STORMWATER MANAGEMENT SUMMARY

RICHARDSON CROSSING
113 Central Street, Acton, MA
6729
June 19, 2009
Revised September 21, 2009

EXISTING RUNOFF PATTERNS

The site is located on the northerly side of Central Street immediately to the east of the intersection of Central Street and the Commuter Rail train tracks and currently consists of a single family residence with a detached garage. The property is bounded on the north by an apartment complex located at 117 Central Street and on the eastern and southern property lines by residential properties.

There are no wetland resource areas located on the property and the site is located above the 500 year flood zone elevation as referenced on FIRM Map, Community Panel 250176-0003 C, dated January 6, 1988. Topography at the site slopes gently to moderately from a high elevation located in the northern portion of the property to a low elevation along the property frontage adjacent to Central Street. Surface characteristics of the property are mostly wooded, with small amounts of grassy lawn surfaces and impervious surfaces consisting of roof and a driveway.

Currently surface runoff collects and flows in a north to south direction towards Central Street. There are no point source discharges.

SURFICIAL GEOLOGY

The site is shown to be located on a drumlin (USGS 1948) and soils consisted of till soils containing ground rock fragments ranging from silt size particles to boulders.

STORMWATER MANAGEMENT SYSTEM

The proposed stormwater collection system for the project consists of a series of deep sump hooded catch basins, interceptor drains, piping/cleanout network and subsurface recharge areas. The stormwater collection system and recharge areas have been sized accordingly to collect, store and recharge the projected increase in runoff volume at the site for a 10-year Type III storm event (see Recharge for Post-Development Drainage calculation sheet). There is a slight increase in the rate of runoff for the proposed project, however the increase is minimal and should have no impact on downstream flooding.

The stormwater management system utilizes areas known to be suitable for subsurface recharge for the recharge chambers which were selected to allow the design of a stormwater management system that could increase recharge to the local aquifer, minimize the impacts of stormwater runoff as well as providing water quality treatment for runoff from the proposed driveway area.

Acton Survey & Engineering, Inc.
P.O. Box 666, 97 Great Rd. #6, Acton, MA 01720
Phone: (978) 263-3666 Fax: (978) 635-0218
Email: actonsurvey@actonsurvey.com

STORMWATER MANAGEMENT SUMMARY

RICHARDSON CROSSING
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The proposed stormwater management system collects surface runoff through the deep sump hooded catch basins and from the interceptor trenches located on the site and recharges runoff on-site. Overflow occurring from the recharge areas exceeding storage volumes for storm events exceeding a 10 year storm discharge through the overflow pipe network at Central Street as currently occurs at the site.

RESULTS OF STORMWATER MODEL

As shown by the following results of the Recharge for Post-Development Drainage calculation sheet and information from the HydroCad computer analysis; insignificant increases in the rate and volume of runoff occur and should have no effect on down stream flooding effects.

METHODOLOGY FOR STORMWATER CALCULATIONS

Calculations were performed based on TR-20 methods with a computer model created with the use of HydroCAD software [Version 8].

A complete data sheets for the model is included as well as the results of the HydroCAD modeling.

STORMWATER MANAGEMENT SUMMARY

RICHARDSON CROSSING
113 Central Street, Acton, MA
6729
June 19, 2009
Revised September 21, 2009

September 21, 2009 ADDENDUM

To

Stormwater Management Summary

Additional subsurface recharge chambers have been added to the site's stormwater management system in order to more effectively attenuate the peak flowrate and volume of stormwater runoff for the various storm events. The plans have been revised to show the additional chambers, and the HydroCAD computer model was used to analyze the modified design. The results of the updated HydroCAD model are tabulated below.

STORM FREQ	PRE Q (cfs)	POST Q (cfs)	ΔQ (cfs)	PRE Vol (acre-ft)	POST Vol (acre-ft)	ΔVol (acre-ft)
2	1.11	0.28	-0.83	0.090	0.001	-0.089
10	2.18	1.48	-0.70	0.173	0.026	-0.147
25	2.82	3.65	0.83	0.225	0.298	0.073
100	3.82	4.22	0.40	0.306	0.215	-0.091

The post-development peak flowrate and volume of runoff have been reduced for both the 2-year and 10-year storms, relative to pre-development conditions. This complies with the Town of Acton's Subdivision Rules and Regulations.

Insignificant post-development increases in the rate and volume of runoff occur for the 25-year and 100-year storms, with the exception of the 100-year runoff volume, which decreases. These increases should have virtually no effect on downstream flooding.

Complete data sheets for the HydroCAD model are included.

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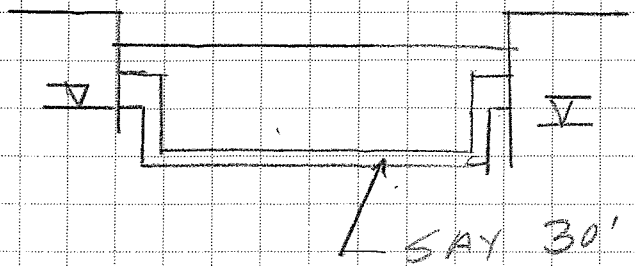
JOB RICHARDSIN CROSSING 6729
SHEET NO. 1 OF
CALCULATED BY MTD DATE 9-27-09
CHECKED BY DATE
SCALE HYDRAULICS

COMMONWEALTH OF MASSACHUSETTS
MARK DONOHOE
No. 37...
REGISTERED PROFESSIONAL ENGINEER
9-28-9

CATCH BASIN CONNECTION



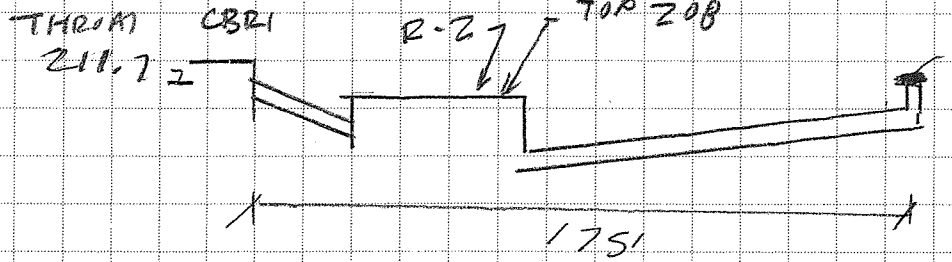
± 0.25' ELEVATION DIFFERENCE

SAY 30' 8" SDR 35 PVC
C = 140

USE HAZEN WILLIAMS FORMULA
VIA FLOWMASTER PROGRAM

Q = 1.75 CFS OR ΣQ_{25} FOR SITE = 3.7 CFS

DISCHARGE @ OLD DRIVEWAY

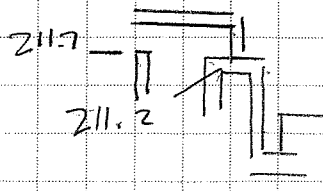


HAZEN-WILLIAMS

Q = 0.5 CFS

8" BASIN TO RECHARGE

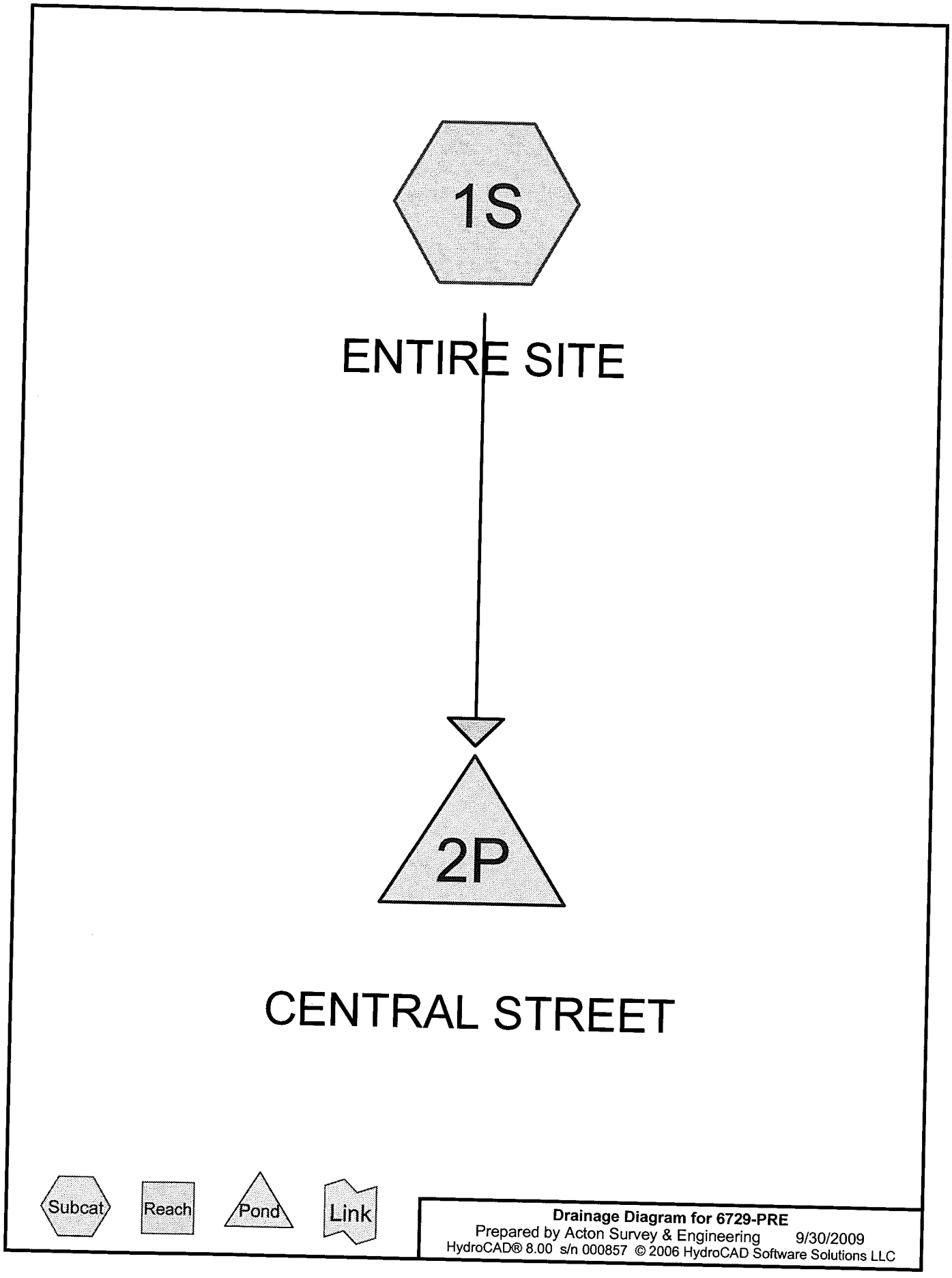
TYPICAL



30.7' 3.2 W/O BASIN SURCHARGED

SAY 10' OF 8" SDR 35 PVC

W/ 3.2' 11.3 CFS W/ 3.5 12.2 CFS OK



Drainage Diagram for 6729-PRE
Prepared by Acton Survey & Engineering 9/30/2009

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: ENTIRE SITE Runoff Area=42,536 sf Runoff Depth>1.10"
Flow Length=228' Tc=11.4 min CN=78 Runoff=1.11 cfs 0.090 af

Pond 2P: CENTRAL STREET Inflow=1.11 cfs 0.090 af
Primary=1.11 cfs 0.090 af

Total Runoff Area = 0.976 ac Runoff Volume = 0.090 af Average Runoff Depth = 1.10"
85.02% Pervious Area = 0.830 ac 14.98% Impervious Area = 0.146 ac

Subcatchment 1S: ENTIRE SITE

Runoff = 1.11 cfs @ 12.17 hrs, Volume= 0.090 af, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Middlesex 002 yr Rainfall=3.10"

Area (sf)	CN	Description
6,372	98	Paved parking & roofs
25,393	73	Woods, Fair, HSG C
10,771	79	50-75% Grass cover, Fair, HSG C
42,536	78	Weighted Average
36,164		Pervious Area
6,372		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.1300	0.14		**Sheet Flow, Through woods** Woods: Light underbrush n= 0.400 P2= 3.10"
4.3	50	0.0400	0.19		**Sheet Flow, Through lawn** Grass: Short n= 0.150 P2= 3.10"
0.7	55	0.0400	1.40		**Shallow Concentrated Flow, Through lawn** Short Grass Pasture Kv= 7.0 fps
0.5	73	0.2200	2.35		**Shallow Concentrated Flow, Through woods** Woodland Kv= 5.0 fps
11.4	228	Total			

Pond 2P: CENTRAL STREET

Inflow Area = 0.976 ac, Inflow Depth > 1.10" for Middlesex 002 yr event
Inflow = 1.11 cfs @ 12.17 hrs, Volume= 0.090 af
Primary = 1.11 cfs @ 12.17 hrs, Volume= 0.090 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: ENTIRE SITE Runoff Area=42,536 sf Runoff Depth>2.13"
Flow Length=228' Tc=11.4 min CN=78 Runoff=2.18 cfs 0.173 af

Pond 2P: CENTRAL STREET Inflow=2.18 cfs 0.173 af
Primary=2.18 cfs 0.173 af

Total Runoff Area = 0.976 ac Runoff Volume = 0.173 af Average Runoff Depth = 2.13"
85.02% Pervious Area = 0.830 ac 14.98% Impervious Area = 0.146 ac

Subcatchment 1S: ENTIRE SITE

Runoff = 2.18 cfs @ 12.16 hrs, Volume= 0.173 af, Depth> 2.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Middlesex 010 yr Rainfall=4.50"

Area (sf)	CN	Description
6,372	98	Paved parking & roofs
25,393	73	Woods, Fair, HSG C
10,771	79	50-75% Grass cover, Fair, HSG C
42,536	78	Weighted Average
36,164		Pervious Area
6,372		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.1300	0.14		**Sheet Flow, Through woods** Woods: Light underbrush n= 0.400 P2= 3.10"
4.3	50	0.0400	0.19		**Sheet Flow, Through lawn** Grass: Short n= 0.150 P2= 3.10"
0.7	55	0.0400	1.40		**Shallow Concentrated Flow, Through lawn** Short Grass Pasture Kv= 7.0 fps
0.5	73	0.2200	2.35		**Shallow Concentrated Flow, Through woods** Woodland Kv= 5.0 fps
11.4	228	Total			

Pond 2P: CENTRAL STREET

Inflow Area = 0.976 ac, Inflow Depth > 2.13" for Middlesex 010 yr event
Inflow = 2.18 cfs @ 12.16 hrs, Volume= 0.173 af
Primary = 2.18 cfs @ 12.16 hrs, Volume= 0.173 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: ENTIRE SITE Runoff Area=42,536 sf Runoff Depth>2.76"
Flow Length=228' Tc=11.4 min CN=78 Runoff=2.82 cfs 0.225 af

Pond 2P: CENTRAL STREET Inflow=2.82 cfs 0.225 af
Primary=2.82 cfs 0.225 af

Total Runoff Area = 0.976 ac Runoff Volume = 0.225 af Average Runoff Depth = 2.76"
85.02% Pervious Area = 0.830 ac 14.98% Impervious Area = 0.146 ac

Subcatchment 1S: ENTIRE SITE

Runoff = 2.82 cfs @ 12.16 hrs, Volume= 0.225 af, Depth> 2.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Middlesex 025 yr Rainfall=5.30"

Area (sf)	CN	Description
6,372	98	Paved parking & roofs
25,393	73	Woods, Fair, HSG C
10,771	79	50-75% Grass cover, Fair, HSG C
42,536	78	Weighted Average
36,164		Pervious Area
6,372		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.1300	0.14		**Sheet Flow, Through woods** Woods: Light underbrush n= 0.400 P2= 3.10"
4.3	50	0.0400	0.19		**Sheet Flow, Through lawn** Grass: Short n= 0.150 P2= 3.10"
0.7	55	0.0400	1.40		**Shallow Concentrated Flow, Through lawn** Short Grass Pasture Kv= 7.0 fps
0.5	73	0.2200	2.35		**Shallow Concentrated Flow, Through woods** Woodland Kv= 5.0 fps
11.4	228	Total			

Pond 2P: CENTRAL STREET

Inflow Area = 0.976 ac, Inflow Depth > 2.76" for Middlesex 025 yr event
Inflow = 2.82 cfs @ 12.16 hrs, Volume= 0.225 af
Primary = 2.82 cfs @ 12.16 hrs, Volume= 0.225 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: ENTIRE SITE Runoff Area=42,536 sf Runoff Depth>3.76"
Flow Length=228' Tc=11.4 min CN=78 Runoff=3.82 cfs 0.306 af

Pond 2P: CENTRAL STREET Inflow=3.82 cfs 0.306 af
Primary=3.82 cfs 0.306 af

Total Runoff Area = 0.976 ac Runoff Volume = 0.306 af Average Runoff Depth = 3.76"
85.02% Pervious Area = 0.830 ac 14.98% Impervious Area = 0.146 ac

Subcatchment 1S: ENTIRE SITE

Runoff = 3.82 cfs @ 12.16 hrs, Volume= 0.306 af, Depth> 3.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Middlesex 100 yr Rainfall=6.50"

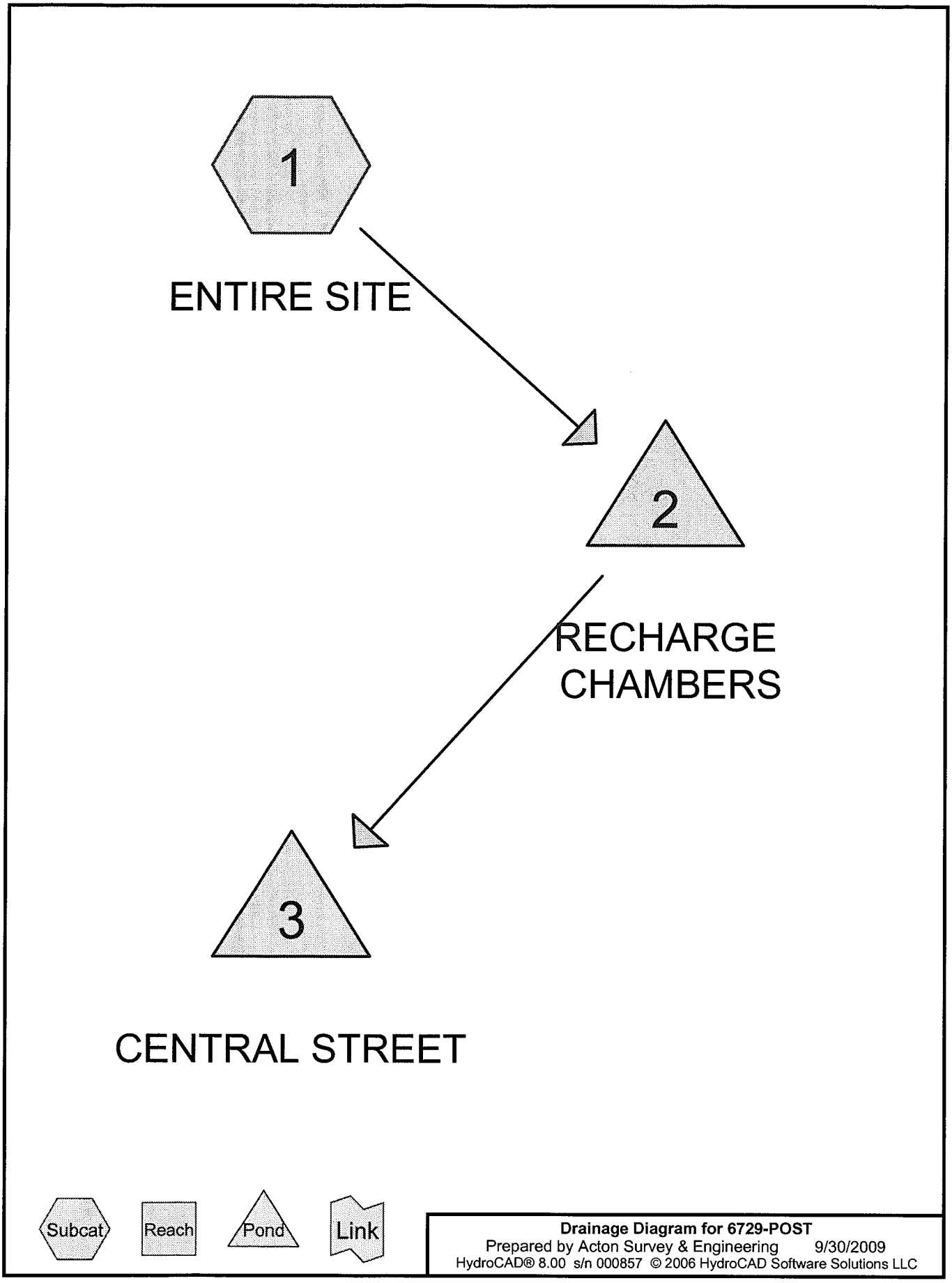
Area (sf)	CN	Description
6,372	98	Paved parking & roofs
25,393	73	Woods, Fair, HSG C
10,771	79	50-75% Grass cover, Fair, HSG C
42,536	78	Weighted Average
36,164		Pervious Area
6,372		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	50	0.1300	0.14		**Sheet Flow, Through woods** Woods: Light underbrush n= 0.400 P2= 3.10"
4.3	50	0.0400	0.19		**Sheet Flow, Through lawn** Grass: Short n= 0.150 P2= 3.10"
0.7	55	0.0400	1.40		**Shallow Concentrated Flow, Through lawn** Short Grass Pasture Kv= 7.0 fps
0.5	73	0.2200	2.35		**Shallow Concentrated Flow, Through woods** Woodland Kv= 5.0 fps
11.4	228	Total			

Pond 2P: CENTRAL STREET

Inflow Area = 0.976 ac, Inflow Depth > 3.76" for Middlesex 100 yr event
Inflow = 3.82 cfs @ 12.16 hrs, Volume= 0.306 af
Primary = 3.82 cfs @ 12.16 hrs, Volume= 0.306 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Drainage Diagram for 6729-POST
Prepared by Acton Survey & Engineering 9/30/2009
HydroCAD® 8.00 s/n 000857 © 2006 HydroCAD Software Solutions LLC

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: ENTIRE SITE Runoff Area=42,536 sf Runoff Depth>1.35"
Tc=10.0 min CN=82 Runoff=1.43 cfs 0.110 af

Pond 2: RECHARGE CHAMBERS Peak Elev=2.06' Storage=1,349 cf Inflow=1.43 cfs 0.110 af
Discarded=0.03 cfs 0.024 af Primary=0.28 cfs 0.001 af Outflow=0.31 cfs 0.025 af

Pond 3: CENTRAL STREET Inflow=0.28 cfs 0.001 af
Primary=0.28 cfs 0.001 af

Total Runoff Area = 0.976 ac Runoff Volume = 0.110 af Average Runoff Depth = 1.35"
68.29% Pervious Area = 0.667 ac 31.71% Impervious Area = 0.310 ac

Subcatchment 1: ENTIRE SITE

Runoff = 1.43 cfs @ 12.15 hrs, Volume= 0.110 af, Depth> 1.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Middlesex 002 yr Rainfall=3.10"

Area (sf)	CN	Description
13,488	98	Paved parking & roofs
29,048	74	>75% Grass cover, Good, HSG C
42,536	82	Weighted Average
29,048		Pervious Area
13,488		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, over entire site**

Pond 2: RECHARGE CHAMBERS

Inflow Area = 0.976 ac, Inflow Depth > 1.35" for Middlesex 002 yr event
Inflow = 1.43 cfs @ 12.15 hrs, Volume= 0.110 af
Outflow = 0.31 cfs @ 12.20 hrs, Volume= 0.025 af, Atten= 78%, Lag= 3.4 min
Discarded = 0.03 cfs @ 10.65 hrs, Volume= 0.024 af
Primary = 0.28 cfs @ 12.20 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 4
Peak Elev= 2.06' @ 12.20 hrs Surf.Area= 1,222 sf Storage= 1,349 cf

Plug-Flow detention time= 189.9 min calculated for 0.025 af (23% of inflow)
Center-of-Mass det. time= 87.7 min (890.7 - 803.0)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	763 cf	**26.00'W x 47.00'L x 2.04'H Prismatoid** 2,493 cf Overall - 586 cf Embedded = 1,907 cf x 40.0% Voids
#2	0.50'	586 cf	**32.1"W x 12.0"H x 7.50'L Cultec C-100** x 42 Inside #1
		1,349 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	2.04'	**47.0' long x 13.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Discarded OutFlow Max=0.03 cfs @ 10.65 hrs HW=0.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.23 cfs @ 12.20 hrs HW=2.06' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.23 cfs @ 0.32 fps)

Pond 3: CENTRAL STREET

Inflow Area = 0.976 ac, Inflow Depth = 0.02" for Middlesex 002 yr event
Inflow = 0.28 cfs @ 12.20 hrs, Volume= 0.001 af
Primary = 0.28 cfs @ 12.20 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: ENTIRE SITE Runoff Area=42,536 sf Runoff Depth>2.46"
Tc=10.0 min CN=82 Runoff=2.60 cfs 0.200 af

Pond 2: RECHARGE CHAMBERS Peak Elev=2.09' Storage=1,349 cf Inflow=2.60 cfs 0.200 af
Discarded=0.03 cfs 0.027 af Primary=1.48 cfs 0.026 af Outflow=1.50 cfs 0.053 af

Pond 3: CENTRAL STREET Inflow=1.48 cfs 0.026 af
Primary=1.48 cfs 0.026 af

Total Runoff Area = 0.976 ac Runoff Volume = 0.200 af Average Runoff Depth = 2.46"
68.29% Pervious Area = 0.667 ac 31.71% Impervious Area = 0.310 ac

Subcatchment 1: ENTIRE SITE

Runoff = 2.60 cfs @ 12.14 hrs, Volume= 0.200 af, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Middlesex 010 yr Rainfall=4.50"

Area (sf)	CN	Description
13,488	98	Paved parking & roofs
29,048	74	>75% Grass cover, Good, HSG C
42,536	82	Weighted Average
29,048		Pervious Area
13,488		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, over entire site**

Pond 2: RECHARGE CHAMBERS

Inflow Area = 0.976 ac, Inflow Depth > 2.46" for Middlesex 010 yr event
Inflow = 2.60 cfs @ 12.14 hrs, Volume= 0.200 af
Outflow = 1.50 cfs @ 12.14 hrs, Volume= 0.053 af, Atten= 42%, Lag= 0.0 min
Discarded = 0.03 cfs @ 9.30 hrs, Volume= 0.027 af
Primary = 1.48 cfs @ 12.14 hrs, Volume= 0.026 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 4
Peak Elev= 2.09' @ 12.14 hrs Surf.Area= 1,222 sf Storage= 1,349 cf

Plug-Flow detention time= 108.6 min calculated for 0.053 af (27% of inflow)
Center-of-Mass det. time= 5.8 min (795.1 - 789.3)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	763 cf	**26.00'W x 47.00'L x 2.04'H Prismatoid** 2,493 cf Overall - 586 cf Embedded = 1,907 cf x 40.0% Voids
#2	0.50'	586 cf	**32.1"W x 12.0"H x 7.50'L Cultec C-100** x 42 Inside #1
		1,349 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	2.04'	**47.0' long x 13.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Discarded OutFlow Max=0.03 cfs @ 9.30 hrs HW=0.02' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.43 cfs @ 12.14 hrs HW=2.09' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.43 cfs @ 0.59 fps)

Pond 3: CENTRAL STREET

Inflow Area = 0.976 ac, Inflow Depth = 0.32" for Middlesex 010 yr event
Inflow = 1.48 cfs @ 12.14 hrs, Volume= 0.026 af
Primary = 1.48 cfs @ 12.14 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: ENTIRE SITE Runoff Area=42,536 sf Runoff Depth>3.14"
Tc=10.0 min CN=82 Runoff=3.30 cfs 0.255 af

Pond 2: RECHARGE CHAMBERS Peak Elev=2.14' Storage=1,349 cf Inflow=3.30 cfs 0.255 af
Discarded=0.03 cfs 0.029 af Primary=3.65 cfs 0.298 af Outflow=3.68 cfs 0.327 af

Pond 3: CENTRAL STREET Inflow=3.65 cfs 0.298 af
Primary=3.65 cfs 0.298 af

Total Runoff Area = 0.976 ac Runoff Volume = 0.255 af Average Runoff Depth = 3.14"
68.29% Pervious Area = 0.667 ac 31.71% Impervious Area = 0.310 ac

Subcatchment 1: ENTIRE SITE

Runoff = 3.30 cfs @ 12.14 hrs, Volume= 0.255 af, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Middlesex 025 yr Rainfall=5.30"

Area (sf)	CN	Description
13,488	98	Paved parking & roofs
29,048	74	>75% Grass cover, Good, HSG C
42,536	82	Weighted Average
29,048		Pervious Area
13,488		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, over entire site**

Pond 2: RECHARGE CHAMBERS

Inflow Area = 0.976 ac, Inflow Depth > 3.14" for Middlesex 025 yr event
Inflow = 3.30 cfs @ 12.14 hrs, Volume= 0.255 af
Outflow = 3.68 cfs @ 12.14 hrs, Volume= 0.327 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.03 cfs @ 8.70 hrs, Volume= 0.029 af
Primary = 3.65 cfs @ 12.14 hrs, Volume= 0.298 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 4
Peak Elev= 2.14' @ 12.14 hrs Surf.Area= 1,222 sf Storage= 1,349 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 32.7 min (816.4 - 783.7)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	763 cf	**26.00'W x 47.00'L x 2.04'H Prismatoid** 2,493 cf Overall - 586 cf Embedded = 1,907 cf x 40.0% Voids
#2	0.50'	586 cf	**32.1"W x 12.0"H x 7.50'L Cultec C-100** x 42 Inside #1
		1,349 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	2.04'	**47.0' long x 13.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Discarded OutFlow Max=0.03 cfs @ 8.70 hrs HW=0.02' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=3.60 cfs @ 12.14 hrs HW=2.14' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 3.60 cfs @ 0.80 fps)

Pond 3: CENTRAL STREET

Inflow Area = 0.976 ac, Inflow Depth > 3.66" for Middlesex 025 yr event
Inflow = 3.65 cfs @ 12.14 hrs, Volume= 0.298 af
Primary = 3.65 cfs @ 12.14 hrs, Volume= 0.298 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: ENTIRE SITE Runoff Area=42,536 sf Runoff Depth>4.18"
Tc=10.0 min CN=82 Runoff=4.35 cfs 0.340 af

Pond 2: RECHARGE CHAMBERS Peak Elev=2.15' Storage=1,349 cf Inflow=4.35 cfs 0.340 af
Discarded=0.03 cfs 0.031 af Primary=4.22 cfs 0.215 af Outflow=4.25 cfs 0.246 af

Pond 3: CENTRAL STREET Inflow=4.22 cfs 0.215 af
Primary=4.22 cfs 0.215 af

Total Runoff Area = 0.976 ac Runoff Volume = 0.340 af Average Runoff Depth = 4.18"
68.29% Pervious Area = 0.667 ac 31.71% Impervious Area = 0.310 ac

Subcatchment 1: ENTIRE SITE

Runoff = 4.35 cfs @ 12.14 hrs, Volume= 0.340 af, Depth> 4.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr Middlesex 100 yr Rainfall=6.50"

Area (sf)	CN	Description
13,488	98	Paved parking & roofs
29,048	74	>75% Grass cover, Good, HSG C
42,536	82	Weighted Average
29,048		Pervious Area
13,488		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0					**Direct Entry, over entire site**

Pond 2: RECHARGE CHAMBERS

Inflow Area = 0.976 ac, Inflow Depth > 4.18" for Middlesex 100 yr event
Inflow = 4.35 cfs @ 12.14 hrs, Volume= 0.340 af
Outflow = 4.25 cfs @ 12.14 hrs, Volume= 0.246 af, Atten= 2%, Lag= 0.0 min
Discarded = 0.03 cfs @ 7.90 hrs, Volume= 0.031 af
Primary = 4.22 cfs @ 12.14 hrs, Volume= 0.215 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs / 4
Peak Elev= 2.15' @ 12.14 hrs Surf.Area= 1,222 sf Storage= 1,349 cf

Plug-Flow detention time= 46.0 min calculated for 0.246 af (72% of inflow)
Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	763 cf	**26.00'W x 47.00'L x 2.04'H Prismatoid** 2,493 cf Overall - 586 cf Embedded = 1,907 cf x 40.0% Voids
#2	0.50'	586 cf	**32.1"W x 12.0"H x 7.50'L Cultec C-100** x 42 Inside #1
		1,349 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	2.04'	**47.0' long x 13.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.60 2.64 2.70 2.66 2.65 2.66 2.65 2.63

Discarded OutFlow Max=0.03 cfs @ 7.90 hrs HW=0.02' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=4.15 cfs @ 12.14 hrs HW=2.14' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 4.15 cfs @ 0.84 fps)

Pond 3: CENTRAL STREET

Inflow Area = 0.976 ac, Inflow Depth = 2.64" for Middlesex 100 yr event
Inflow = 4.22 cfs @ 12.14 hrs, Volume= 0.215 af
Primary = 4.22 cfs @ 12.14 hrs, Volume= 0.215 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs