NOTICE OF INTENT **EXHIBIT 6**

STORMWATER MANAGEMENT REPORT

ETHAN CIRCLE SUBDIVISION

SOUTH HADLEY, MA

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1/20/14
Revised: 8/25/14, 9/28/14

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1/20/14, Rev. 8/25/14, 9/28/14

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for
ETHAN CIRCLE SUBDIVISION
SOUTH HADLEY, MA

SUMMARY:

The project is a single family subdivision of 8 lots, including two existing homes, on a proposed cul-de-sac off of Hadley Street, between existing house # 57 and #61. The Stormwater Management System begins with deep-sump catch basins that collect runoff, to be piped to a diversion manhole (DMH1). There, flows are split, with all flows up to the volume required for groundwater recharge and water quality treatment going to an infiltration basin. Larger flows are also routed to an open detention basin. Overflow from the infiltration basin in larger storms also is piped to the detention basin. The restricted discharge from the detention basin leads to a level spreader over 50 feet from the nearest wetland. Two small rain-gardens are also proposed to provide additional recharge and runoff control. The stormwater management system complies with DEP standards in preventing increases in peak runoff, providing for groundwater recharge, removing pollutants, controlling erosion and sediment during construction, and providing for long-term management. There will be no increase in peak rate of runoff to any of the abutting properties to the project.

EXISTING CONDITIONS:

Land Use and vegetative cover: Except for the two existing house lots fronting on Hadley Street, the area is currently forested. The forest vegetation is predominantly deciduous, with understory shrubs and vines, dispersed ground cover of ferns, seedlings, and herbaceous growth, and detrital litter and debris.

Soils: The soils on the site have been mapped by the USDA. Our field investigations confirm the general character of the mapped soils, but we have adjusted the mapped boundaries based on our soils investigations and detailed topographic mapping. Adjusted soil boundaries and map codes are shown on the accompanying tributary area maps. The soil series present are all formed on glacial outwash materials. The difference in hydrologic characteristics is due to both the soil texture and the depth to underlying silty soils and the water table. Windsor loamy sand (Wo) is excessively drained and rated as Hydrologic Soil Group (HSG) “A”, with little direct runoff except in major storms. Agawam fine sandy loam (Ag) soil is well drained and rated as HSG B, yielding somewhat higher runoff rates. Amostown fine sandy loam (Am) is moderately well drained, with underlying silty material closer to the surface. It is rated as HSG C, with relatively high runoff rate. A small area of wetland in the southeast corner of the property is typically saturated and we have mapped that area as HSG D.

Hydrologic Setting: (See Tributary Area Maps - 2 pages) Drainage from the site flows in four different directions. The central and eastern portions of the site drain to a wetland along the easterly property line. A smaller area in the northwest drains to the northwest boundary. The front of the existing houses drains to Hadley Street, while a small area in the northeast drains to the abutting lots to the north. There is very little off-site area that drains onto or through the site.

PROPOSED CONDITIONS AND STORMWATER MANAGEMENT SYSTEM:

Low Impact Development:
The use of "Low Impact Development" practices is limited by both the Town's zoning and subdivision regulations, and by the topography and soils of the site. The Town of South Hadley Zoning Bylaw provides for a "Flexible Development" which can allow for flexibility from the normal zoning lot sizes and configurations, and from standard subdivision design standards. However, this provision is limited to sites of 5 acres or larger. The site in question is 3.624 acres, and therefore not eligible for "Flexible Development" under the town's zoning. A preliminary plan for the proposed subdivision was approved in 2007, prior to the LID requirement in the Mass. Stormwater Standards.

Although slopes and limited yard areas on the lots make use of on-lot rain-gardens or direction of runoff over "qualifying pervious areas" difficult, two rain-gardens are proposed where site conditions allow. Favorable soils and groundwater depth in the northeastern portion of the site allow an infiltration basin that provides groundwater recharge and water quality treatment in excess of Stormwater Management requirements. Otherwise, relatively high groundwater levels prevent effective use of drywells or other underground chambers for recharge of roof runoff. A grass swale is proposed along the rear of lots 4 & 5, but it is intended for runoff control and does not have adequate travel time for water quality treatment. The current proposal for a "Y" turnaround instead of a conventional pave circle reduces the impervious area by approximately 2875 sq. ft. A brief analysis if alternative LID measures is provided in Appendix F.

Of the total project area of 158,667 sq. ft., approximately 33,258 sq.ft., or 20.96% will be impervious. This is over the 15% limit for Environmentally Sensitive Development credit and does not qualify for the credit.

Stormwater Management System Summary:
Runoff from most of the lots and roofs, and all but 15 ft. of the roadway is captured in deep-sump catch basins and routed through a diversion manhole (DMH1) to separate infiltration and detention systems. At DMH1, flows are split, with all flows up to the volume required for groundwater recharge and water quality treatment going to an infiltration basin. Larger flows are also routed to a surface detention basin. Overflow from the infiltration basin in larger storms also is piped to the detention basin. The restricted discharge from the detention basin leads to a level spreader over 50 feet from the nearest wetland.

Pretreatment for the infiltration basin is provided by a grit chamber which provides slightly greater volume than required for a forebay, and also provides control of floating materials by use of a pipe "T" at the outlet. The infiltration basin provides final water quality treatment by infiltration and also provides groundwater recharge meeting DEP requirements. The bottom of the basin (94.0) is over 4' above the estimated seasonal high water table (89.77).. Above the level required for recharge and treatment (94.5), flows are directed to the surface detention basin.

At DMH1, flows from larger storms are a directed to the detention basin that also receives inflow from the separate infiltration basin when levels in the infiltration basin exceed the volume required for recharge or treatment. At the outlet of the detention basin, a 3" orifice in the

bottom of a 12" diameter standpipe and a 6" diameter orifice in the side of the standpipe provide control of peak flows. A stone spreader assures that flows from the detention basin are dispersed and non-erosive.

Runoff to Hadley Street is reduced slightly by reduction of the tributary area that compensates for the added impervious surface of the new street entrance. Runoff to the north is calculated as zero (below the limit of estimates) because of the highly permeable soils and reduction in the tributary area. In the northwest, the tributary area is reduced and two rain-gardens provide additional runoff control, keeping proposed runoff rates to abutting properties below existing.

DESIGN CRITERIA

Infiltration Basin: Embankment slopes 4:1 interior and 3:1 exterior. Depth to estimated seasonal high groundwater over 4'. Max. Depth in 100 yr storm = 0.68'.

Detention Basin: No increase in peak discharge for 2 through 100 year storms. Embankment slopes 4:1 interior and 3:1 exterior. Maximum depth in 100 year storm < 3ft (2.55')

Grit Chamber: volume over 400 cf/acre of tributary impervious surfaces. Exceeds forebay treatment volume and provides control of floating materials.

Water quality treatment: 1093 cu. ft. required. 1283 cu. ft. infiltration volume is provided for over 80% TSS removal for over 0.5" of runoff from impervious surfaces, by deep-sump-catch-basins, grit chamber, and infiltration.

Groundwater Recharge: 1229 cu. ft. required. 1283cu. ft. is provided by the infiltration basin to elev. 94.5, (elevation of the overflow weir) with an additional 498 cu. ft. provided by the two rain gardens although not counted. Infiltration calculations for recharge are based on the “Static” method. Drain time for the infiltration basin is less than 72 hours (estimated 6 hours).

Assumed infiltration rate: = 1in./hr, conservatively estimated, allowing for compaction of “loamy sand” surface so that it acts like “sandy loam” due to the potential use of the basin as lawn and yard area. Drain time is also evaluated assuming 0.17 in/hr, the rate for “sandy clay loam”, (time 35.3hrs).

Capture area of the main infiltration basin includes 90% of all new impervious surfaces, far exceeding the DEP requirement of 65%

Pipe outlet stability: velocities of pipe flows to discharges are estimated for the 100 year storm. Except for the inflow to the detention basin, (6 fps), all are less than 5 fps, generally considered the maximum for well developed sod cover. To assure no erosion at the outlets, either stone aprons or turf reinforcement mat are proposed to conservatively assure protection during establishment of vegetation. See Appendix E for calculations.

DESIGN METHODOLOGY:

For watershed modeling and design of the detention/infiltration basin, Natural Resource Conservation Service methods, based on TR-55 and TR-20, were followed using the "HydroCad" computer program (ver. 10.0 build 12), an adaptation of SCS TR-20 and TR-55 methods. The drainage basin characteristics of Curve Number (CN) and time of concentration (Tc) are described and calculated based on NRCS methodology. To facilitate calculations, a separate spreadsheet was used for Tc and area calculations, which was then input to the HydroCad model. Appendix E provides the principal calculations normally needed for review. Summaries are provided for the 2 and 10 year storms. Detail of parameters used for the model are provided in the section on the 100 year storm. All input parameters for the runoff estimate from the tributary areas are the same except for the rainfall.

For conservative calculations, the 2, 10, and 100 year storms are modeled as if there was effectively no storage or infiltration in the infiltration basin, and the diverted flows through the infiltration basin continue un-controlled to the detention basin. This is done to demonstrate that even if the detention basin did not infiltrate as designed, there would be no increase in peak discharges from the site for the design storms.

The diversion to the grit chamber and infiltration basin was designed so that the storm (0.76") that would produce at least the required recharge or treatment volume from the tributary area would flow entirely to the infiltration basin and not to the detention chamber system. Larger storms would be increasingly diverted to the detention chamber system. See Appendix E for calculations.

The Hydrocad model was also used to estimate the flow velocities from the several pipe outlets to allow verification of stability at the outlets. In this case, separate pipe reaches were modeled, with the 100 year discharge being input as base flow in order for the model to estimate maximum flow velocity.

If additional information or the Hydrocad computer model are needed for review, please contact Charles H. Dauchy at 413-548-8005 or cdauchy@wildblue.net

COMPLIANCE WITH DEP STANDARDS:

The project design complies fully with MA DEP stormwater management standards, as summarized below.

1. *No new untreated discharge or erosion*: The new point source discharge from the project will receive over 80% TSS removal for water quality treatment in compliance with DEP guidelines. Erosion controls will be implemented during construction to prevent sediment discharge from the site (see Appendix C and plans). The flow rate from the detention basin to the upland swale leading to the wetland is lower than under current conditions, and the discharge is dispersed by a stone spreader, eliminating erosion hazard. Discharge velocity from the 12" outlet, with an upstream 3" orifice, is 4.54 ft./sec., or within the control capacity of a good sod cover. The stone stilling basin and spreader will further reduce the discharge velocities to well below any potentially erosive rates.

2. *Post-development peak discharge rates do not exceed pre-development*: Proposed peak flows from the site are reduced compared to existing flows as summarized below. For the runoff to Hadley St., the 2 year storm instantaneous peak increases by 0.01 cfs, but the volume decreases by 10 cubic feet (both changes being insignificant):

Rainfall return period:		2 yr	10 yr	100 yr
To southeast property line & wetland:				
Existing-	ESUM2	0.60 cfs	1.59 cfs	3.24 cfs
Proposed-	PSUM2	0.59 cfs	1.48 cfs	2.93 cfs
To northwest property line:				
Existing -	ESUM3	0.11 cfs	0.51 cfs	1.25 cfs
Proposed-	PSUM3	0.10 cfs	0.47 cfs	1.00 cfs
To northeast property line				
Existing	E3	0.0 cfs	0.0 cfs	0.0 cfs
Proposed	P3	0.0 cfs	0.0 cfs	0.0 cfs
To Hadley Street				
Existing	E4	0.20 cfs	0.46 cfs	0.87 cfs
Proposed	P4	0.21 cfs	0.42 cfs	0.72 cfs

Note: these flows are less than the limits of the model to compute. The tributary area is reduced under proposed conditions, with no impervious tributary area added.

See Appendix E for Hydrocad model calculations of peak flows and detention.

3. *Annual recharge of groundwater should approximate current conditions*: Runoff from the storm that would generate the required groundwater recharge volume is diverted at DMH1 to a grit chamber and then an infiltration basin, with over 4' depth to the estimated seasonal high water table. The recharge requirement is based on DEP's differential requirements for each hydrologic soil group and is tabulated in Appendix C, totaling 1062 cubic feet . Adjusted for the percentage of impervious area draining to the infiltration basin, IAW the DEP capture area adjustment, the total required recharge volume is 1229 cubic feet. The proposed infiltration basin provides 1283 cubic feet of volume below the outlet structure invert (6" depth at elev. 94.5). Therefore, the recharge volume requirement is exceeded. Drain time of the infiltration basin for the recharge volume is estimated as 6 hours at 1" per hour.

The two rain-gardens provide an additional 498 cubic feet of storage for infiltration, but are not considered in meeting the recharge volume requirement due to the limited depth to groundwater.

4. *80% Total Suspended Solids (TSS) removal*: All point source discharges from impervious surfaces are treated to remove over 80% of Total Suspended Solids (TSS). All impervious areas tributary to the discharge are routed through the stormwater management system. Runoff from the storm that would generate the required treatment volume is diverted at DMH1

to a grit chamber and then infiltration basin. Treatment is provided by deep sump catch basins, a grit chamber, and infiltration. The required runoff volume to be treated is 1097 cu. ft.,based on 0.5" of runoff over 26335 sq. ft. of new impervious tributary area. The infiltration volume provided is 1283 cu. ft. (below the infiltration basin overflow weir crest). Calculated TSS removal will be 85.0% (See Appendix C).

5. *Higher potential pollutant loadings prohibit certain practices*: Not Applicable

6. *Discharges to critical areas treat 1" of runoff and prohibit certain practices*: Not Applicable

7. *Redevelopment sites must meet standards to maximum extent practicable and improve existing conditions*: Not Applicable

8. *Construction related Impacts including Erosion and Sediment Controls must be implemented*: See Appendix B.
A detailed erosion and sediment control procedure is spelled out for the project on the Erosion & Sediment Control detail sheet. This includes a perimeter sediment barrier, temporary use of a partially excavated detention basin as a sediment basin, rough grading of lots to provide depressions for sediment capture, and interim seeding of rough graded lots for stabilization until final construction is done on the lots. Until construction is completed and all tributary areas are stabilized, frequent inspection and maintenance of the erosion controls is required. Construction period maintenance will be the responsibility of the site work contractor. A construction period "Stormwater Pollution Prevention Plan" (SWPPP) will be prepared and submitted by the ultimate developer and site contractor before any site work begins.

9. *Long Term Operation and Maintenance Plan required*: See Appendix A.
After construction, a minimum of annual inspection and maintenance of all system components is recommended. It is hoped that the Town of South Hadley will be ultimately take responsibility for maintenance of any stormwater facilities within the street Right-of-Way, with the exception of the detention basin. Maintenance of stormwater facilities outside of the public way will be the responsibility of the homeowners' association. In compliance with the Town of South Hadley Stormwater Bylaw, an operation, maintenance, and inspection agreement will be submitted for approval before any site work.

The only vegetation management required is annual mowing of the detention and infiltration basins and adjacent fill embankment slopes to prevent development of large woody vegetation and maintain a good sod cover. Slopes to be mown are 3:1 or flatter, allowing safe mowing by tractor or riding mower. Slopes that are not serving as a retaining dike can be planted to trees and shrubs if desired to provide screening. The infiltration basin is designed so that it can be maintained as lawn by the owner of Lot #5 if desired. The assumed infiltration rate makes allowance for compaction by regular mowing and foot traffic.

The stormwater management facilities should be inspected monthly during the first year of operation or until it is clear they are functioning properly. After that, inspections should generally be twice a year, with maintenance as required.

With proper construction and maintenance, clogging of the infiltration surface of the infiltration basin is not expected to be a problem. However, if ponding persists in the basin for over 72

hours, the basin should be de-watered (pump to the detention basin) and roto-tilled to restore the infiltration capacity, and re-seeded.

10. *Illicit discharges prohibited*: No illicit discharges are known to exist on the site, and the proposed project has no potential sources of illicit discharge. Sanitary sewerage will be pumped to the municipal sewer system as shown on the plans. An Illicit Discharge Compliance Statement will be submitted to the South Hadley Conservation Commission prior to any discharge from the proposed stormwater management system.

APPENDIX A

LONG TERM OPERATION & MAINTENANCE PLAN

ETHAN CIRCLE SUBDIVISION

SOUTH HADLEY, MA

LONG TERM OPERATION AND MAINTENANCE PLAN **APPENDIX A**
FOR STORMWATER MANAGEMENT SYSTEM Rev. 9/28/14

ETHAN CIRCLE SUBDIVISION, SOUTH HADLEY, MA

OWNERS: For the street Right of Way - The Town of South Hadley (after/if acceptance)
For the Infiltration and Detention Basins - Owners of lots 5 & 6, with easement to the Homeowners Association
For rain-gardens and grass swale on lots 4 & 5, Owners, with easement to the Homeowners Association.
Responsibilities will be specified in Homeowners Association agreement and initial contact information will be provided to the town when the identities are determined .

RESPONSIBILITY: The project developer will be responsible for maintenance of the stormwater facilities until establishment of the Homeowners Association. The Homeowners Association shall be responsible for effective operation and maintenance of stormwater management facilities and related parts of the site as required by the conditions of approval by the Town of South Hadley. The association may contract the required work to outside parties, but retains responsibility for effective maintenance. The responsible party shall maintain an operation and maintenance log for the last three years. Logs shall include inspections, repairs, replacement, and disposal. Disposal shall be in accordance with state and federal regulations. Records for disposal shall include type of material and disposal location.

PUBLIC SAFETY: The stormwater infiltration and detention basins are designed to avoid potential safety hazards. The side slopes within the stormwater basins are 4 horizontal to 1 vertical. This is flatter than the DEP standard of 3 horizontal to 1 vertical, which is flat enough for mowing by riding mower or tractor and does not present a hazard of “falling in”. The maximum prolonged ponding depth in the infiltration basin is less than 6" for 6 hours. Maximum depth of the detention basin in a 100 year storm is 2.7 feet for a brief period. No fencing should be required.

MAINTENANCE TASKS and BUDGET - ROUTINE AND NON-ROUTINE:

SYSTEM COMPONENT	WHEN NEEDED	REQUIRED MAINTENANCE	ESTIMATED COST - 2014 $
Infiltration Basin	After major storms (3.1"/24hrs), and at least 2x/year in spring and fall.	Inspect for signs of prolonged ponding, erosion of slopes or at inlet, clogging of outlet weir and pipe, complete vegetative cover, settlement of embankment.	$20/inspection when combined with other inspections
	2 x per year or more often if desired.	-Mow basin, slopes, and fill embankment not shorter than 3". Remove debris.	$200/year

	If ponded over 72 hours after end of rainfall	Pump to detention basin to de-water. Rototill basin surface, re-seed, and mulch. Block pipe to Grit Chamber until re-vegetated.	$1000/occurrence
	If needed - (when average grade in basin bottom is 4" or less below outlet weir	-Remove accumulated sediment to design grade. Rototill, reseed and mulch. -Avoid traffic on basin during wet conditions	$3000/occurrence
Detention Basin	After major storms (3.1"/24hrs) and at least 2x/year in spring and fall.	Inspect for erosion of slopes or at inlet, clogging of outlet orifice and pipe, complete vegetative cover, settlement of embankment. Repair as needed.	$30/inspection when combined with other inspections
	2 x per year or more often if desired..	Mow basin, fill embankment, and other slopes (if desired) not shorter than 3". Remove debris.	$400/yr
Stone Level Spreader	After major storms (3.1"/24hrs) and at least 2x/year in spring and fall	Check for displacement of stone or signs of erosive flows downslope. Repair or adjust as needed.	$20/inspection when combined with other inspections
Grit Chamber, Catch Basins, DMH 1	Spring and Fall	Inspect. Clean-out when sediment ½ depth of sump.	500/yr avg. cost
Grass Swale on Lots 4 & 5	Annually	Inspect to assure no obstruction or erosion. Remove obstruction or repair erosion as needed.	$20/inspection when combined with other inspections
Rain Gardens on Lots 2 & 3	Annually or if homeowner reports ponding over 72 hrs.	Inspect to assure no obstruction or fill. If prolonged ponding, replace planting media.	$20/inspection when combined with other inspections

LAWN AND LANDSCAPE MAINTENANCE: Use of fertilizers, herbicides, and pesticides will be at the discretion of individual lot owners and should be accordance with manufacturer's recommendations and regulatory requirements. All lawn or landscaped areas are over 50 feet from the wetlands.

SNOW PLOWING AND DISPOSAL: Snow plowing of the street will be done by the Town of South Hadley or by contractor for the Homeowners Association. Snow will normally be plowed to the treebelt. Meltwater from snow in the street or on driveways will be routed through the stormwater management system.

PLAN OF STORMWATER MANAGEMENT SYSTEM: See project plans.

SAMPLE DRAFT - OPERATION AND MAINTENANCE LOG FORM:

ETHAN CIRCLE, SOUTH HADLEY, MA

SYSTEM COMPONENT	WHEN NEEDED	REQUIRED MAINTENANCE	COMMENTS, DATE DONE, BY WHOM
Infiltration Basin	If ponded over 72 hours after end of rainfall	Pump to detention basin to de-water. Rototill basin surface, re-seed, and mulch. Block pipe to Grit Chamber until vegetation established.	
	If needed - (when average grade in basin bottom is 4" or less below outlet weir.	-Remove accumulated sediment to design grade. Rototill, reseed and mulch. -Avoid traffic on basin during wet conditions	
Detention Basin	After major storms (3.1"/24hrs) and at least 2x/year in spring and fall.	Inspect for erosion of slopes or at inlet, clogging of outlet orifice and pipe, complete vegetative cover, settlement of embankment. Repair or clean as needed.	.
Detention and Infiltration Basins	2 x per year or more often if desired..	-Mow basins and fill embankments not shorter than 3". Remove debris.	
Stone Level Spreader	After major storms, (3.1"/24hrs) and 2x/year in spring and fall	Check for displacement of stone or signs of erosive flows downslope. Repair or adjust as needed.	
Grit Chamber DMH 1& Catch Basins	Spring and Fall	Inspect. Clean-out when sediment ½ depth of sump.	
Grass Swale on Lots 4 & 5	Annually	Inspect to assure no obstruction or erosion. Remove obstruction or repair erosion as needed.	
Rain Gardens on Lots 2 & 3	Annually or if homeowner reports ponding over 72 hrs.	Inspect to assure no obstruction or fill. If prolonged ponding, replace planting media.	

APPENDIX B

CONSTRUCTION PERIOD POLLUTION PREVENTION & EROSION/SEDIMENTATION CONTROL PLAN

ETHAN CIRCLE, SOUTH HADLEY, MA

CONSTRUCTION PERIOD POLLUTION PREVENTION & EROSION/SEDIMENTATION CONTROL PLAN ETHAN CIRCLE SUBDIVISION SOUTH HADLEY, MA.

CONTENTS:

CONSTRUCTION PERIOD POLLUTION PREVENTION & EROSION & SEDIMENTATION CONTROL PLAN ETHAN CIRCLE SUBDIVISION, SOUTH HADLEY, MA.

1. INTRODUCTION:

This document and the referenced plans and reports are intended to provide guidance to the responsible party on site for protection of water quality in adjacent receiving water during construction of the project, and to be integrated with required Storm Water Pollution Prevention Plan (SWPPP) in compliance with the NPDES General Permit for Storm Water Discharge from Construction Sites, issued by US EPA. A full SWPPP will be filed with the South Hadley Conservation Commission before construction begins.

2. PROJECT OPERATOR AND RESPONSIBILITIES:

2.1 OPERATOR: The responsible "operator" for this project is that party that has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications. The operator for this project shall be designated on the USEPA eNOI "Notice of Intent", to be submitted to the USEPA. Land disturbance on the site may begin 14 days after acknowledgment of receipt on the EPA wet site, http://www.epa.gov/npdes/stormwater/cgpnoisearch.

The Operator for the road way and utility construction, stormwater management construction and rough grading on lots will be determined prior to construction, and designated in the SWPPP.

Owner/operators of individual lots, not under control of the "operator" for the overall subdivision construction, are responsible for Submittal of their own "Notice of Intent", for preparation and execution of their own SWPPP for any work not covered by the final SWPPP, and for compliance with relevant portions of the SWPPP.

2.2 OPERATOR'S RESPONSIBILITIES:
The Operator shall install, maintain, and replace as necessary all measures for erosion control, sediment control, wetland protection, and water quality protection, throughout the site as is outlined in this document and shown on the drawings and in accordance with local, state, and federal wetlands and environmental regulations and permits. The Operator shall execute all work in such a manner as to prevent alteration or degradation of wetlands or buffer zones beyond designated work limit lines, including taking temporary or emergency measures as necessary.

The Operator shall assume all responsibility for compliance with the following permits and related regulations:

1. Orders of Conditions issued under the Mass. Wetlands Protection Act, including referenced Notice of Intent for the project.
2. Water Quality Certification requirements of the Mass. DEP. under Section 401 of the Clean Water Act. (Not expected to be applicable)
3. U.S. Army Corps of Engineers Programmatic General Permit under Section 404 of the Clean Water Act. (Not expected to be applicable)
4. NPDES General Permit for Storm Water Discharge from Construction Sites, issued by US EPA.

3. DESCRIPTION OF SITE AND ACTIVITIES:

3.1 PROJECT DESCRIPTION: The Ethan Circle Subdivision is an 8 lot single family residential subdivision (including 2 existing homes) located on approximately 3.624 acres. The undeveloped land consists predominantly of soils derived from glacial outwash, with a forest cover. Slopes on the site range from gentle to moderate. The site includes a small area of wetland which will not be disturbed.

The work includes the construction of approximately 340 linear feet of roadway, private sanitary pressure sewer, public water supply, a stormwater management system, other utilities, and the construction of 6 new single family homes and related site work on the lots. A 50 ft wide naturally vegetated buffer is maintained between all land disturbance and any wetlands or waters.

3.2 AREAS:

Total site area:	3.624± Acres
Total Land Disturbance:	2.685± Acres.
Total New Impervious Area:	0.70± Acres

3.4 PLANS and DOCUMENTS: (to be available on-site during construction):

Plans will include Topography and Grading with Plan/Profile sheet, and Construction Details and Erosion/Sediment Control Details and specifications. Documents will include the "Notice of Intent" (under Mass. Wetlands Protection Act), with exhibits (including Stormwater Management Plan), and any "Order of Conditions" (Mass. Wetlands Protection Act).

3.5 POTENTIAL SOURCES OF STORMWATER POLLUTION DURING CONSTRUCTION

1. Exposed soils during site work and grading - temporarily susceptible to erosion and source of sediment until re-stabilized by construction or permanent vegetation.
2. Construction vehicle and equipment fueling and maintenance
3. Sanitary waste from construction crews
4. Concrete truck wash-water
5. Building site waste and trash
6. Sediment tracked onto pavement by vehicles
7. Fertilizer for lawn establishment
8. Paints, glues, cleaning solvents, and other construction related chemicals

4.0 STORMWATER MANAGEMENT CONTROLS:

4.1 PHASING OF WORK AREAS:

Due to the small size of the site (3.6 AC) and extent of grading required, the potential for phasing of disturbance within this subdivision phase is limited. Therefore the work will be in two basic phases as follows:

- Stormwater basin, roadway, drainage, and utilities, and rough grading on lots where related to road construction, with seeding on lots for interim vegetative cover and permanent seeding of treebelt, grass swale, infiltration basin, and detention basin.
- House construction on individual lots with finish grading and permanent vegetative cover.

4.2 GENERAL SEQUENCE OF WORK:

1. Stakeout and review of clearing limits and perimeter sediment barrier locations.
2. Clearing of work areas without stripping or grubbing. Installation of perimeter sediment barriers along perimeter work limit.
3. Construction of detention basin, installation of outlet and stone spreader with temporary skimmer and filter sock at spreader, permanent seeding of cut slopes and embankment, and temporary seeding of basin bottom.
4. Grubbing and stripping of ROW and grubbing of lots as needed, including loaming and temporary seeding of disturbed areas on lots.
5. Rough grading of roadway and grading/seeding of slope to Detention Basin, with stone swale.
6. Construction and seeding of infiltration basin and swale on lots 4 & 5.
7. Construction of roadway, drainage, sewer, water, and utilities, with temporary erosion controls and maintenance of erosion control measures, as site conditions require.
8. Permanent seeding and stabilization of ROW. Outlet from DMH1 to Grit Chamber shall be blocked until ROW and adjacent slopes are stabilized.

9. Removal of accumulated sediment from detention basin and permanent seeding of basin bottom after initial temporary and permanent seedings on the site are sufficiently established to prevent erosion. Detention basin outlet skimmer shall remain in place until vegetation is established on detention basin bottom.
10. Site development of individual lots may begin during road construction, with erosion/sediment controls for each lot.

4.3 EROSION AND SEDIMENT CONTROL MEASURES:

Preconstruction notifications and meetings: No land disturbance associated with this project shall occur until 14 days after receipt of USEPA eNOI has been confirmed by the USEPA. No work shall be performed within 100 feet of any wetland area until any notification and pre-construction meeting requirements of the Order of Conditions under the Mass. Wetlands Protection Act have been completed. These requirements shall be the responsibility of the Operator to arrange, attend, and document.

Perimeter Sediment Barrier and Work Limit: Before installation of the sediment barriers, the location shall be staked in the field for review and approval by the engineer or their representative. To facilitate sediment barrier installation, woody vegetation may then be removed and any required trench may be cut by machine, provided other ground cover is left intact.

No excavation, grading, filling, or removal of vegetative ground cover shall be performed within 100 feet of any wetland or stream until perimeter sediment barriers have been installed as shown on plans and have been inspected by the engineer or their representative.

Perimeter sediment barriers located adjacent to wetland areas shall serve as the limit of work for this project. No construction, equipment traffic, stockpiles, removal of vegetation, or other alteration shall be permitted on the wetland side of the sediment barrier/work limit without the approval of the engineer or their representative and the municipal Conservation Commission,

Silt fence: The bottom of the fence shall be trenched into the ground a minimum of 4" and back-filled with compacted soil. Where trenching is not feasible, silt fence skirt shall be covered with compacted soil or washed stone. The top of the fabric shall be stretched as tightly as is practical, with intermediate stakes added to correct excessive sags. Stakes shall be driven at least 12" into the ground. Splices between sections shall be made by rolling end stakes together one complete turn and driving into the ground together.

Straw bales: Bales may be used as temporary and moveable control measures, temporary check dams, or as reinforcement for silt fence in areas of concentrated runoff or high fills. Bales shall be tightly butted and staked 12" into the ground, with joints stuffed with straw.

Filter Sock ("Filtrexx" or equivalent): In areas of expected sheet flow, filter sock may be placed directly on the ground without trenching or stakes. In areas of expected concentrated flow, filter sock shall be staked as required to prevent movement or floatation, and mulch or washed stone shall be placed along the up-slope face to filter underflow. Area for filter sock installation may be machine or hand prepared to provide best bonding of sock with soil.

Stone Construction Entrance: A "Stone construction entrance" or "tracking mat" shall be installed and maintained at any points where construction traffic from an unpaved construction road or site access enters onto the paved public way or a paved portion of the project roadway.

Stockpiles: There shall be a sediment barrier between any soil stockpile any wetland, waterway, swale, gutter, or drain inlet. The base of the stockpile shall be kept at least 10 feet from the barrier. Temporary piles of trench spoil may be closer to the sediment barrier but shall not rest against the barrier. Soil expected to remain stockpiled for over 30 days shall be shaped to stable slopes and seeded or mulched for temporary cover. No stockpile shall be placed within a swale, drainage-way, or other path of concentrated surface runoff.

Temporary runoff controls: As site grading progresses, temporary erosion control measures shall be installed, maintained, and removed as necessary to control erosive accumulations of runoff or sediment discharge until final grade and cover are established. Temporary control measures may include sediment barriers, check dams, diversions, sediment basins, open-top culverts, and stone-lined swales.

Stocking additional materials: A stock of additional erosion control materials shall be maintained available on the site for emergency repairs and temporary measures. Stock shall be replenished when decreased to 50% of the numbers below. Stock shall include:

Straw-bales -	15 (Covered to be kept dry)
Oak stakes -	30
Silt fence -	100 linear feet.
Washed stone -	2 cubic yards, 3/4" to 1 ½" diameter
Filter fabric -	25± linear feet of 12 ft. Wide roll, or equivalent.

Trench protection: Open trenches shall be protected from accumulation of surface water or groundwater that could result in erosion of the trench and discharge of sediment. Where feasible, spoil shall be stockpiled on the up-slope side of the trench to prevent entrance of surface runoff. Backfill shall be crowned to allow for settlement and to avoid concentration of runoff on top of the trench.

Storm drain protection: The storm drain system shall be put into operation as soon as possible in order to control runoff within a non-erodible system. The storm drain system shall be protected against inflow of sediment. Open storm drain structures shall be protected by sediment barriers, filtrex filter socks, stone filter berms, or filter fabric inserts ("tea-bags", "silt-sacks" or equivalents). These measures shall be maintained until the tributary area is stabilized by pavement and vegetative cover. If CB grates are set above the base course of pavement, temporary asphalt berms or other measures may be required to direct runoff into the CB's.

Roadside slopes: Cut and fill slopes for roadway construction shall be finish graded, loamed, seeded, and mulched as soon as possible during road construction. This stabilization shall not await finish grading of roadway, tree-belts, or lots. Where necessary, temporary runoff controls will be provided to permit establishment of permanent vegetative cover.

Erosion control netting, mulch mats or Turf Reinforcement Mats shall be used on steep slopes or in swales if required to protect seeding until establishment. Materials shall be installed per manufacturers'

recommendations and anchored by burial of edges, staples, or stakes, as applicable.

Site Stabilization - Temporary: Where a portion of the site will not be subject to construction activity for over 14 days, measures shall be taken to provide temporary stabilization of that inactive portion of the site, within 14 days of the cessation of construction activity. Stabilization measures may include seeding for temporary cover, mulching, or other measures to protect exposed soil from erosion and prevent sediment movement.

Site Stabilization - Permanent: Within 14 days of completion of loaming and finish grading on any portion of the site, that area shall be seeded or planted for permanent cover in accordance with USDA NRCS guidelines or equivalent, season permitting.

Roadway Sweeping: The entrance to the site and affected portions of the public roadway or paved project roadway shall be swept as needed to control sediment runoff into storm drains or waterways and to control blowing dust.

Dust Control: Until the roadway is paved, the contractor shall take measures as necessary to control blowing dust, such as wetting the road surface, calcium chloride, or other soil stabilization compounds.

4.4 WORK ON INDIVIDUAL LOTS:

Site work on individual lots shall be controlled so as to prevent sediment discharge to the roadway, wetlands, or abutting lots. Typical measures may include:

- Sediment barrier along down-slope edge of graded areas.
- Stone construction entrance on driveway cut.
- Check dams across swales carrying concentrated runoff.
- Temporary diversions to carry runoff around open construction site.
- Stone-lined swales to carry concentrated runoff.
- Immediate temporary re-vegetation of slopes, prior to finish grading of yard and lawn.
- Curtain drainage or stone blanket to control seepage from cut slopes.
- Temporary piping of down-spout discharges across graded areas until lawn establishment.
- Water-bars or open-topped culverts on unpaved driveways to divert runoff to vegetated areas.

4.5 CONSTRUCTION PHASE HOUSE-KEEPING MEASURES:

- All vehicles on site will be monitored for leaks and receive regular preventive maintenance.
- Petroleum products will be stored in tightly sealed containers which are clearly labeled.
- Asphalt substances will be applied according to manufacturer's recommendations.
- Sanitary waste will be collected from portable units a minimum of weekly to avoid overfilling.
- A covered dumpster or appropriate trash container will be used for all waste materials.
- Concrete trucks will not be allowed to wash out chutes within 100 feet of any waterway or wetland. Discharge of surplus concrete or drum wash is not permitted on site.
- Vehicle maintenance and fueling will not be allowed within 100 feet of any waterway or wetland.
- Fertilizer for lawn establishment and stabilization seeding will be applied in accordance with

manufacturers instructions and will be incorporated into the soil or as part of a hydro seeding mulch or "Terraseeding" mix.

- Paints, Glues, cleaning solvents, and other construction related chemicals will be used in accordance with manufacturer's instructions. Residue and empty containers will be disposed of in closed containers for appropriate final off-site disposal. Hazardous materials shall be stored in lockable secondary containment boxes.

4.6 POST-CONSTRUCTION STORMWATER MANAGEMENT:

See accompanying "Stormwater Management Report" for stormwater management design calculations, TSS removal calculations, Groundwater Recharge calculations, and post-construction maintenance program. See Appendix B for Operation and Maintenance procedures.

5.0 INSPECTION AND MAINTENANCE PROCEDURES:

All cleared and/or graded areas of the site that have not been permanently stabilized shall be inspected by the Operator or their designated representative at least once every 7 days during construction, or at least once every 14 days and within 24 hours after any storm event of 0.25 inches or more. The inspections are intended to verify that erosion and sediment control measures are properly functioning, to identify any repairs or maintenance needed, and to identify actual or potential sources of sediment discharge and recommend corrective action. Inspections may be monthly if the ground is covered with snow and/or ice or is temporarily stabilized. Measures shall be kept in functioning condition until tributary areas are stabilized. Sediment will be removed from sediment barriers, check dams, swales, and sediment basins when it reaches 6" depth or half the depth of the structure, whichever is less. The inspector shall complete and sign an inspection report, including date, conditions noted, and corrective actions taken. Corrective actions or maintenance or maintenance on existing controls must be performed on the same day or next day after discovery that corrective action is required.

Inspections shall be performed by qualified personnel, knowledgeable in construction practices for erosion and sediment control. Inspectors shall be designated by the Operator or Site Contractor. Completed inspection reports will be maintained on-site until stabilization of the project area. All records will then be kept by the Operator for a minimum of 3 years.

STORMWATER MANAGEMENT - CONSTRUCTION PHASE MAINTENANCE

SYSTEM COMPONENT	RECOMMENDED MAINTENANCE BY SITE CONTRACTOR
SEDIMENT BARRIERS Silt Fence, Straw Bale, or Filtrex Sock	-Add stakes or re-staple sagging silt fence -Replace decomposed bales or deteriorated fabric -Remove sediments when 6" deep against the barrier -Any sediment remaining after barrier is no longer required should be removed or dressed to conform to existing grade, prepared and seeded. - Remove barrier as soon as tributary area is permanently stabilized.
Storm Drain Inlet Protection	- inspect to assure runoff is not by-passing inlet and creating erosion downstream. - Inspect for integrity - Remove sediment as needed or when at ½ design depth - Remove protection as soon as tributary area is permanently stabilized.
Catch Basins	-Check monthly until tributary area is stabilized and clean when sediment is half the depth of the sump.
Mulching	-Check rill erosion and apply additional mulch if needed -Inspect nets or mats for dislocation or failure -Repair washouts and reinstall nets or mats -Inspect until grass is established
Detention Basin as Sediment basin	-Remove sediment when it is 6" deep in bottom of basin. -Check skimmer to be sure it is floating freely. -Check for erosion of embankment, outlet blockage or other operational problems
Stone Construction Entrance (Tracking Mat)	- Check for clogging of stone surface and sediment accumulation - Remove clogged surface and renew, or wash to sediment trap.
Straw bale/silt fence sediment traps	-Remove sediment as needed when depth is 6" -Replace rotten and destroyed bales or deteriorated fence
Stone/fabric sediment filter	-Inspect for excessive clogging and prolonged ponding behind filter. -Remove sediment as needed when depth is 6" -Replace fabric and stone cover
Check Dams (stone, hay-bales, filtrex)	- Inspect for underflow or bypass. Low point should be approx center, 6" below ends. - Reshape or reinforce. Add stone upstream to control underflow
Water-bars	- Reshape as necessary to assure continued operation. - Inspect outlet for erosion and provide stone protection if needed
Open-Top Culverts	-Clean as necessary to assure continued operation -Inspect outlet for erosion and provide stone protection if needed

INSPECTION AND MAINTENANCE REPORT FORM

To be completed every 7 days or every 14 days and within 24 hours of a rainfall of 0.25" or more, or more frequently if weather conditions or site activities require. A copy of this report shall be kept on site with the SWPPP.

Inspector:_____ Title: _____ Date:_____

Qualifications:_____

Date of last storm: _____ Amount of last storm (inches): _____

Weather during inspection: _____

Location: _____

Items inspected: ___ Sediment barrier ___ Drain inlet protection ___ Mulch ___ Vegetative cover

____ Tracking mat ___ Detention/sediment basin ___ Check dams Other_____

Findings: ____ No sediment discharge (project is in compliance with SWPPP)

____ No action required ____ Maintenance required ____ Additional measures needed

____ Sediment discharge (describe)_____

_____

Signature of Inspector: _____

Corrective action/maintenance required:_____

_____

_____

_____

by whom:_____ by date:_____ Completed(initials) : _____ Date: _____

Sketch (if needed)

APPENDIX C

WATER QUALITY MANAGEMENT & RECHARGE CALCULATIONS

ETHAN CIRCLE SUBDIVISION

SOUTH HADLEY, MA

APPENDIX C

RECHARGE AND WATER QUALITY TREATMENT CALCULATIONS **ETHAN CIRCLE SUBDIVISION**

REVISED 9/28/14

VOLUME FOR GROUNDWATER RECHARGE:

HYDROLOGIC SOIL GROUP					A	B	C	D	
DEPTH TO INFILTRATE (INCHES)					0.60	0.35	0.25	0.1	
AREA:	NEW IMPERVIOUS (SQ.FT.)								TOTAL
	ROOF	DRIVE	ROAD	WALK					
Wo	6080	2965	886	502	10433				
Ag	4999	2400	6321	913		14633			
Am		750	4486	170			5406		
	11079	6115	11693	1585					
TOTAL IMPERV AREA BY HSG:					10433	14633	5406	0	30472 SQ.FT.
% OF TOTAL IMPERVIOUS:					34.2%	48.0%	17.7%	0.0%	
TOTAL RECHARGE REQUIRED (UNADJUSTED):					522	427	113	0	1062 CUBIC FEET
IMPERV AREA DRAINING TO RECHARGE BASIN:					26335	SQ.FT. =	86.42%	OF TOTAL	= % CAPTURE AREA
RECHARGE VOLUME ADJUSTMENT FACTOR:					1.157091				
TOTAL ADJUSTED RECHARGE VOLUME REQUIRED:									**1229 CUBIC FEET**
	PROVIDED AT ELEV		**94.5**						**1283 CU FT.**

DRAIN TIME CALCULATION MAIN INFILTRATION BASIN

2341	SF INFILTRATION AREA			2341	SF INFILTRATION AREA		
0.5	FT DEPTH	AT ELEV	94.5	0.5	FT DEPTH	AT ELEV	94.5
1	IN PER HOUR EXFILTRATION RATE			0.17	IN PER HOUR EXFILTRATION RATE		
0.083333	FT PER HOUR EXFILTRATION RATE			0.014167	FT PER HOUR EXFILTRATION RATE		
6	**HOURS DRAIN TIME**			**35.3**	**HOURS DRAIN TIME**		

DRAIN TIME CALCULATION RAIN GARDENS

420	SF INFILTRATION AREA			420	SF INFILTRATION AREA		
0.5	FT DEPTH	AT ELEV		0.5	FT DEPTH	AT ELEV	
1	IN PER HOUR EXFILTRATION RATE			0.17	IN PER HOUR EXFILTRATION RATE		
0.083333	FT PER HOUR EXFILTRATION RATE			0.014167	FT PER HOUR EXFILTRATION RATE		
6	**HOURS DRAIN TIME**			**35.3**	**HOURS DRAIN TIME**		

VOLUME FOR TREATMENT

30472	SQ.FT.	TOTAL NEW IMPERVIOUS				
-4137	SQ. FT.	NEW IMPERV.NOT DRAINING TO STORMWATER DISCHARGE (rear roofs, lots 2,3,&6, Rd entrance)				
26335	SQ. FT.	NEW IMPERVIOUS AREA FOR TREATMENT				
0.5	INCH TREATMENT VOLUME					
1097	**CU FT.**	**REQUIRED**	**1283**	**CU FT.**	**PROVIDED AT ELEV**	**94.5**

GRIT CHAMBER VOLUME

IMPERVIOUS AREA FOR TREATMENT:	26335	SQ.FT.=	0.60	ACRES	
TREATMENT VOLUME REQUIRED:	400	CF/AC x	0.60	AC =	242 CU. FT. REQUIRED

VOLUME CALCULATIONS:	WIDTH	LENGTH	DEPTH	VOLUME	
	4.5	10.7	5.4	260	CU.FT. MINIMUM PROVIDED

TSS REMOVAL CALCULATIONS

A	B	C	D	E	
BMP	TSS REMOVAL RATE	STARTING LOAD	REMOVED A x C	REMAINING LOAD (C-D)	COMBINED REMOVAL
DEEP SUMP CB'S	25.00%	100.00%	0.250	75.0%	25.00%
INFILTRATION BASIN	80.00%	75.00%	0.600	15.0%	**85.00%**

WITH PRETREATMENT BY GRIT CHAMBER, EQUIVALENT TO OR GREATER THAN FOREBAY.

APPENDIX D

WORKSHEET FOR Tc & AREA CALCULATIONS

ETHAN CIRCLE SUBDIVISION

SOUTH HADLEY, MA

APPENDIX D

TIME OF CONCENTRATION AND DRAINAGE AREA WORKSHEET **ETHAN CIRCLE, SO. HADLEY, MA**

12/24/13
REVISED 09/28/14

AREA ID: E1A TO NORTHWESTERN PL, HSGA

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
109.1	106	100	3.10%	0.4	WOODS	3.1	18.3

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
106	104	50	4.00%	0.1	0.1	WOODS NO DEFINED SWALE	3	0.6	1.4
104	102	80	2.50%	0.08	0.15	LAWN, SLIGHT SWALE	5	0.8	1.7

TOTAL TIME OF CONCENTRATION: E1A **MINUTES 21.4**

WOODS	HSGA	12903

AREA ID: E1B TO NORTHWESTERN PL, HSGB

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
108.1	104	80	5.12%	0.4	WOODS	3.1	12.5

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
104	102.5	65	2.31%	0.1	0.15	WOODS, SLIGHT SWALE	4	0.6	1.8
102.5	102	55	0.91%	0.08	0.15	LAWN, SLIGHT SWALE	5	0.5	1.8

TOTAL TIME OF CONCENTRATION: E1B **MINUTES 16.1**

ROOFS UNCON	HSGB	603
DRIVE UNCON	HSGB	478
LAWN	HSGB	14026
WOODS	HSGB	16429
TOTAL AREA:		31536

AREA ID: E2A CENTRAL AREA, HSGA TO SOUTHEASTERN PL

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
109.1	101	100	8.10%	0.4	WOODS	3.1	12.5

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
101	96	60	8.33%	0.1	0.15	WOODS, SLIGHT SWALE	4	1.2	0.8

TOTAL TIME OF CONCENTRATION: **MINUTES 13.3**

WOODS	HSGA	24255

AREA ID: E2B CENTRAL AREA, HSGB TO SOUTHEASTERN PL

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
108.1	107	75	1.47%	0.4	WOODS	3.1	19.6

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
107	104	115	2.61%	0.1	0.15	LAWN & WOODS, SLIGHT SWALE	4	0.6	3.2
104	96	80	10.00%	0.1	0.15	WOODS, SLIGHT SWALE	4	1.3	1.0

TOTAL TIME OF CONCENTRATION: **MINUTES 23.8**

ROOFS UNCON	HSGB	2000	rear #57 + est. Rear abutter
LAWN	HSGB	13290	
WOODS	HSGB	16481	
	TOT. B	31771	

AREA ID: E2C CENTRAL AREA, HSGC TO SOUTHEASTERN PL

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
103.5	94.5	100	9.00%	0.4	WOODS	3.1	12.0

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
94.5	88	90	7.22%	0.1	0.1	WOODS NO DEFINED SWALE	3	0.8	1.9

TOTAL TIME OF CONCENTRATION: **MINUTES** **13.9**

WOODS	HSGC	25334

TOTAL AREA E2'S 81360

WOODED SWALE SOUTHEAST TO PL

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"
96	88	175	4.57%	0.1

AREA ID: E3 TO NORTHEASTERN PL

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
108	101	75	9.33%	0.4	WOODS	3.1	9.4

TOTAL TIME OF CONCENTRATION: **E3** **MINUTES** **9.4**

WOODS	HSGA	12089

AREA ID: E4 TO HADLEY STREET

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
108.1	105.5	75	3.47%	0.24	LAWN	3.1	9.2

TOTAL TIME OF CONCENTRATION: **E4** **MINUTES** **9.2**

DRIVES CON	HSGB	1427
ROOFS UNCON	HSGB	1173
LAWN	HSGB	10171
TOTAL AREA:		12771

AREA ID: E5

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
103	93	66	15.15%	0.4	WOODS	3.1	7.0

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
93	90	80	3.75%	0.1	0.1	WOODS NO DEFINED SWALE	3	0.6	2.2

TOTAL TIME OF CONCENTRATION: **E5** **MINUTES** **9.2**

WOODS	HSGC	7274
WOODS	HSGD	6234
TOTAL AREA:		13508

AREA ID: P1A TO RAINGARDEN #2 HSGA

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
107.8	105.5	100	2.30%	0.24	LAWN	3.1	**13.7**

GRASS	HSGA	8171	
ROOFS-UNCON	HSGA	990	Lot 3,rear roof.
TOTAL AREA:	HSGA	9161	

SLIGHT SWALE IN LAWN FROM RG2 TO RG1

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"
105	102	30	10.00%	0.08

AREA ID: P1B TO NORTHWESTERN PL HSGB

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
106	102	115	3.48%	0.24	LAWN	3.1	**13.0**

ROOFS-UNCON	HSGB	1653	Lot 1 part, & lot 2 rear
GRASS	HSGB	17610	
TOTAL AREA:	HSGB	19263	

-

AREA ID: P2AB TO CB1,2,3 - DMH1

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
107.3	104.5	40	7.00%	0.24	LAWN	3.1	4.2

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
104.5	101.2	186	1.77%	0.012	0.2	GUTTER	42	5.6	0.6

TOTAL TIME OF CONCENTRATION: P2AB MINUTES 4.8

ROOFS CON	HSGB	3371	Lot 1 part, Lot 2 front, Lot 7 front, Lot 6 front
ROOFS CON	HSGA	2384	Lot 3, front, lot 4 front, Lot 5 part.
ROOFS UNCON	HSGB	3050	Lots 7 & 8 + abutter, rear roofs.
DRIVES CON	HSGB	2400	Lots 1,2,7
DRIVES CON	HSGA	2965	Lots 3,4,5
DRIVES CON	HSGC	750	Lot 6
ROAD	HSGB	5945	
ROAD	HSGA	886	
ROAD	HSGC	4486	
WALK	HSGB	683	
WALK	HSGA	502	
WALK	HSGC	170	
LAWN	HSGA	9814	
LAWN	HSGC	3835	
LAWN	HSGB	26777	
TOTAL AREA:		68018	

AREA ID: P2C OVERLAND TO DETENTION BASIN

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
101.5	94	55	13.64%	0.24	LAWN	3.1	4.2

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
NA	NA	NA	NA	0.12	0.15	SLIGHT SWALE IN LAWN	4	0.0	NA

TOTAL TIME OF CONCENTRATION: P2C MINUTES 4.2

ROOFS CON	HSGA	780
DTN BSN BTM	HSGC	2893
GRASS	HSGA	3980
GRASS	HSGB	6080
TOTAL AREA:		13733

AREA ID: P2D DIRECT TO SOUTHEASTERN PL

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
99	92	100	7.00%	0.4	WOODS	3.1	13.2

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
92	89	35	8.57%	0.1	0.1	WOODS NO DEFINED SWALE	3	0.9	0.7
89	88	20	5.00%	0.1	0.15	WOODLAND SWALE	4	0.9	0.4

TOTAL TIME OF CONCENTRATION: P2D MINUTES 14.2

GRASS	HSGA	1409	
WOODS	HSGA	1200	
WOODS	HSGC	5715	
GRASS	HSGC	2506	
TOTAL AREA:		10830	

AREA ID: P2E OVERLAND TO INFILTRATION BASIN

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
107.5	107	47	1.06%	0.24	LAWN	3.1	10.2

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
107	94	154	8.44%	0.04	0.2	GRASS SWALE	13	3.8	0.7

TOTAL TIME OF CONCENTRATION: P2E MINUTES 10.9

ROOFS CON	HSGA	204	LOT 5 PART
ROOFS UNCON	HSGA	1722	LOT 4 REAR, LOT 5 NORTH PART
INFILTR. BASIN	HSGA	2341	
GRASS	HSGA	9417	
TOTAL AREA:		13684	

AREA ID: P3 TO NORTHEASTERN PL

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
95	94	10	10.00%	0.24	LAWN	3.1	1.2

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
NA	NA	MA	NA						

TOTAL TIME OF CONCENTRATION: P3 MINUTES 1.2

GRASS, MEADOW	HSGA	1390	

AREA ID: P4 TO HADLEY STREET

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
108.1	105.5	75	3.47%	0.24	LAWN	3.1	9.2

TOTAL TIME OF CONCENTRATION: P4 MINUTES 9.2

DRIVES CON	HSGB	607	
ROOFS UNCON	HSGB	890	
NEW WALK	HSGB	230	
NEW STREET	HSGB	1367	
LAWN	HSGB	6077	
TOTAL AREA:		9171	

AREA ID: P5 SOUTHEAST CORNER TO WETLAND

SHEET FLOW: (TR55, REV. 6/86, EQ.3-3)

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"		24 HR. PRECIP. (INCHES)	TIME(MIN)
108.5	108	60	0.83%	0.24	LAWN	3.1	13.7

SHALLOW CONCENTRATED FLOW

ELEV.	TO ELEV.	DIST.(FT)	SLOPE	"n"	HYD. RAD.	DESCRIPTION	Kv	VEL(FPS)	TIME(MIN)
108	101	50	14.00%	0.08	0.15	LAWN, SLIGHT SWALE	5	1.9	0.4
101	93	60	13.33%	0.1	0.1	WOODS NO DEFINED SWALE	3	1.1	0.9
93	90	80	3.75%	0.1	0.1	WOODS NO DEFINED SWALE	3	0.6	2.2

TOTAL TIME OF CONCENTRATION: P5 **MINUTES 17.3**

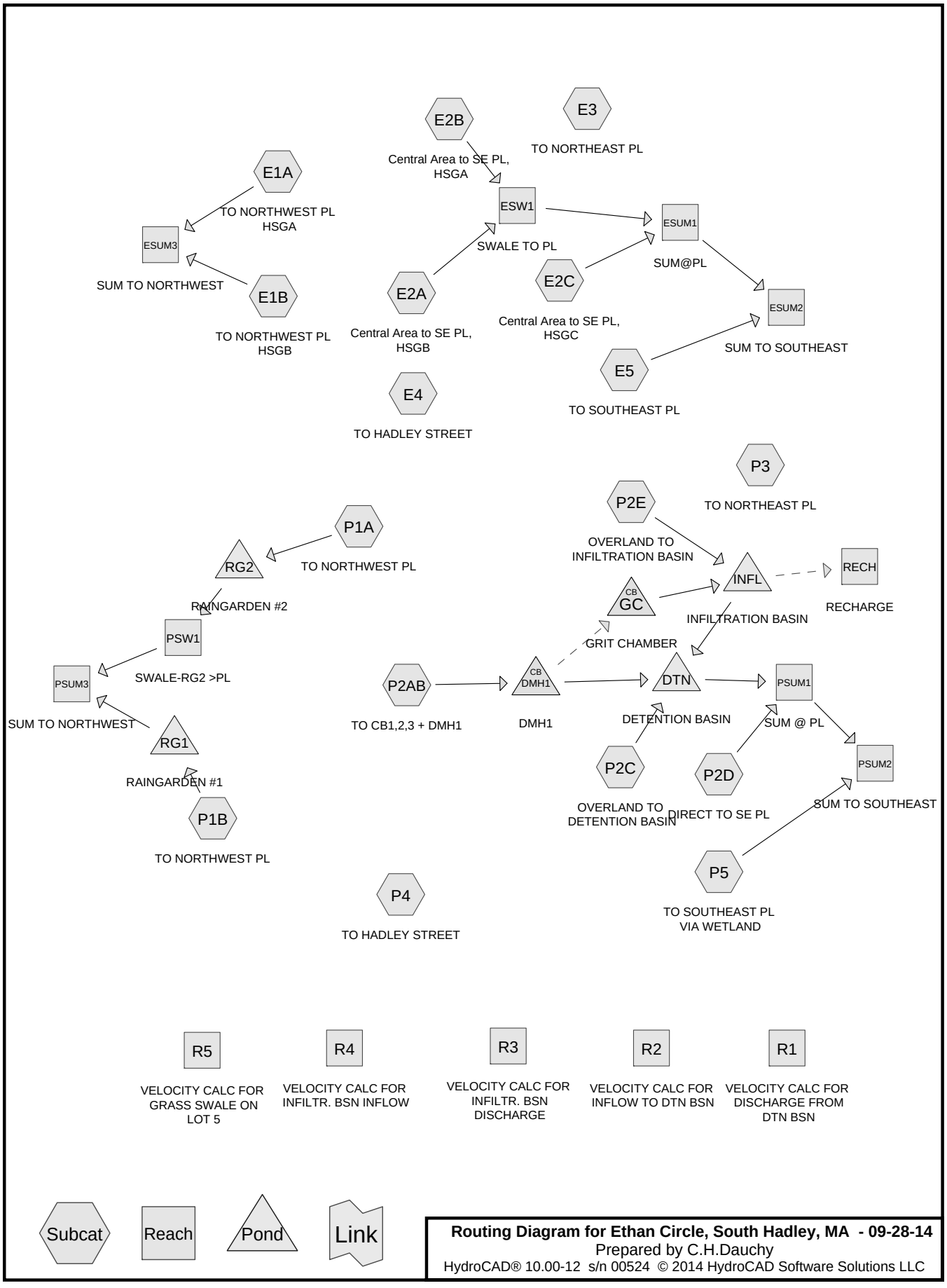
WOODS	HSGC	6521
LAWN	HSGC	964
LAWN	HSGB	4109
ROOFS UNCON		1050
WOODS	HSGD	6234
TOTAL AREA:		18878

APPENDIX E

WATERSHED MODEL AND ROUTING CALCULATIONS

ETHAN CIRCLE SUBDIVISION

SOUTH HADLEY, MA



Routing Diagram for Ethan Circle, South Hadley, MA - 09-28-14

Prepared by C.H.Dauchy

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 2
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1A: TO NORTHWEST PL Runoff Area=12,903 sf 0.00% Impervious Runoff Depth=0.00"
Tc=21.4 min CN=30/0 Runoff=0.00 cfs 0 cf

Subcatchment E1B: TO NORTHWEST PL Runoff Area=31,536 sf 3.43% Impervious Runoff Depth=0.36"
Tc=16.1 min CN=58/98 Runoff=0.11 cfs 944 cf

Subcatchment E2A: Central Area to SE PL, Runoff Area=31,771 sf 6.30% Impervious Runoff Depth=0.43"
Tc=23.8 min CN=58/98 Runoff=0.13 cfs 1,141 cf

Subcatchment E2B: Central Area to SE PL, Runoff Area=24,255 sf 0.00% Impervious Runoff Depth=0.00"
Tc=13.3 min CN=30/0 Runoff=0.00 cfs 0 cf

Subcatchment E2C: Central Area to SE PL, Runoff Area=25,334 sf 0.00% Impervious Runoff Depth=0.71"
Tc=13.9 min CN=70/0 Runoff=0.33 cfs 1,508 cf

Subcatchment E3: TO NORTHEAST PL Runoff Area=12,089 sf 0.00% Impervious Runoff Depth=0.00"
Tc=9.4 min CN=30/0 Runoff=0.00 cfs 0 cf

Subcatchment E4: TO HADLEY STREET Runoff Area=12,771 sf 20.36% Impervious Runoff Depth=0.85"
Tc=9.2 min CN=61/98 Runoff=0.20 cfs 909 cf

Subcatchment E5: TO SOUTHEAST PL Runoff Area=13,508 sf 0.00% Impervious Runoff Depth=0.86"
Tc=9.2 min CN=73/0 Runoff=0.26 cfs 965 cf

Subcatchment P1A: TO NORTHWEST PL Runoff Area=9,161 sf 10.81% Impervious Runoff Depth=0.30"
Tc=18.1 min CN=39/98 Runoff=0.05 cfs 228 cf

Subcatchment P1B: TO NORTHWEST PL Runoff Area=19,263 sf 8.58% Impervious Runoff Depth=0.57"
Tc=13.0 min CN=61/98 Runoff=0.16 cfs 917 cf

Subcatchment P2AB: TO CB1,2,3 + DMH1 Runoff Area=68,266 sf 38.97% Impervious Runoff Depth=1.23"
Tc=4.6 min CN=57/98 Runoff=1.89 cfs 6,991 cf

Subcatchment P2C: OVERLAND TO Runoff Area=13,733 sf 5.68% Impervious Runoff Depth=0.39"
Tc=4.2 min CN=57/98 Runoff=0.07 cfs 446 cf

Subcatchment P2D: DIRECT TO SE PL Runoff Area=10,830 sf 0.00% Impervious Runoff Depth=0.40"
Tc=14.2 min CN=62/0 Runoff=0.05 cfs 359 cf

Subcatchment P2E: OVERLAND TO Runoff Area=13,684 sf 14.07% Impervious Runoff Depth=0.39"
Tc=10.9 min CN=39/98 Runoff=0.11 cfs 444 cf

Subcatchment P3: TO NORTHEAST PL Runoff Area=1,390 sf 0.00% Impervious Runoff Depth=0.00"
Tc=1.2 min CN=30/0 Runoff=0.00 cfs 0 cf

Subcatchment P4: TO HADLEY STREET Runoff Area=9,171 sf 33.74% Impervious Runoff Depth=1.18"
Tc=9.2 min CN=61/98 Runoff=0.21 cfs 899 cf

Subcatchment P5: TO SOUTHEAST PL VIA Runoff Area=18,878 sf 5.56% Impervious Runoff Depth=0.87"
Tc=17.3 min CN=71/98 Runoff=0.28 cfs 1,372 cf

Reach ESUM1: SUM@PL Inflow=0.39 cfs 2,649 cf
Outflow=0.39 cfs 2,649 cf

Reach ESUM2: SUM TO SOUTHEAST Inflow=0.60 cfs 3,614 cf
Outflow=0.60 cfs 3,614 cf

Reach ESUM3: SUM TO NORTHWEST Inflow=0.11 cfs 944 cf
Outflow=0.11 cfs 944 cf

Reach ESW1: SWALE TO PL Avg. Flow Depth=0.06' Max Vel=0.39 fps Inflow=0.13 cfs 1,141 cf
n=0.100 L=175.0' S=0.0457 '/' Capacity=48.40 cfs Outflow=0.13 cfs 1,141 cf

Reach PSUM1: SUM @ PL Inflow=0.32 cfs 8,187 cf
Outflow=0.32 cfs 8,187 cf

Reach PSUM2: SUM TO SOUTHEAST Inflow=0.59 cfs 9,559 cf
Outflow=0.59 cfs 9,559 cf

Reach PSUM3: SUM TO NORTHWEST Inflow=0.10 cfs 303 cf
Outflow=0.10 cfs 303 cf

Reach PSW1: SWALE-RG2 >PL Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0 cf
n=0.080 L=30.0' S=0.0967 '/' Capacity=13.85 cfs Outflow=0.00 cfs 0 cf

Reach RECH: RECHARGE Inflow=0.00 cfs 53 cf
Outflow=0.00 cfs 53 cf

Pond DMH1: DMH1 Peak Elev=96.27' Inflow=1.89 cfs 6,991 cf
Primary=1.12 cfs 936 cf Secondary=0.77 cfs 6,055 cf Outflow=1.89 cfs 6,991 cf

Pond DTN: DETENTION BASIN Peak Elev=92.55' Storage=2,384 cf Inflow=2.04 cfs 7,828 cf
Outflow=0.27 cfs 7,827 cf

Pond GC: GRIT CHAMBER Peak Elev=95.90' Inflow=0.77 cfs 6,055 cf
Outflow=0.77 cfs 6,055 cf

Pond INFL: INFILTRATION BASIN Peak Elev=94.64' Storage=0 cf Inflow=0.85 cfs 6,500 cf
Primary=0.85 cfs 6,446 cf Secondary=0.00 cfs 53 cf Outflow=0.85 cfs 6,500 cf

Pond RG1: RAINGARDEN #1 Peak Elev=102.12' Storage=263 cf Inflow=0.16 cfs 917 cf
Discarded=0.01 cfs 613 cf Primary=0.10 cfs 303 cf Outflow=0.11 cfs 916 cf

Pond RG2: RAINGARDEN #2 Peak Elev=104.78' Storage=132 cf Inflow=0.05 cfs 228 cf
Discarded=0.00 cfs 227 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 227 cf

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points x 2
Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1A: TO NORTHWEST PL Runoff Area=12,903 sf 0.00% Impervious Runoff Depth=0.00"
Tc=21.4 min CN=30/0 Runoff=0.00 cfs 0 cf

Subcatchment E1B: TO NORTHWEST PL Runoff Area=31,536 sf 3.43% Impervious Runoff Depth=1.02"
Tc=16.1 min CN=58/98 Runoff=0.51 cfs 2,680 cf

Subcatchment E2A: Central Area to SE PL, Runoff Area=31,771 sf 6.30% Impervious Runoff Depth=1.12"
Tc=23.8 min CN=58/98 Runoff=0.49 cfs 2,955 cf

Subcatchment E2B: Central Area to SE PL, Runoff Area=24,255 sf 0.00% Impervious Runoff Depth=0.00"
Tc=13.3 min CN=30/0 Runoff=0.00 cfs 0 cf

Subcatchment E2C: Central Area to SE PL, Runoff Area=25,334 sf 0.00% Impervious Runoff Depth=1.67"
Tc=13.9 min CN=70/0 Runoff=0.86 cfs 3,534 cf

Subcatchment E3: TO NORTHEAST PL Runoff Area=12,089 sf 0.00% Impervious Runoff Depth=0.00"
Tc=9.4 min CN=30/0 Runoff=0.00 cfs 0 cf

Subcatchment E4: TO HADLEY STREET Runoff Area=12,771 sf 20.36% Impervious Runoff Depth=1.73"
Tc=9.2 min CN=61/98 Runoff=0.46 cfs 1,839 cf

Subcatchment E5: TO SOUTHEAST PL Runoff Area=13,508 sf 0.00% Impervious Runoff Depth=1.90"
Tc=9.2 min CN=73/0 Runoff=0.61 cfs 2,134 cf

Subcatchment P1A: TO NORTHWEST PL Runoff Area=9,161 sf 10.81% Impervious Runoff Depth=0.56"
Tc=18.1 min CN=39/98 Runoff=0.07 cfs 427 cf

Subcatchment P1B: TO NORTHWEST PL Runoff Area=19,263 sf 8.58% Impervious Runoff Depth=1.35"
Tc=13.0 min CN=61/98 Runoff=0.48 cfs 2,171 cf

Subcatchment P2AB: TO CB1,2,3 + DMH1 Runoff Area=68,266 sf 38.97% Impervious Runoff Depth=2.18"
Tc=4.6 min CN=57/98 Runoff=3.58 cfs 12,401 cf

Subcatchment P2C: OVERLAND TO Runoff Area=13,733 sf 5.68% Impervious Runoff Depth=1.04"
Tc=4.2 min CN=57/98 Runoff=0.33 cfs 1,194 cf

Subcatchment P2D: DIRECT TO SE PL Runoff Area=10,830 sf 0.00% Impervious Runoff Depth=1.14"
Tc=14.2 min CN=62/0 Runoff=0.23 cfs 1,029 cf

Subcatchment P2E: OVERLAND TO Runoff Area=13,684 sf 14.07% Impervious Runoff Depth=0.70"
Tc=10.9 min CN=39/98 Runoff=0.17 cfs 793 cf

Subcatchment P3: TO NORTHEAST PL Runoff Area=1,390 sf 0.00% Impervious Runoff Depth=0.00"
Tc=1.2 min CN=30/0 Runoff=0.00 cfs 0 cf

Subcatchment P4: TO HADLEY STREET Runoff Area=9,171 sf 33.74% Impervious Runoff Depth=2.15"
Tc=9.2 min CN=61/98 Runoff=0.42 cfs 1,646 cf

Subcatchment P5: TO SOUTHEAST PL VIA Runoff Area=18,878 sf 5.56% Impervious Runoff Depth=1.89"
Tc=17.3 min CN=71/98 Runoff=0.66 cfs 2,968 cf

Reach ESUM1: SUM@PL Inflow=1.11 cfs 6,489 cf
Outflow=1.11 cfs 6,489 cf

Reach ESUM2: SUM TO SOUTHEAST Inflow=1.59 cfs 8,623 cf
Outflow=1.59 cfs 8,623 cf

Reach ESUM3: SUM TO NORTHWEST Inflow=0.51 cfs 2,680 cf
Outflow=0.51 cfs 2,680 cf

Reach ESW1: SWALE TO PL Avg. Flow Depth=0.12' Max Vel=0.58 fps Inflow=0.49 cfs 2,955 cf
n=0.100 L=175.0' S=0.0457 '/' Capacity=48.40 cfs Outflow=0.47 cfs 2,955 cf

Reach PSUM1: SUM @ PL Inflow=0.96 cfs 15,362 cf
Outflow=0.96 cfs 15,362 cf

Reach PSUM2: SUM TO SOUTHEAST Inflow=1.54 cfs 18,329 cf
Outflow=1.54 cfs 18,329 cf

Reach PSUM3: SUM TO NORTHWEST Inflow=0.47 cfs 1,484 cf
Outflow=0.47 cfs 1,484 cf

Reach PSW1: SWALE-RG2 >PL Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0 cf
n=0.080 L=30.0' S=0.0967 '/' Capacity=13.85 cfs Outflow=0.00 cfs 0 cf

Reach RECH: RECHARGE Inflow=0.00 cfs 55 cf
Outflow=0.00 cfs 55 cf

Pond DMH1: DMH1 Peak Elev=96.40' Inflow=3.58 cfs 12,401 cf
Primary=2.59 cfs 2,670 cf Secondary=0.99 cfs 9,731 cf Outflow=3.58 cfs 12,401 cf

Pond DTN: DETENTION BASIN Peak Elev=93.11' Storage=4,503 cf Inflow=4.03 cfs 14,333 cf
Outflow=0.81 cfs 14,333 cf

Pond GC: GRIT CHAMBER Peak Elev=96.04' Inflow=0.99 cfs 9,731 cf
Outflow=0.99 cfs 9,731 cf

Pond INFL: INFILTRATION BASIN Peak Elev=94.67' Storage=0 cf Inflow=1.13 cfs 10,524 cf
Primary=1.13 cfs 10,469 cf Secondary=0.00 cfs 55 cf Outflow=1.13 cfs 10,524 cf

Pond RG1: RAINGARDEN #1 Peak Elev=102.17' Storage=290 cf Inflow=0.48 cfs 2,171 cf
Discarded=0.01 cfs 686 cf Primary=0.47 cfs 1,484 cf Outflow=0.48 cfs 2,170 cf

Pond RG2: RAINGARDEN #2 Peak Elev=104.93' Storage=210 cf Inflow=0.07 cfs 427 cf
Discarded=0.01 cfs 425 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 425 cf

Summary for Subcatchment E1A: TO NORTHWEST PL HSGA

Runoff = 0.00 cfs @ 15.24 hrs, Volume= 129 cf, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
12,903	30	Woods, Good, HSG A
12,903	30	100.00% Pervious Area

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

Summary for Subcatchment E1B: TO NORTHWEST PL HSGB

Runoff = 1.25 cfs @ 12.24 hrs, Volume= 5,659 cf, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
16,429	55	Woods, Good, HSG B
14,026	61	>75% Grass cover, Good, HSG B
603	98	Unconnected roofs, HSG B
478	98	Unconnected pavement, HSG B
31,536	59	Weighted Average
30,455	58	96.57% Pervious Area
1,081	98	3.43% Impervious Area

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

Summary for Subcatchment E2A: Central Area to SE PL, HSGB

Runoff = 1.13 cfs @ 12.35 hrs, Volume= 6,016 cf, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
2,000	98	Unconnected roofs, HSG B
13,290	61	>75% Grass cover, Good, HSG B
16,481	55	Woods, Good, HSG B
31,771	60	Weighted Average
29,771	58	93.70% Pervious Area
2,000	98	6.30% Impervious Area

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

Summary for Subcatchment E2B: Central Area to SE PL, HSGA

Runoff = 0.01 cfs @ 15.12 hrs, Volume= 242 cf, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
24,255	30	Woods, Good, HSG A
24,255	30	100.00% Pervious Area

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

Summary for Subcatchment E2C: Central Area to SE PL, HSGC

Runoff = 1.65 cfs @ 12.19 hrs, Volume= 6,599 cf, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
25,334	70	Woods, Good, HSG C
25,334	70	100.00% Pervious Area

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

Summary for Subcatchment E3: TO NORTHEAST PL

Runoff = 0.00 cfs @ 15.07 hrs, Volume= 121 cf, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
12,089	30	Woods, Good, HSG A
12,089	30	100.00% Pervious Area

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

Summary for Subcatchment E4: TO HADLEY STREET

Runoff = 0.87 cfs @ 12.13 hrs, Volume= 3,266 cf, Depth= 3.07"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

	Area (sf)	CN	Description
	10,171	61	>75% Grass cover, Good, HSG B
*	1,427	98	Driveway, HSG B
	1,173	98	Unconnected roofs, HSG B
	12,771	69	Weighted Average
	10,171	61	79.64% Pervious Area
	2,600	98	20.36% Impervious Area

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

Summary for Subcatchment E5: TO SOUTHEAST PL

Runoff = 1.12 cfs @ 12.13 hrs, Volume= 3,854 cf, Depth= 3.42"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

	Area (sf)	CN	Description
	7,274	70	Woods, Good, HSG C
*	6,234	77	Woods, Good, HSG D (WETLAND)
	13,508	73	Weighted Average
	13,508	73	100.00% Pervious Area

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

Summary for Subcatchment P1A: TO NORTHWEST PL

Runoff = 0.12 cfs @ 12.29 hrs, Volume= 894 cf, Depth= 1.17"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
8,171	39	>75% Grass cover, Good, HSG A
990	98	Unconnected roofs, HSG A
9,161	45	Weighted Average
8,171	39	89.19% Pervious Area
990	98	10.81% Impervious Area

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

Summary for Subcatchment P1B: TO NORTHWEST PL

Runoff = 1.02 cfs @ 12.18 hrs, Volume= 4,191 cf, Depth= 2.61"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
17,610	61	>75% Grass cover, Good, HSG B
603	98	Unconnected roofs, HSG B
1,050	98	Unconnected roofs, HSG B
19,263	64	Weighted Average
17,610	61	91.42% Pervious Area
1,653	98	8.58% Impervious Area

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

Summary for Subcatchment P2AB: TO CB1,2,3 + DMH1

Runoff = 6.12 cfs @ 12.07 hrs, Volume= 20,338 cf, Depth= 3.58"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

	Area (sf)	CN	Description
	3,371	98	Roofs, HSG B
	2,384	98	Roofs, HSG A
	3,050	98	Unconnected roofs, HSG B
*	2,400	98	Driveways, HSG B
*	2,965	98	Driveways, HSG A
*	750	98	Driveways, HSG C
	4,954	98	Paved roads w/curbs & sewers, HSG B
	886	98	Paved roads w/curbs & sewers, HSG A
	4,486	98	Paved roads w/curbs & sewers, HSG C
*	683	98	Walk, HSG B
*	502	98	Walk, HSG A
*	170	98	Walk, HSG C
	9,814	39	>75% Grass cover, Good, HSG A
	3,835	74	>75% Grass cover, Good, HSG C
	28,016	61	>75% Grass cover, Good, HSG B
	68,266	73	Weighted Average
	41,665	57	61.03% Pervious Area
	26,601	98	38.97% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6					**Direct Entry, See Separate Calculations**

Summary for Subcatchment P2C: OVERLAND TO DETENTION BASIN

Runoff = 0.79 cfs @ 12.07 hrs, Volume= 2,477 cf, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

	Area (sf)	CN	Description
	780	98	Roofs, HSG A
*	2,893	74	Detention Basin Bottom, HSG C
	6,080	61	>75% Grass cover, Good, HSG B
	3,980	39	>75% Grass cover, Good, HSG A
	13,733	59	Weighted Average
	12,953	57	94.32% Pervious Area
	780	98	5.68% Impervious Area

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

Summary for Subcatchment P2D: DIRECT TO SE PL

Runoff = 0.51 cfs @ 12.20 hrs, Volume= 2,138 cf, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
1,409	39	>75% Grass cover, Good, HSG A
1,200	30	Woods, Good, HSG A
5,715	70	Woods, Good, HSG C
2,506	74	>75% Grass cover, Good, HSG C
10,830	62	Weighted Average
10,830	62	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.2					**Direct Entry, See separate calculations**

Summary for Subcatchment P2E: OVERLAND TO INFILTRATION BASIN

Runoff = 0.27 cfs @ 12.17 hrs, Volume= 1,543 cf, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

	Area (sf)	CN	Description
	1,722	98	Unconnected roofs, HSG A
	204	98	Roofs, HSG A
*	2,341	39	Infiltration Basin Bottom, HSG A
	9,417	39	>75% Grass cover, Good, HSG A
	13,684	47	Weighted Average
	11,758	39	85.93% Pervious Area
	1,926	98	14.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9					**Direct Entry, 11.1**

Summary for Subcatchment P3: TO NORTHEAST PL

Runoff = 0.00 cfs @ 14.92 hrs, Volume= 14 cf, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

	Area (sf)	CN	Description
	1,390	30	Meadow, non-grazed, HSG A
	1,390	30	100.00% Pervious Area

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

Summary for Subcatchment P4: TO HADLEY STREET

Runoff = 0.72 cfs @ 12.13 hrs, Volume= 2,742 cf, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

	Area (sf)	CN	Description
	6,077	61	>75% Grass cover, Good, HSG B
	890	98	Unconnected roofs, HSG B
*	607	98	Driveways, HSG B
	1,367	98	Paved roads w/curbs & sewers, HSG B
*	230	98	Walk, HSG B
	9,171	73	Weighted Average
	6,077	61	66.26% Pervious Area
	3,094	98	33.74% Impervious Area

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

Summary for Subcatchment P5: TO SOUTHEAST PL VIA WETLAND

Runoff = 1.21 cfs @ 12.24 hrs, Volume= 5,329 cf, Depth= 3.39"

Runoff by SCS TR-20 method, UH=SCS, Split Pervious/Imperv., Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100YR STORM Rainfall=6.40"

Area (sf)	CN	Description
6,521	70	Woods, Good, HSG C
964	74	>75% Grass cover, Good, HSG C
4,109	61	>75% Grass cover, Good, HSG B
1,050	98	Unconnected roofs, HSG B
6,234	77	Woods, Good, HSG D
18,878	72	Weighted Average
17,828	71	94.44% Pervious Area
1,050	98	5.56% Impervious Area

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

Summary for Reach ESUM1: SUM@PL

Inflow Area = 81,360 sf, 2.46% Impervious, Inflow Depth = 1.90" for 100YR STORM event
Inflow = 2.37 cfs @ 12.25 hrs, Volume= 12,857 cf
Outflow = 2.37 cfs @ 12.25 hrs, Volume= 12,857 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

Summary for Reach ESUM2: SUM TO SOUTHEAST

Inflow Area = 94,868 sf, 2.11% Impervious, Inflow Depth = 2.11" for 100YR STORM event
Inflow = 3.24 cfs @ 12.19 hrs, Volume= 16,711 cf
Outflow = 3.24 cfs @ 12.19 hrs, Volume= 16,711 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

Summary for Reach ESUM3: SUM TO NORTHWEST

Inflow Area = 44,439 sf, 2.43% Impervious, Inflow Depth = 1.56" for 100YR STORM event
Inflow = 1.25 cfs @ 12.24 hrs, Volume= 5,788 cf
Outflow = 1.25 cfs @ 12.24 hrs, Volume= 5,788 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

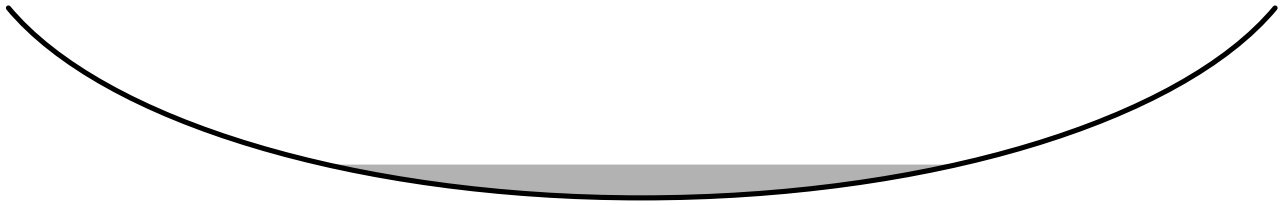
Summary for Reach ESW1: SWALE TO PL

Inflow Area = 56,026 sf, 3.57% Impervious, Inflow Depth = 1.34" for 100YR STORM event
Inflow = 1.13 cfs @ 12.35 hrs, Volume= 6,258 cf
Outflow = 1.10 cfs @ 12.40 hrs, Volume= 6,258 cf, Atten= 2%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.76 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 0.25 fps, Avg. Travel Time= 11.9 min

Peak Storage= 255 cf @ 12.40 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 1.00' Flow Area= 20.0 sf, Capacity= 48.40 cfs

30.00' x 1.00' deep Parabolic Channel, n= 0.100
Length= 175.0' Slope= 0.0457 '/'
Inlet Invert= 96.00', Outlet Invert= 88.00'



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Summary for Reach PSUM1: SUM @ PL

Inflow Area = 106,513 sf, 27.51% Impervious, Inflow Depth = 2.98" for 100YR STORM event
Inflow = 2.23 cfs @ 12.43 hrs, Volume= 26,442 cf
Outflow = 2.23 cfs @ 12.43 hrs, Volume= 26,442 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

Summary for Reach PSUM2: SUM TO SOUTHEAST

Inflow Area = 125,391 sf, 24.21% Impervious, Inflow Depth = 3.04" for 100YR STORM event
Inflow = 3.15 cfs @ 12.36 hrs, Volume= 31,771 cf
Outflow = 3.15 cfs @ 12.36 hrs, Volume= 31,771 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

Summary for Reach PSUM3: SUM TO NORTHWEST

Inflow Area = 28,424 sf, 9.30% Impervious, Inflow Depth = 1.58" for 100YR STORM event
Inflow = 1.00 cfs @ 12.20 hrs, Volume= 3,741 cf
Outflow = 1.00 cfs @ 12.20 hrs, Volume= 3,741 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

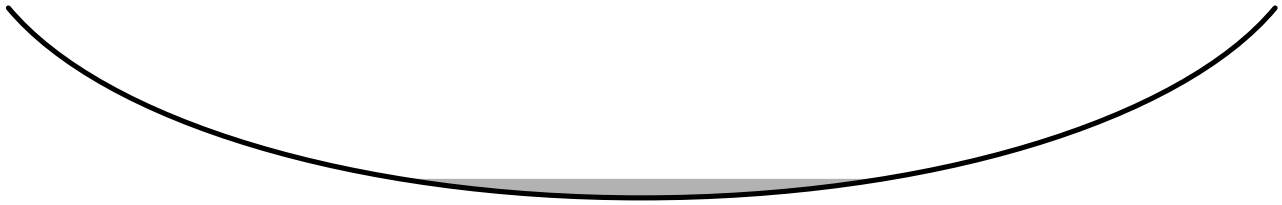
Summary for Reach PSW1: SWALE-RG2 >PL

Inflow Area = 9,161 sf, 10.81% Impervious, Inflow Depth = 0.36" for 100YR STORM event
Inflow = 0.09 cfs @ 12.49 hrs, Volume= 275 cf
Outflow = 0.09 cfs @ 12.50 hrs, Volume= 275 cf, Atten= 0%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 0.59 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 1.8 min

Peak Storage= 5 cf @ 12.50 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 0.50' Flow Area= 5.0 sf, Capacity= 13.85 cfs

15.00' x 0.50' deep Parabolic Channel, n= 0.080
Length= 30.0' Slope= 0.0967 '/'
Inlet Invert= 104.90', Outlet Invert= 102.00'



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Summary for Reach RECH: RECHARGE

Inflow = 0.00 cfs @ 12.14 hrs, Volume= 56 cf
Outflow = 0.00 cfs @ 12.14 hrs, Volume= 56 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

Summary for Pond DMH1: DMH1

Inflow Area = 68,266 sf, 38.97% Impervious, Inflow Depth = 3.58" for 100YR STORM event
Inflow = 6.12 cfs @ 12.07 hrs, Volume= 20,338 cf
Outflow = 6.12 cfs @ 12.07 hrs, Volume= 20,338 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.06 cfs @ 12.07 hrs, Volume= 6,050 cf
Secondary = 1.08 cfs @ 12.11 hrs, Volume= 14,289 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 96.58' @ 12.07 hrs
Flood Elev= 102.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	93.50'	**18.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.50' / 93.00' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	96.10'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

#3	Secondary	95.70'	**8.0" Round Culvert** L= 17.0' Ke= 0.500 Inlet / Outlet Invert= 95.70' / 95.50' S= 0.0118 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Primary OutFlow Max=5.05 cfs @ 12.07 hrs HW=96.58' TW=93.16' (Dynamic Tailwater)
└─**1=Culvert** (Passes 5.05 cfs of 12.98 cfs potential flow)
└─**2=Orifice/Grate** (Weir Controls 5.05 cfs @ 2.25 fps)

Secondary OutFlow Max=1.09 cfs @ 12.11 hrs HW=96.53' TW=96.11' (Dynamic Tailwater)
└─**3=Culvert** (Inlet Controls 1.09 cfs @ 3.12 fps)

Summary for Pond DTN: DETENTION BASIN

Inflow Area = 95,683 sf, 30.63% Impervious, Inflow Depth = 3.05" for 100YR STORM event
Inflow = 7.10 cfs @ 12.07 hrs, Volume= 24,303 cf
Outflow = 1.91 cfs @ 12.45 hrs, Volume= 24,304 cf, Atten= 73%, Lag= 22.9 min
Primary = 1.91 cfs @ 12.45 hrs, Volume= 24,304 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 93.85' @ 12.45 hrs Surf.Area= 4,989 sf Storage= 7,837 cf
Flood Elev= 94.10' Surf.Area= 5,314 sf Storage= 9,140 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 86.1 min (878.0 - 792.0)

Volume	Invert	Avail.Storage	Storage Description
#1	91.30'	14,457 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)
91.30	0	0.0	0	0	0
92.00	2,850	263.0	665	665	5,505
93.00	3,960	292.0	3,390	4,055	6,816
94.00	5,187	321.0	4,560	8,615	8,263
95.00	6,524	347.0	5,843	14,457	9,685

Device	Routing	Invert	Outlet Devices
#1	Primary	91.20'	**12.0" Round Culvert** L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 91.20' / 91.00' S= 0.0080 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Device 1	91.20'	**3.0" Horiz. Orifice/Grate** C= 0.600
#3	Device 1	92.60'	**6.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	93.70'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.91 cfs @ 12.45 hrs HW=93.85' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.91 cfs of 5.54 cfs potential flow)
├─**2=Orifice/Grate** (Orifice Controls 0.38 cfs @ 7.83 fps)
├─**3=Orifice/Grate** (Orifice Controls 0.94 cfs @ 4.81 fps)
└─**4=Orifice/Grate** (Weir Controls 0.58 cfs @ 1.25 fps)

Summary for Pond GC: GRIT CHAMBER

Inflow = 1.08 cfs @ 12.11 hrs, Volume= 14,289 cf
Outflow = 1.08 cfs @ 12.11 hrs, Volume= 14,289 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.08 cfs @ 12.11 hrs, Volume= 14,289 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 96.11' @ 12.11 hrs
Flood Elev= 96.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	95.36'	**8.0" Round Culvert** L= 136.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.36' / 94.00' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#2	Device 1	95.50'	**8.0" Horiz. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.08 cfs @ 12.11 hrs HW=96.11' TW=94.68' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 1.08 cfs @ 3.09 fps)
↑**2=Orifice/Grate** (Passes 1.08 cfs of 1.31 cfs potential flow)

Summary for Pond INFL: INFILTRATION BASIN

Inflow Area = 13,684 sf, 14.07% Impervious, Inflow Depth = 13.88" for 100YR STORM event
Inflow = 1.33 cfs @ 12.14 hrs, Volume= 15,832 cf
Outflow = 1.33 cfs @ 12.14 hrs, Volume= 15,832 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.33 cfs @ 12.14 hrs, Volume= 15,776 cf
Secondary = 0.00 cfs @ 12.14 hrs, Volume= 56 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 94.68' @ 12.14 hrs Surf.Area= 2,983 sf Storage= 0 cf
Flood Elev= 95.00' Surf.Area= 3,316 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.0 min (807.8 - 807.8)

Volume	Invert	Avail.Storage	Storage Description
#1	94.00'	0 cf	**Custom Stage Data (Irregular)**Listed below (Recalc) 2,809 cf Overall x 0.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
94.00	2,341	194.0	0	0	2,341
94.50	2,796	224.0	1,283	1,283	3,344
95.00	3,316	263.0	1,526	2,809	4,861

Device	Routing	Invert	Outlet Devices
#1	Secondary	94.00'	**0.010 in/hr Exfiltration over Horizontal area** Phase-In= 0.02'
#2	Primary	93.20'	**10.0" Round Culvert** L= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.20' / 93.00' S= 0.0111 '/' Cc= 0.900

n= 0.012, Flow Area= 0.55 sf

#3	Device 2	94.50'	**6.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.33 cfs @ 12.14 hrs HW=94.68' TW=93.46' (Dynamic Tailwater)
└**2=Culvert** (Passes 1.33 cfs of 2.71 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 1.33 cfs @ 1.20 fps)

Secondary OutFlow Max=0.00 cfs @ 12.14 hrs HW=94.68' TW=0.00' (Dynamic Tailwater)
└**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Summary for Pond RG1: RAINGARDEN #1

Inflow Area =	19,263 sf,	8.58% Impervious,	Inflow Depth =	2.61"	for 100YR STORM event
Inflow =	1.02 cfs @	12.18 hrs,	Volume=	4,191 cf	
Outflow =	1.01 cfs @	12.20 hrs,	Volume=	4,190 cf,	Atten= 1%, Lag= 0.9 min
Discarded =	0.01 cfs @	12.20 hrs,	Volume=	725 cf	
Primary =	1.00 cfs @	12.20 hrs,	Volume=	3,466 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 102.22' @ 12.20 hrs Surf.Area= 613 sf Storage= 317 cf

Plug-Flow detention time= 79.8 min calculated for 4,190 cf (100% of inflow)
Center-of-Mass det. time= 79.7 min (919.8 - 840.1)

Volume	Invert	Avail.Storage	Storage Description
#1	101.60'	577 cf	**6.00'W x 70.00'L x 1.00'H Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Discarded	101.60'	**2.400 in/hr Exfiltration over Horizontal area above 101.60'** Conductivity to Groundwater Elevation = 1.70' Excluded Horizontal area = 420 sf Phase-In= 0.01'
#2	Primary	102.10'	**10.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.01 cfs @ 12.20 hrs HW=102.22' (Free Discharge)
└**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=1.00 cfs @ 12.20 hrs HW=102.22' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.00 cfs @ 0.86 fps)

Summary for Pond RG2: RAINGARDEN #2

Inflow Area =	9,161 sf,	10.81% Impervious,	Inflow Depth =	1.17"	for 100YR STORM event
Inflow =	0.12 cfs @	12.29 hrs,	Volume=	894 cf	
Outflow =	0.10 cfs @	12.49 hrs,	Volume=	892 cf,	Atten= 19%, Lag= 12.0 min
Discarded =	0.01 cfs @	12.49 hrs,	Volume=	617 cf	
Primary =	0.09 cfs @	12.49 hrs,	Volume=	275 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 105.02' @ 12.49 hrs Surf.Area= 584 sf Storage= 262 cf

Plug-Flow detention time= 315.8 min calculated for 892 cf (100% of inflow)
Center-of-Mass det. time= 314.9 min (1,157.5 - 842.6)

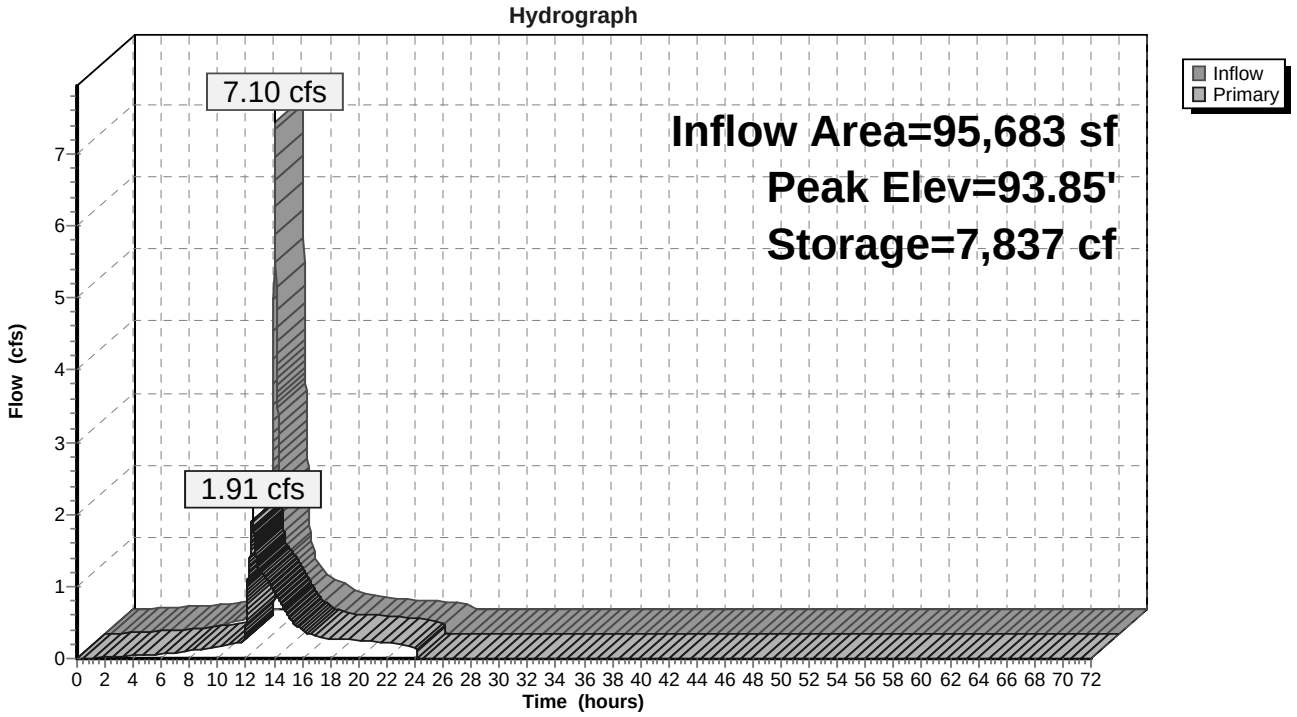
Volume	Invert	Avail.Storage	Storage Description
#1	104.50'	577 cf	**6.00'W x 70.00'L x 1.00'H Prismatoid Z=2.0**

Device	Routing	Invert	Outlet Devices
#1	Discarded	104.50'	**2.400 in/hr Exfiltration over Horizontal area above 104.50'** Conductivity to Groundwater Elevation = 2.00' Excluded Horizontal area = 420 sf Phase-In= 0.02'
#2	Primary	105.00'	**10.0' long x 2.0' 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 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.01 cfs @ 12.49 hrs HW=105.02' (Free Discharge)
└**1=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.09 cfs @ 12.49 hrs HW=105.02' TW=104.95' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.09 cfs @ 0.39 fps)

Pond DTN: DETENTION BASIN



Summary for Reach RECH: RECHARGE

Inflow = 0.06 cfs @ 12.59 hrs, Volume= 1,332 cf
Outflow = 0.06 cfs @ 12.59 hrs, Volume= 1,332 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2

Summary for Pond DMH1: DMH1

Inflow Area = 68,266 sf, 38.97% Impervious, Inflow Depth = 0.22" for RECHARGE VOL event
Inflow = 0.41 cfs @ 12.07 hrs, Volume= 1,242 cf
Outflow = 0.41 cfs @ 12.07 hrs, Volume= 1,242 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.41 cfs @ 12.07 hrs, Volume= 1,242 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 96.09' @ 12.07 hrs
Flood Elev= 102.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	93.50'	**18.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.50' / 93.00' S= 0.0100 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	96.10'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Secondary	95.70'	**8.0" Round Culvert** L= 17.0' Ke= 0.500 Inlet / Outlet Invert= 95.70' / 95.50' S= 0.0118 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=93.58' TW=91.30' (Dynamic Tailwater)
1=Culvert (Passes 0.00 cfs of 0.04 cfs potential flow)
2=Orifice/Grate (Controls 0.00 cfs)

Secondary OutFlow Max=0.41 cfs @ 12.07 hrs HW=96.09' TW=95.73' (Dynamic Tailwater)
3=Culvert (Barrel Controls 0.41 cfs @ 2.83 fps)

Summary for Pond GC: GRIT CHAMBER

Inflow = 0.41 cfs @ 12.07 hrs, Volume= 1,242 cf
Outflow = 0.41 cfs @ 12.07 hrs, Volume= 1,242 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.41 cfs @ 12.07 hrs, Volume= 1,242 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 95.73' @ 12.07 hrs
Flood Elev= 96.80'

Device	Routing	Invert	Outlet Devices
#1	Primary	95.36'	**8.0" Round Culvert** L= 136.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 95.36' / 94.00' S= 0.0100 '/' Cc= 0.900

n= 0.012, Flow Area= 0.35 sf
#2 Device 1 95.50' **8.0" Horiz. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.41 cfs @ 12.07 hrs HW=95.73' TW=94.09' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 0.41 cfs @ 2.07 fps)
└**2=Orifice/Grate** (Passes 0.41 cfs of 0.80 cfs potential flow)

Summary for Pond INFL: INFILTRATION BASIN

Inflow Area = 13,684 sf, 14.07% Impervious, Inflow Depth = 1.17" for RECHARGE VOL event
Inflow = 0.43 cfs @ 12.07 hrs, Volume= 1,332 cf
Outflow = 0.06 cfs @ 12.59 hrs, Volume= 1,332 cf, Atten= 87%, Lag= 31.5 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.06 cfs @ 12.59 hrs, Volume= 1,332 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 94.19' @ 12.59 hrs Surf.Area= 2,506 sf Storage= 451 cf
Flood Elev= 95.00' Surf.Area= 3,316 sf Storage= 2,809 cf

Plug-Flow detention time= 59.4 min calculated for 1,332 cf (100% of inflow)
Center-of-Mass det. time= 59.4 min (855.9 - 796.4)

Volume	Invert	Avail.Storage	Storage Description
#1	94.00'	2,809 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)
94.00	2,341	194.0	0	0	2,341
94.50	2,796	224.0	1,283	1,283	3,344
95.00	3,316	263.0	1,526	2,809	4,861

Device	Routing	Invert	Outlet Devices
#1	Secondary	94.00'	**1.000 in/hr Exfiltration over Horizontal area** Phase-In= 0.02'
#2	Primary	93.20'	**10.0" Round Culvert** L= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.20' / 93.00' S= 0.0111 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#3	Device 2	94.50'	**6.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=94.00' TW=91.30' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.00 cfs of 1.51 cfs potential flow)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.06 cfs @ 12.59 hrs HW=94.19' TW=0.00' (Dynamic Tailwater)
└**1=Exfiltration** (Exfiltration Controls 0.06 cfs)

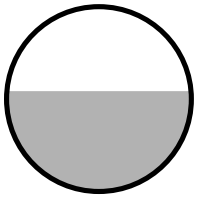
Summary for Reach R1: VELOCITY CALC FOR DISCHARGE FROM DTN BSN

Inflow = 1.71 cfs @ 0.00 hrs, Volume= 443,294 cf, Incl. 1.71 cfs Base Flow
Outflow = 1.98 cfs @ 0.01 hrs, Volume= 443,284 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.54 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.39 fps, Avg. Travel Time= 0.1 min

Peak Storage= 11 cf @ 0.01 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.45 cfs

12.0" Round Pipe
n= 0.012
Length= 25.0' Slope= 0.0080 '/'
Inlet Invert= 91.20', Outlet Invert= 91.00'



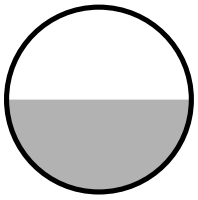
Summary for Reach R2: VELOCITY CALC FOR INFLOW TO DTN BSN

Inflow = 4.74 cfs @ 0.00 hrs, Volume= 1,228,779 cf, Incl. 4.74 cfs Base Flow
Outflow = 5.51 cfs @ 0.01 hrs, Volume= 1,228,737 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 6.25 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 6.01 fps, Avg. Travel Time= 0.1 min

Peak Storage= 47 cf @ 0.01 hrs
Average Depth at Peak Storage= 0.75'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 11.05 cfs

18.0" Round Pipe
n= 0.012
Length= 53.0' Slope= 0.0094 '/'
Inlet Invert= 93.50', Outlet Invert= 93.00'



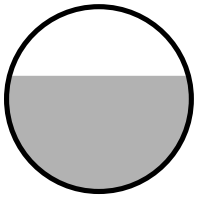
Summary for Reach R3: VELOCITY CALC FOR INFILTR. BSN DISCHARGE

Inflow = 1.41 cfs @ 0.00 hrs, Volume= 365,523 cf, Incl. 1.41 cfs Base Flow
Outflow = 1.62 cfs @ 0.01 hrs, Volume= 365,516 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.51 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 4.38 fps, Avg. Travel Time= 0.1 min

Peak Storage= 8 cf @ 0.01 hrs
Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 2.26 cfs

10.0" Round Pipe
n= 0.012
Length= 22.0' Slope= 0.0091 '/'
Inlet Invert= 93.20', Outlet Invert= 93.00'



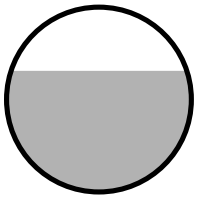
Summary for Reach R4: VELOCITY CALC FOR INFILTR. BSN INFLOW

Inflow = 1.19 cfs @ 0.00 hrs, Volume= 308,491 cf, Incl. 1.19 cfs Base Flow
Outflow = 1.20 cfs @ 0.01 hrs, Volume= 308,466 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 4.94 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 4.93 fps, Avg. Travel Time= 0.4 min

Peak Storage= 25 cf @ 0.01 hrs
Average Depth at Peak Storage= 0.44'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 1.56 cfs

8.0" Round Pipe
n= 0.012
Length= 105.0' Slope= 0.0143 '/'
Inlet Invert= 95.50', Outlet Invert= 94.00'



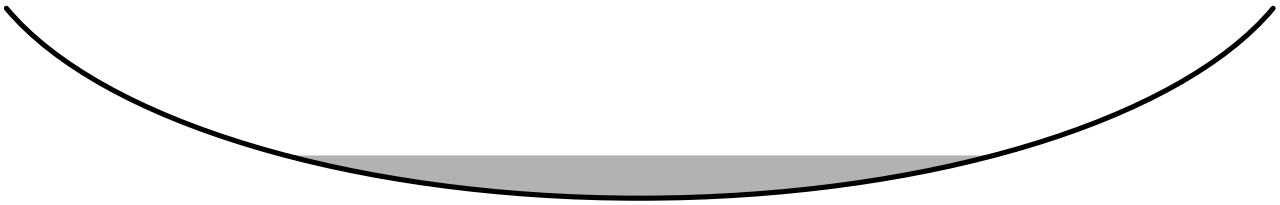
Summary for Reach R5: VELOCITY CALC FOR GRASS SWALE ON LOT 5

Inflow	=	0.27 cfs @	0.00 hrs, Volume=	69,994 cf,	Incl. 0.27 cfs Base Flow
Outflow	=	0.27 cfs @	0.57 hrs, Volume=	69,972 cf,	Atten= 0%, Lag= 34.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 1.91 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 1.90 fps, Avg. Travel Time= 1.3 min

Peak Storage= 22 cf @ 0.57 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 0.50' Flow Area= 1.3 sf, Capacity= 6.74 cfs

4.00' x 0.50' deep Parabolic Channel, n= 0.040
Length= 154.0' Slope= 0.0844 '/'
Inlet Invert= 107.00', Outlet Invert= 94.00'



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APPENDIX F

SOILS LOGS & SUMMARY

ETHAN CIRCLE SUBDIVISION

SOUTH HADLEY, MA

FORM 11: Soil Evaluation Form NO:_____

Commonwealth of Massachusetts
Town of SOUTH HADLEY

Soil Suitability Assessment: On-Site Sewage Disposal

Performed By: SHAWN KIMBERLEY Date: 11/9/12
Witnessed By: _____

Location Address of: RT 47
Lot #:
Owner's Name: ETHAN BAGG
Address of:

New Construction ☐ Repair ☐ Telephone:

Number of bedrooms:

Office Review

Published Soil Survey Available? No ☐ Yes ☒
Year Published _____ Publication Scale _____ Soil Map Unit _____
Drainage Class _____ Soil Limitations _____

Surficial Geologic Report Available? No ☐ Yes ☐
Year Published _____ Publication Scale _____
Geologic Material (map unit) _____
Landform _____

Flood Insurance Rate Map:
Above 500 year flood boundary? No ☐ Yes ☒
Within 500 year flood boundary? No ☒ Yes ☐
Within 100 year flood boundary? No ☒ Yes ☐

Wetland Area:
National Wetland Inventory Map (map unit) _____
Wetlands Conservancy Program Map (map unit) _____

Current Water Resource Conditions (USGS): month _____
Range: Above Normal ☐ Normal ☒ Below Normal ☐

Other Reference Reviewed:

Determination: Seasonal High Water Table

Methods Used:

☐ Depth observed standing in observation hole _____ inches
☐ Depth weeping from side of observation hole _____ inches
☐ Depth to soil mottles _____ inches
☐ Ground water adjustment _____ feet

Index Well No. _____ Reading Date _____ Index Well Level _____
Adjustment factor _____ Adjusted ground water _____

Depth of Naturally Occurring Pervious Material

Does at least four feet of naturally occurring pervious materials exist in all areas observed throughout the area proposed for this soil absorption system? yes

If not, what is the depth of naturally occurring pervious material?
_____

Certification

I certify that on 6/97 *(date) I have passed the soil evaluator examination approved by the Department of Environmental Protection and that the above analysis was performed by me consistent with the required training, expertise, and experience described in 310 CMR 15.017.*

Signature _____

Date _____

On-Site Review

Deep Hole Number 2012-01 Date: 11/19/12 Time 1:30
Weather CLEAR
Land Use WOODLAND Slope (%) 4%
Surface Stone FEW
Vegetation:
MIXED

Landform:

Position on Landscape (sketch on back)
Distances from:

Open Water Body 50+ feet — Drainageway _____ feet
Possible Wet Areas 50+ feet — Property Line 50 feet
Drinking Water Well _____ feet — Other _____

DEEP OBSERVATION HOLE LOG

depth from surface (inches)	soil horizon	soil texture (USDA)	soil color (Munsel)	soil mottling	other (structure, stones, boulders) consistency, % gravel
0-13	A	LOAMY SAND	10YR 4/4	-	CRUMB
13-20	B	LOAMY SAND	10YR 5/6	-	SI.GR.
20-64	C1	FINE SAND	2.5Y 5/4	7.5YR 4/6 @ 54"	SI.GR.
64-72	C2	VERY FINE SAND	5Y 4/2	SAME	FIRM
-					
-					
-					
-					
-					

Parent Material (geologic)
Depth to Bedrock >72
Depth to Groundwater:

Standing Water in the Hole NONE
Weeping from Pit Face NONE
Estimated Seasonal High Water 54"

Comments:

On-Site Review

Deep Hole Number 02 Date: Time
Weather
Land Use Slope (%)
Surface Stone
Vegetation:

Landform:

Position on Landscape (sketch on back)
Distances from:

Open Water Body feet — Drainageway _____ feet
Possible Wet Areas _____ feet — Property Line _____ feet
Drinking Water Well _____ feet — Other _____

DEEP OBSERVATION HOLE LOG

depth from surface (inches)	soil horizon	soil texture (USDA)	soil color (Munsel)	soil mottling	other (structure, stones, boulders) consistency, % gravel
0-12	A	LOAMY SAND	10YR 4/4	-	CRUMB
12-24	B	LOAMY SAND	10YR 5/6	-	SI.GR.
24-60	C1	FINE SAND	2.5Y 5/4	7.5YR 4/6 @ 48"	SI.GR.
60-70	C2	VERY FINE SAND	5Y 4/2	SAME	FIRM
-					
-					
-					
-					
-					

Parent Material (geologic)
Depth to Bedrock >70"
Depth to Groundwater:

Standing Water in the Hole NONE
Weeping from Pit Face NONE
Estimated Seasonal High Water 48"

Comments:

On-Site Review

Deep Hole Number 2012-03 Date: 11/9/12 Time 2:00
Weather
Land Use Slope (%)
Surface Stone
Vegetation:

Landform:

Position on Landscape (sketch on back)
Distances from:

Open Water Body feet Drainageway feet
Possible Wet Areas feet Property Line feet
Drinking Water Well feet Other

DEEP OBSERVATION HOLE LOG

depth from surface (inches)	soil horizon	soil texture (USDA)	soil color (Munsel)	soil mottling	other (structure, stones, boulders) consistency, % gravel
0-15	A	LOAMY SAND	10YR 3/4	-	CRUMB
15-20	B	LOAMY SAND	10YR 4/4	-	SI.GR.
20-36	C1	FINE SAND	2.5Y 5/4	-	SI.GR.
36-43	Ab	LOAMY SAND	10YR 3/2	7.5YR 4/6	MS,FR
43-63	C2	SANDY LOAM	5Y 4/2	SAME	FIRM
63-68	C3	FINE SANDY LOAM	5Y 4/2	SAME	FIRM
-					
-					
-					

Parent Material (geologic)
Depth to Bedrock >68"
Depth to Groundwater:

Standing Water in the Hole NONE
Weeping from Pit Face NONE
Estimated Seasonal High Water 36"

Comments:

On-Site Review

Deep Hole Number -04 Date: 11/9/12 Time 2:30
Weather
Land Use Slope (%)
Surface Stone
Vegetation:

Landform:

Position on Landscape (sketch on back)
Distances from:

Open Water Body feet Drainageway feet
Possible Wet Areas feet Property Line feet
Drinking Water Well feet Other

DEEP OBSERVATION HOLE LOG

depth from surface (inches)	soil horizon	soil texture (USDA)	soil color (Munsel)	soil mottling	other (structure, stones, boulders) consistency, % gravel
0-8	A	SANDY LOAM	10YR 3/4	-	CRUMB
8-16	B	SANDY LOAM	10YR 4/4	7.5YR 4/6 @ 15"	FIRM
16-42	C	SILT LOAM	5Y 4/3	SAME	COMPACT
-					
-					
-					
-					
-					
-					

Parent Material (geologic)
Depth to Bedrock >42"
Depth to Groundwater:

Standing Water in the Hole NONE
Weeping from Pit Face NONE
Estimated Seasonal High Water 15"

Comments:

LOG OF SOIL INVESTIGATION

ETHAN CIRCLE SUBDIVISION - STORMWATER INFILTRATION BASIN

INVESTIGATION DATE: 8/24/2014 BY: C. H. DAUCHY

AH #5

DEPTH FROM SURFACE (INCHES)	MATRIX COLOR	REDOX COLOR	REDOX %	SOIL TEXTURE (USDA)	OTHER	REMARKS
0-3	10YR 3/2			LOAMY SAND	CRUMB	
3-12	10YR 3/3			FINE SAND	SI.GR.	
12-18	10YR 5/4			FINE SAND	SI.GR.	
18-26	10YR 4/4			LOAMY SAND	SI.GR.	
26-60	10YR 5/4			FINE SAND	SI.GR.	
60-74	10YR 5/4	7.5YR 4/6	5%	FINE SAND	SI.GR.	ESHWT = 60"
74-79	10YR 4/3			VERY FINE SANDY LOAM	FIRM	
79-84	10YR 4/4	7.5YR 4/6	5%	FINE SAND	SI.GR.	

AH #6

DEPTH FROM SURFACE (INCHES)	MATRIX COLOR	REDOX COLOR	REDOX %	SOIL TEXTURE (USDA)	OTHER	REMARKS
0/13	10YR 3/3			LOAMY SAND	CRUMB	
13-28	10YR 4/5			FINE SAND	SI.GR.	
28-53	10YR 5/4			FINE SAND	SI.GR.	
53-60	10YR 5/4	7.5YR 4/6	5%	FINE SAND	SI.GR.	ESHWT = 53"
60-62	10YR 5/4	7.5YR 4/6	20%	FINE SAND	SI.GR.	
62-74	10YR 5/4	7.5YR 4/6	20%	FINE SAND	SI.GR.	STRATIFIED
	10YR 4/3			LOAMY SAND	FIRM	
74-80	10YR 5/4	7.5YR 4/6	20%	FINE SAND	SI.GR.	STRATIFIED
	10YR 4/3			VERY FINE SANDY LOAM	FIRM	
80-84	10YR 4/3			SILT LOAM	FIRM	

ESTIMATED GROUNDWATER ELEVATIONS
ETHAN CIRCLE SUBDIVISION, SOUTH HADLEY, MA

HOLE ID	DOMINANT TEXTURES	GROUND ELEV.	DEPTH TO ESHWT	ESHWT ELEV.
2012-01	LS, FS	94.27	4.5	89.77
2012-2	LS, FS	94.1	4	90.1
2012-3	LS, FS	92.87	3	89.87
2012-4	SL, SIL	91.76	1.25	90.51
AH1	LS	102.45	2.5	99.95
AH2	LS, FS	106.5	3.5	103
AH3	FS	108.76	6	102.76
AH4	SL, SIL	106.4	3	103.4

HAND AUGER HOLES A1-4 WERE DONE 11/9/12 BY C. H. DAUCHY TO DETERMINE FEASIBILITY OF RAIN GARDENS.

AH5	LS,FS	94.58	5	89.58
AH6	LS,FS	94.07	4.42	89.65

HA HOLES A5-A6, 8/24/14 BY C.H.DAUCHY

APPENDIX G

ANALYSIS OF
LOW IMPACT DEVELOPMENT ALTERNATIVES

ETHAN CIRCLE SUBDIVISION
SOUTH HADLEY, MA

APPENDIX G

Analysis of Low Impact Development Alternatives for Stormwater Management
Ethan Circle Subdivision, South Hadley, MA Rev. 9/28/14

The list of LID alternatives considered below (*shown in italics*) reflects Feb. 2010 guidance from DEP to Conservation Commissions. Considerations are shown without italics.

a. Removal of all proposed work and/or impervious surfaces from the Department's jurisdiction:
Due to the configuration of this small site, such an alternative would make the project economically unfeasible.

b. Division of the upper portion of the subject catchments into smaller subcatchments, where resultant stormwater discharges should be completely infiltrated and/or retained;
The small size of the site means that the subcatchments are small to start with and that there are few "upper" portions of the subcatchments. Due to the relatively high groundwater levels and topographic constraints, retention and infiltration on most of the lots is not feasible.

c. Maintaining existing drainage patterns and not mixing country drainage with untreated stormwater; The overall drainage patterns from the site are maintained, except that the tributary are to the northwest and northeast is somewhat reduced to avoid exacerbating existing neighborhood drainage complaints.

d. Treatment of remaining stormwater at or proximate to its source within these subcatchments;
Topography, small lot size, and groundwater elevations prevent significant treatment and/or infiltration of stormwater within the tributary subcatchments. Two raingardens are proposed for control of runoff peak flows and volumes, but do not qualify for treatment or recharge due to the limited depth to water table. A grass swale is also proposed to direct flow away from abutters, but has insufficient travel time to qualify as providing treatment.

e .Installation of "qualifying pervious areas" (See Handbook, Volume 3, Chapter 1, p. 42) to accept stormwater discharge from roads and driveways within each subcatchment;
On this site, only the rear of two lots, draining away from the regulated point source discharge might be considered for "qualifying pervious areas". However the additional requirements in terms of length and width of flow path could not reasonably be met, enforced, and inspected on these small individual lots. This practice is more applicable to larger lots, or to a condominium.

f .Installation of dry wells for acceptance of roof drainage;
Dry wells, or even shallower infiltration trenches or chambers, are not practicable on this site due to the relatively high groundwater level on most of the site. There is also the practical impediment of enforcement, supervision of installation, and maintenance of an underground infiltration structure on an individual lot.

g. Disconnection of roof drainage;
The design proposes disconnection of roof drainage where feasible, in that no drain is to be directly connected to the storm drain system. All rear roofs are expected to drain to the rear lawns, where they will flow over vegetated areas. Except for Lots 1(already developed), 2, and 3, the rear yard runoff is directed over vegetated areas, but ultimately to the stormwater

management system. Front roofs will drain to the front lawns, but due to the small lot areas, the flow paths to the street are so short that they are considered connected impervious for purposes of conservative runoff calculations.

h Installation of discrete structural Best Management Practices at relatively high elevations in each subcatchment. For instance, canting access road surfaces into grassed channels, water quality swales, vegetated filter strips, bioretention areas, sand and organic filters, drainage swales, level spreaders, etc. which terminate outside of the Department's jurisdiction;
As discussed above, small lots, topographic constraints, and the matter of individual lot ownership and maintenance responsibility limit the practicality of such techniques in this situation. Drainage swales and rain gardens are used where feasible, but cannot meet DEP standards for treatment or recharge.

i.If a redesign based upon the above requirements still results in a "point source" of "stormwater discharge" into the Department's jurisdiction, then further assessment of the following should be included in the written analysis:
•Reduction in impervious surfaces;
The proposed road is as narrow as is permitted under the town subdivision regulations. The proposed houses and driveways are typical in size to others in the general neighborhood. The Planning Board has agreed to a sidewalk on only one side of the street.

•Reduction in the number of proposed lots, proposed housing units, and/or allied appurtenances;
The concept of 5 new lots instead of 6 was considered and rejected due to economic considerations.

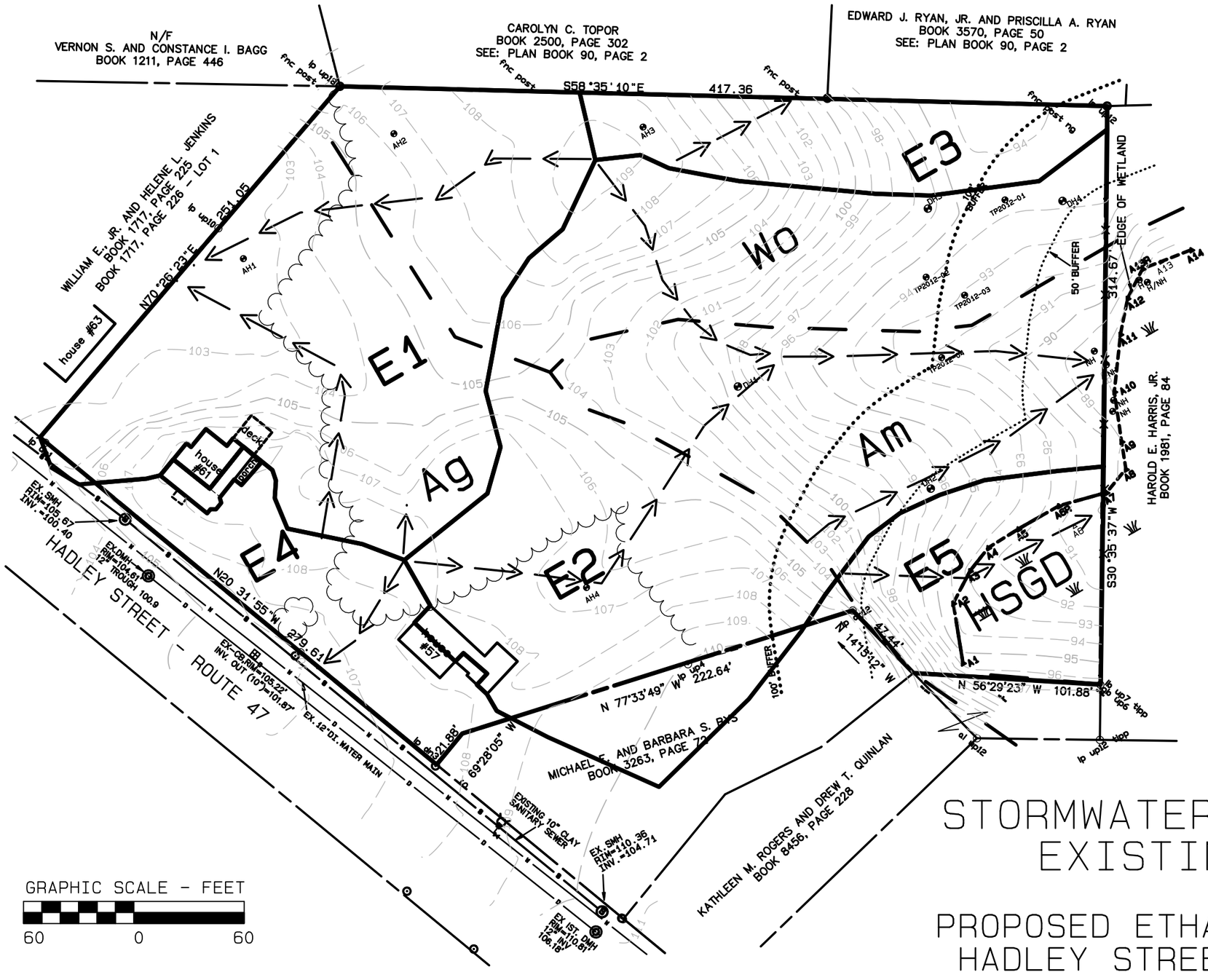
•Road width and length reductions;
The road is as narrow as permitted by town subdivision regulations. Based on a preliminary discussion with the Town Planner, it may be possible to reduce the total pavement by using a "Y" turnaround instead of the conventional circle. This approach is now proposed and shown on the plans, subject to Planning Board approval.

•Clustering of impervious surfaces;
The total project area is too small to qualify for "Flexible Development" under the town's zoning, which might otherwise allow clustering of impervious surfaces.

•Addition of planted materials and landscaped areas;
All lots will be vegetated, except for normal features such as houses, driveways, walks, patios.

•Re-grading of landscaped areas away from jurisdictional Resource Areas and their Buffer Zones;
Due to neighborhood concerns about runoff to abutting properties, re-grading to divert runoff away from the buffer zone is not feasible.

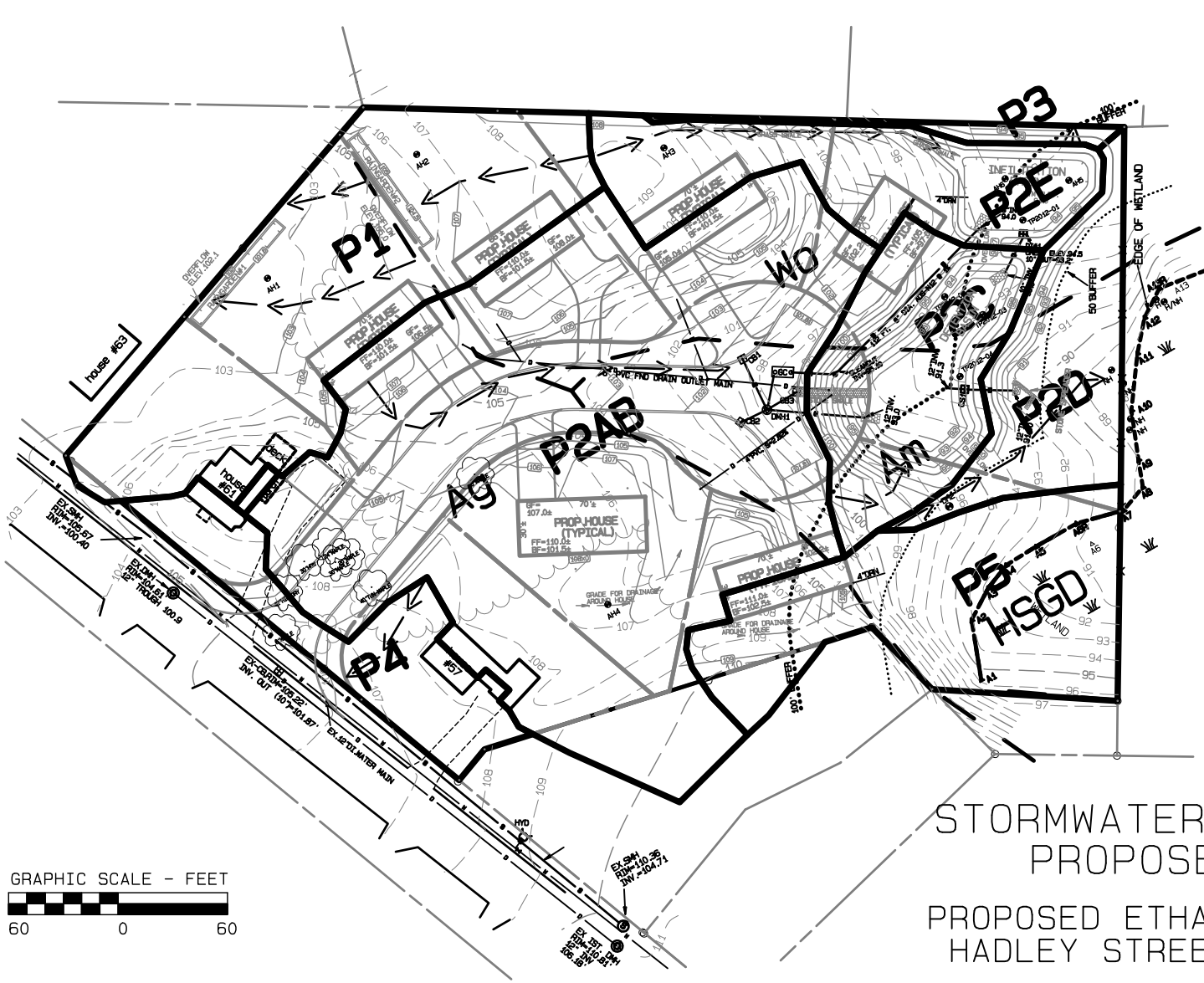
•Preservation of vegetated areas within the Buffer Zone, and immediately proximate to jurisdictional resource areas;
A 50' wide undisturbed upland buffer will be preserved between developed areas and the wetlands.



STORMWATER TRIBUTARY AREAS EXISTING CONDITIONS

PROPOSED ETHAN CIRCLE SUBDIVISION
HADLEY STREET, SOUTH HADLEY, MA

12/24/13



STORMWATER TRIBUTARY AREAS
PROPOSED CONDITIONS

PROPOSED ETHAN CIRCLE SUBDIVISION
HADLEY STREET, SOUTH HADLEY, MA

12/24/13, REV.8/13/14, 9/28/14