seeding - $500 per year for mowing and necessary re-seeding.
- Rain Gardens (3 total) – Inspection/debris removal - $750 per year based on yearly inspections and trash removal. Re-mulching/pruning/vegetation replacement/fertilizing - $750 per year based on yearly spring-time maintenance for three basins.

- Vegetated Filter Strip (3 total) – Inspection - $750 per year based on semi-annual inspections. Cleaning/debris removal/mowing/raking - $750 per year based on semi-annual service.
- Pocket Wetlands (2 total) – inspection - $1,000 per year based on annual inspections. Cleaning/debris removal/outlet adjustment - $2,000 to be completed once every 5 years. Mowing - $1,000 per year based on semi-annual mowing of berms.

Additional costs may be incurred if it is determined during routine inspections of the BMP's that further corrective actions are necessary.

Inspection Report

Operation and Maintenance Log

General Information	
Project Name	Parker Street Affordable Housing

MA DEP File No.		**Location**	99 Parker Street, Acton, MA
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your O&M Plan on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues
Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
	the street?			
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete."

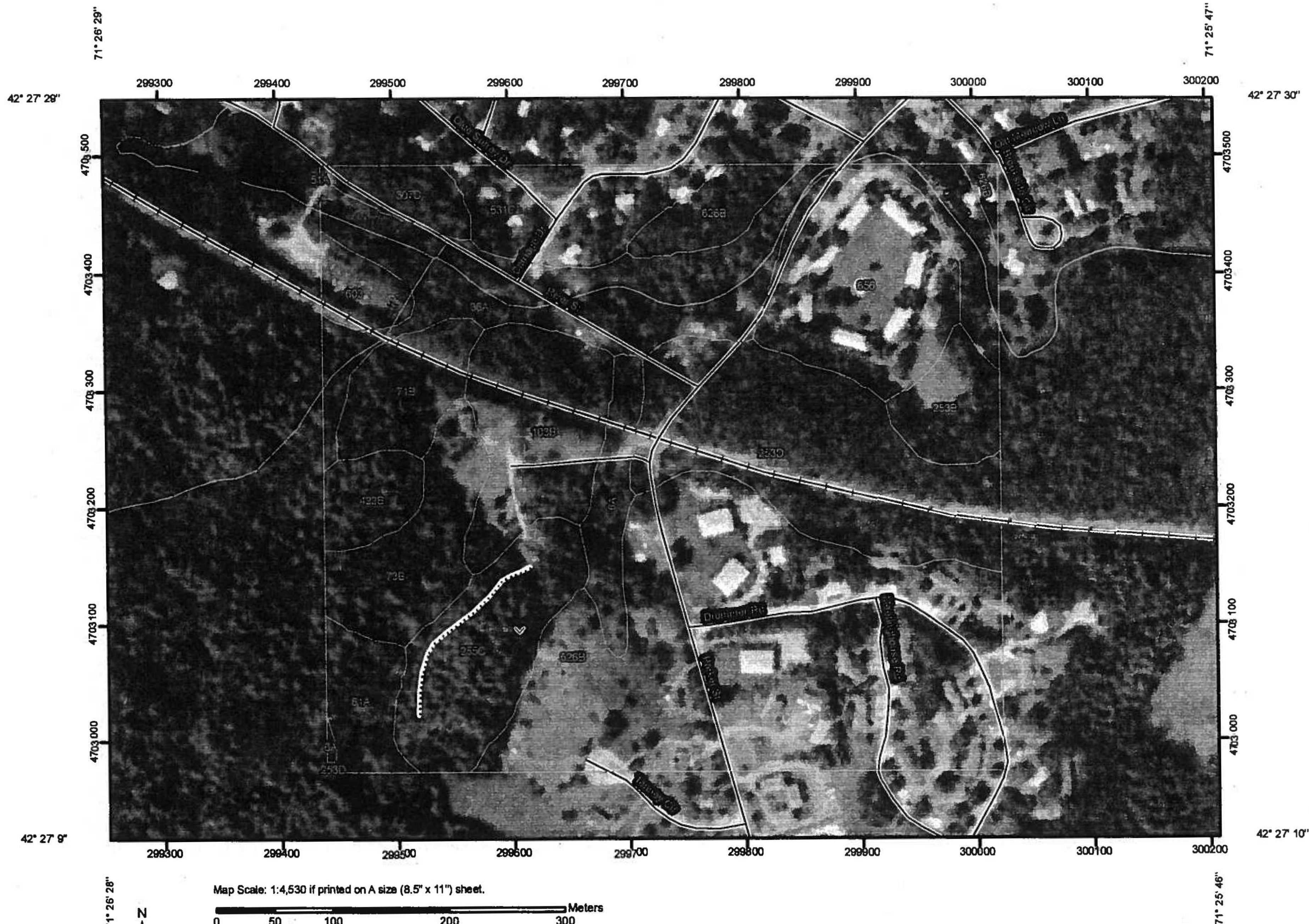
Print name and title: Mark Starr, Red Acre Development, or his designated assignee.

Signature:_____

Date:_____

SOILS INFORMATION

Soil Map—Middlesex County, Massachusetts



Map Scale: 1:4,530 if printed on A size (8.5" x 11") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 250, 500, 1,000, 1,500

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Special Point Features

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

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Oceans
- Streams and Canals

Transportation

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

MAP INFORMATION

Map Scale: 1:4,530 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

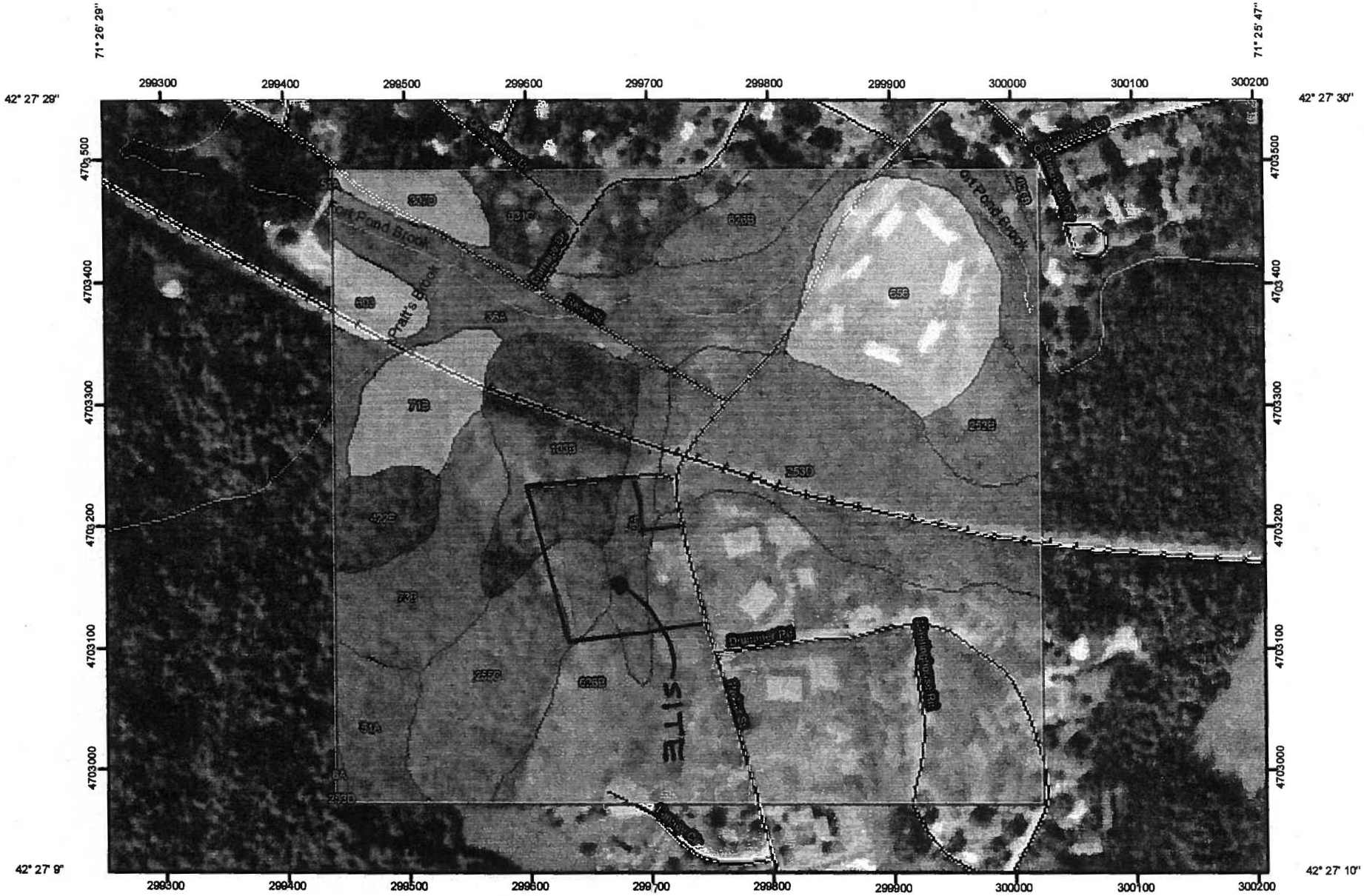
Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 9, Apr 15, 2009

Date(s) aerial images were photographed: 7/28/2003; 8/14/2003

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

Map Unit Legend

Middlesex County, Massachusetts (MA017)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	1.9	2.5%
36A	Saco mucky silt loam, 0 to 1 percent slopes	9.3	12.4%
51A	Swansea muck, 0 to 1 percent slopes	1.8	2.4%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	2.4	3.2%
73B	Whitman fine sandy loam, 0 to 5 percent slopes, extremely stony	3.6	4.7%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	4.7	6.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	1.9	2.5%
253D	Hinckley loamy sand, 15 to 25 percent slopes	9.2	12.3%
255C	Windsor loamy sand, 8 to 15 percent slopes	4.9	6.5%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	1.2	1.6%
422B	Canton fine sandy loam, 3 to 8 percent slopes, extremely stony	1.5	2.0%
603	Urban land, wet substratum	1.1	1.5%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	21.7	29.0%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	3.5	4.7%
656	Udorthents-Urban land complex	6.1	8.2%
Totals for Area of Interest		**74.8**	**100.0%**


71° 26' 29"
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299300
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300100
300200
4703500
4703400
4703300
4703200
4703100
4703000
Old Pond Brook
Pratt's Brook
SITE
Map Scale: 1:4,530 if printed on A size (8.5" x 11") sheet.
N
Meters
0
50
100
200
300
Feet
0
250
500
1,000
1,500

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Political Features

Cities

Water Features

Oceans

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:4,530 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:25,000.

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Coordinate System: UTM Zone 19N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 9, Apr 15, 2009

Date(s) aerial images were photographed: 7/28/2003; 8/14/2003

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	D	1.9	2.5%
36A	Saco mucky silt loam, 0 to 1 percent slopes	D	9.3	12.4%
51A	Swansea muck, 0 to 1 percent slopes	D	1.8	2.4%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	C	2.4	3.2%
73B	Whitman fine sandy loam, 0 to 5 percent slopes, extremely stony	D	3.6	4.7%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	B	4.7	6.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	1.9	2.5%
253D	Hinckley loamy sand, 15 to 25 percent slopes	A	9.2	12.3%
255C	Windsor loamy sand, 8 to 15 percent slopes	A	4.9	6.5%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	C	1.2	1.6%
422B	Canton fine sandy loam, 3 to 8 percent slopes, extremely stony	B	1.5	2.0%
603	Urban land, wet substratum		1.1	1.5%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	21.7	29.0%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	B	3.5	4.7%
656	Udorthents-Urban land complex		6.1	8.2%
Totals for Area of Interest			**74.8**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

Excessively drained

Somewhat excessively drained

Well drained

Moderately well drained

Somewhat poorly drained

Poorly drained

Very poorly drained

Not rated or not available

Political Features

Cities

Water Features

Oceans

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:4,530 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 9, Apr 15, 2009

Date(s) aerial images were photographed: 7/28/2003; 8/14/2003

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

Drainage Class

Drainage Class— Summary by Map Unit — Middlesex County, Massachusetts				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	Very poorly drained	1.9	2.5%
36A	Saco mucky silt loam, 0 to 1 percent slopes	Very poorly drained	9.3	12.4%
51A	Swansea muck, 0 to 1 percent slopes	Very poorly drained	1.8	2.4%
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	Poorly drained	2.4	3.2%
73B	Whitman fine sandy loam, 0 to 5 percent slopes, extremely stony	Very poorly drained	3.6	4.7%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	Well drained	4.7	6.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	Excessively drained	1.9	2.5%
253D	Hinckley loamy sand, 15 to 25 percent slopes	Excessively drained	9.2	12.3%
255C	Windsor loamy sand, 8 to 15 percent slopes	Excessively drained	4.9	6.5%
307D	Paxton fine sandy loam, 15 to 25 percent slopes, extremely stony	Well drained	1.2	1.6%
422B	Canton fine sandy loam, 3 to 8 percent slopes, extremely stony	Well drained	1.5	2.0%
603	Urban land, wet substratum		1.1	1.5%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	Somewhat excessively drained	21.7	29.0%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	Well drained	3.5	4.7%
656	Udorthents-Urban land complex		6.1	8.2%
Totals for Area of Interest			**74.8**	**100.0%**

STORMWATER MANAGEMENT CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

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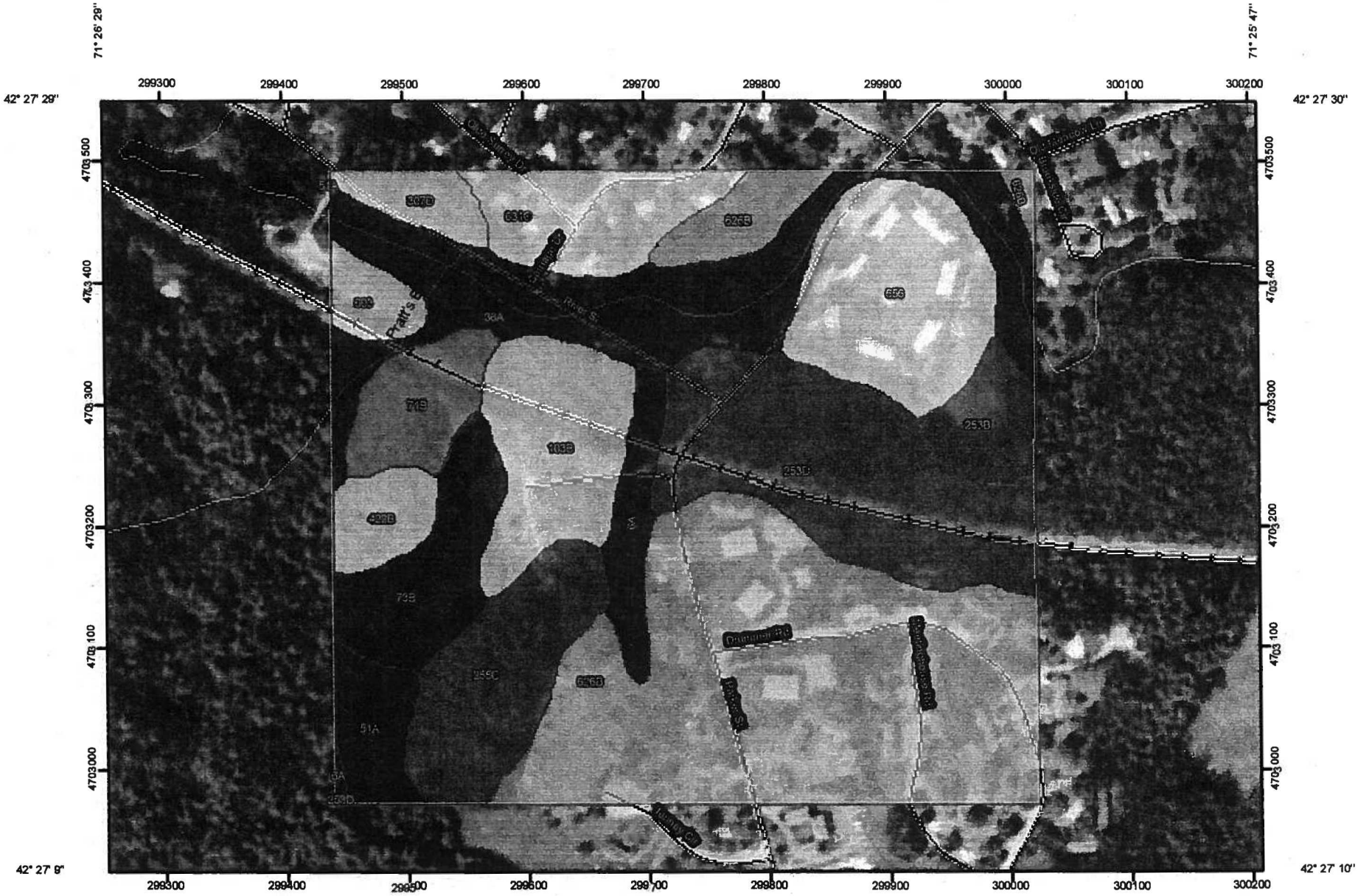
[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Drainage Class—Middlesex County, Massachusetts



Map Scale: 1:4,530 if printed on A size (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1,000 1,500

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

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

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
MARK E. BEAUDRY
CIVIL
No. 38189
REGISTERED PROFESSIONAL ENGINEER

8/6/09

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development w/ EXCEPTION OF RENOVATION OF EXISTING HOUSE & APPURTENANCES.

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- [x] No disturbance to any Wetland Resource Areas
- [x] Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- [ ] Reduced Impervious Area (Redevelopment Only)
- [x] Minimizing disturbance to existing trees and shrubs
- [ ] LID Site Design Credit Requested: LID MEASURES PROPOSED BUT NO CREDITS PURSUED
  - [ ] Credit 1
  - [ ] Credit 2
  - [ ] Credit 3
- [x] Use of "country drainage" versus curb and gutter conveyance and pipe
- [x] Bioretention Cells (includes Rain Gardens)
- [x] Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- [ ] Treebox Filter
- [ ] Water Quality Swale
- [x] Grass Channel
- [ ] Green Roof
- [x] Other (describe): VEGETATED FILTER STRIPS

Standard 1: No New Untreated Discharges

- [x] No new untreated discharges
- [x] Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- [x] Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

☐ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☒ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

VOLUME REQ'S MET, BUT 65% RULE NOT MET *

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

* CONSERVATIVE IN THAT NO RECHARGE ACCOUNTED FOR IN POCKET WETLANDS.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

NO PEAK ATTENUATION IN RAIN GARDENS FOR 10 YEAR +

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs) N/A

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas N/A

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☒ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

65% RULE (SEE PG. 4)

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☒ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

PENDING ~ COND. OF APPROVAL SUGGESTED

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.