



AvalonBay Communities

Stormwater Management Report

Avalon Hingham Shipyard II

Prepared by
Howard Stein Hudson

February 25, 2016





Table of Contents

Introduction	1
Hydrology	2
Pre-construction Hydrology	2
Post-construction Hydrology	2
Stormwater Management Standards	3
Standard 1: No New Untreated Discharges	3
Standard 2: Post-Development Peak Discharge Rates Not to Exceed Pre-Development Peak Discharge Rates.....	3
Standard 3: Minimize or Eliminate Loss of Annual Recharge to Groundwater.....	4
Standard 4: Stormwater Management System to Remove 80% of Average Annual Load of Total Suspended Solids (TSS).....	4
Standard 5: Land Uses with Higher Potential Pollutant Loads	4
Standard 6: Stormwater Discharges to Critical Areas	5
Standard 7: Redevelopment Projects.....	5
Standard 8: Control Construction-Related Impacts	5
Standard 9: Long-Term Operation and Maintenance Plan.....	5
Standard 10: No Illicit Discharges	5

List of Tables

Table 1. Pre- Vs Post-Development Peak Discharge Rates	4
--	---



Appendices

Appendix A: Soil Information

Appendix B: Pre-Construction Hydrology

Appendix C: Post-Construction Hydrology

Appendix D: Water Quality Calculations

Appendix E: Closed Drainage System Calculations

Introduction

This Stormwater Management Report describes the existing drainage conditions and proposed stormwater best management practices (BMPs) designed to treat and control runoff at Avalon Hingham Shipyard II (the “Project”).

The existing site encompasses approximately 3.8± acres of land. It contains a vacant 163,760± square foot (sf) building and paved parking and loading areas. The majority of the existing site is impervious. Currently, a majority of the site’s stormwater runoff flows overland to USS Amesbury Drive with some runoff flowing to Lincoln Street. The runoff flowing to USS Amesbury Drive flows into two different drainage pipe systems and the runoff flowing to Lincoln Street enters into another drainage system. All three drainage systems flow into Weymouth Back River and ultimately to Hingham Bay. There are six catch basins in the front of the building that, along with the rooftop runoff, appear to discharge into the USS Amesbury Drive drainage system. The parking area to the south of the existing building contains a catch basin that drains into the drainage system on Lincoln Street. The existing runoff generally receives no water quality treatment.

The Project is a new 250-unit, 6-story multi-residential apartment building with both surface parking and covered parking below the building podium. The proposed improvements to the site will result in a decrease in impervious area of approximately 6,280 ft². Stormwater BMPs will be constructed to improve the water quality of runoff from the Project. Stormwater BMPs will include deep sump catch basins and proprietary stormwater treatment (water quality) units. These systems will capture and help reduce pollutant concentrations in the stormwater runoff prior to discharging to the three separate drainage systems.

The Soil Map available from the Natural Resources Conservation Service indicates that the soils on-site are Udorthents (0% to 8% slopes). Hydrologic Soil Group B classification was used as a basis for the calculations. Refer to Appendix A for the Soils Map.

Pre and post-construction hydrology was analyzed with HydroCAD v 10.0, model using TR-20 methodology. The rainfall data was obtained from Technical Paper No. 40 (TP 40) Rainfall Frequency Atlas of the United States for 24 hour storms. The result of this analysis shows there will be a decrease in the peak discharge rates & volumes from the site in the post-development conditions for all the storm events analyzed (Refer to Table 1 for pre- and post-development peak discharge rate comparisons). The Project is a redevelopment project and is designed to the maximum extent practicable to be in compliance with the Massachusetts Department of Environmental Protection’s Stormwater Management Policy for Redevelopment.



Closed drainage system calculations can be found in Appendix E. The Rational Method and the Manning's Equation were used to size the pipes for the stormwater management system.

Hydrology

PRE-CONSTRUCTION HYDROLOGY

The hydrology calculations analyze three design points: (DP#1) flow drainage system one, (DP#2) flow to drainage system 2, and (DP#3) drainage system 3. The existing project site was divided into 3 Subcatchment areas. These Subcatchment areas are shown on the plans entitled "Pre-Development Drainage Areas" provided in Appendix B.

Subcatchment E1 collects stormwater from a southwesterly portion of the parking lot which flows directly to Lincoln Street and into a catch basin connected to drainage system 1 (DP#1). Some of the drainage flows into a catch basin located on the existing property which is connected to drainage system 1.

Subcatchment E2 collects stormwater from a southeasterly portion of the parking lot which flows directly to USS Amesbury Drive and into a catch basin connected to drainage system 2 (DP#2).

A majority of the surface runoff from Subcatchment E3 flows overland in a northeasterly direction into a catch basin on the northern property connected to drainage system 3 (DP#3). The rooftop runoff appears to discharge through two 12-inch outlet pipes located north of the building and into a pipe system that connects to drainage system 3.

POST-CONSTRUCTION HYDROLOGY

The proposed development will improve the stormwater management system by introducing elements to improve the water quality of the runoff. Structural Best Management practices (BMPs) proposed include: deep sump catch basins and stormwater treatment units. The proposed project site was divided into 8 subcatchment areas. These subcatchment areas are shown on the plans entitled "Post-Development Drainage Areas" provided in Appendix C.

DRAINAGE SYSTEM 1 (DP#1)

In the proposed condition, stormwater generated to southwest will flow into a water quality inlet structure and into drainage system 1 (DP#1). A small portion of the stormwater will flow overland into Lincoln Street and into a catch basin connected to drainage system 1. Drainage system 1 discharges into Weymouth Back River and ultimately to Hingham Bay.

DRAINAGE SYSTEM 2 (DP#2)

In the proposed condition, stormwater generated to southeast will flow into a water quality inlet and into drainage system 2 (DP#2) located in USS Amesbury Drive. The east side of the property next to the building will flow overland into USS Amesbury Drive and into a catch basin connected to drainage system 2. Drainage system 2 discharges into Weymouth Back River and ultimately to Hingham Bay.

DRAINAGE SYSTEM 3 (DP#3)

In the proposed condition, stormwater runoff generated from the surface parking lot not under the proposed building will be collected by deep sump catch basins and treated by water quality structures prior to discharging into the existing drainage system in USS Amesbury Drive. The roof runoff will be piped separately and directly discharge to the existing system. These areas will discharge into drainage system 3 located in USS Amesbury Drive and discharge into Weymouth Back River and ultimately to Hingham Bay.

Stormwater Management Standards

STANDARD 1: NO NEW UNTREATED DISCHARGES

The Massachusetts Stormwater Handbook requires that the project demonstrates that there are no new untreated discharges and that new discharges will not cause erosion or scour to downstream wetlands.

The project will improve the water quality of the runoff leaving the site through the use of deep sump catch basins and water quality treatment units.

STANDARD 2: POST-DEVELOPMENT PEAK DISCHARGE RATES NOT TO EXCEED PRE-DEVELOPMENT PEAK DISCHARGE RATES

The Post-development peak discharge rate is less than the existing peak discharge rate due to the decrease in impervious area. There is a 0.03 cfs increase to DP#2 during the 10-year storm event and a 0.15 cfs increase to DP#2 during the 100-year storm event. This increase is negligible. There is a 0.33 cfs combined decrease in the site's overall runoff from pre-development to post-development to the Weymouth Back River.



Table 1. Pre- Vs Post-Development Peak Discharge Rates

Design Point	Pre-Development Rate (cfs)	Post-Development Rate (cfs)
2-Year Storm Event		
DP #1: Drainage System 1	1.69	1.38
DP #2: Drainage System 2	0.33	0.30
DP #2: Drainage System 3	10.24	10.17
Sub-total	12.26	11.85
10-Year Storm Event		
DP #1: Drainage System 1	2.35	2.07
DP #2: Drainage System 2	0.46	0.49
DP#3: Drainage System 3	14.32	14.19
Sub-total	17.13	16.75
100-Year Storm Event		
DP #1: Drainage System 1	3.51	3.27
DP #2: Drainage System 2	0.70	0.85
DP #3: Drainage System 3	21.49	21.25
Sub-total	25.70	25.37

STANDARD 3: MINIMIZE OR ELIMINATE LOSS OF ANNUAL RECHARGE TO GROUNDWATER

The project proposes to decrease the amount of impervious area on site which will allow greater recharge to groundwater than in the existing condition.

STANDARD 4: STORMWATER MANAGEMENT SYSTEM TO REMOVE 80% OF AVERAGE ANNUAL LOAD OF TOTAL SUSPENDED SOLIDS (TSS)

The stormwater management system is designed to remove 80% of the average annual total suspended solids (TSS) from a majority of the project site. This is accomplished by the installation of deep sump catch basins and water quality treatment units. The water quality treatment units were designed to treat the 1 inch water quality volume.

STANDARD 5: LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS

The development is not considered a land use that generally produces higher potential pollutant loads.

STANDARD 6: STORMWATER DISCHARGES TO CRITICAL AREAS

The proposed stormwater system does not discharge to a critical area.

STANDARD 7: REDEVELOPMENT PROJECTS

The project is a redevelopment project and improves existing conditions by decreasing the amount of impervious area on site and by treating surface parking and driveways to improve TSS removal. This project meets the requirements of Standards 1, 2, and 4 and meets the requirement to the greatest extent practicable of Standards 3.

STANDARD 8: CONTROL CONSTRUCTION-RELATED IMPACTS

The project will install erosion and sediment controls prior to any major earthwork activity. A Storm Water Pollution Prevention Plan will be prepared in conjunction with the General Permit for Construction Activity that will have to be filed with the Environmental Protection Agency.

STANDARD 9: LONG-TERM OPERATION AND MAINTENANCE PLAN

A long-term operation and maintenance plan will be provided for the stormwater management system.

STANDARD 10: NO ILLICIT DISCHARGES

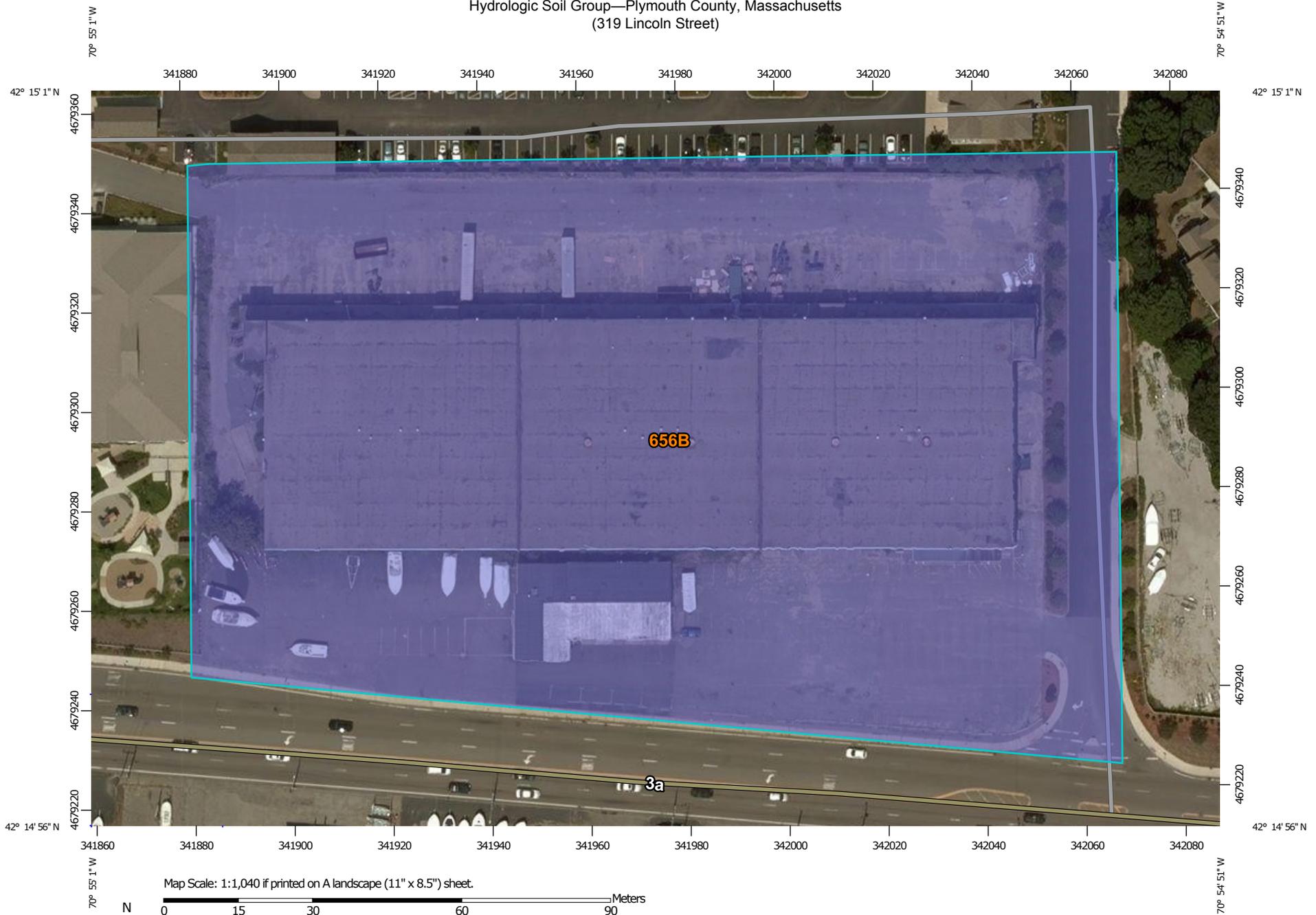
There are no known or proposed illicit connections associated with this project. An illicit discharge compliance statement will be provided by the property owner.



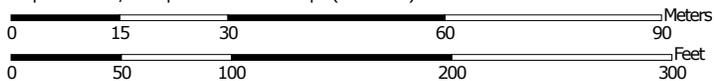
Appendix A.

Soil Information

Hydrologic Soil Group—Plymouth County, Massachusetts
(319 Lincoln Street)



Map Scale: 1:1,040 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Plymouth County, Massachusetts
 Survey Area Data: Version 8, Sep 28, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 2014

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Plymouth County, Massachusetts (MA023)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
656B	Udorthents - Urban land complex, 0 to 8 percent slopes	B	5.3	100.0%
Totals for Area of Interest			5.3	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

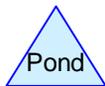
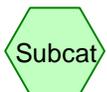
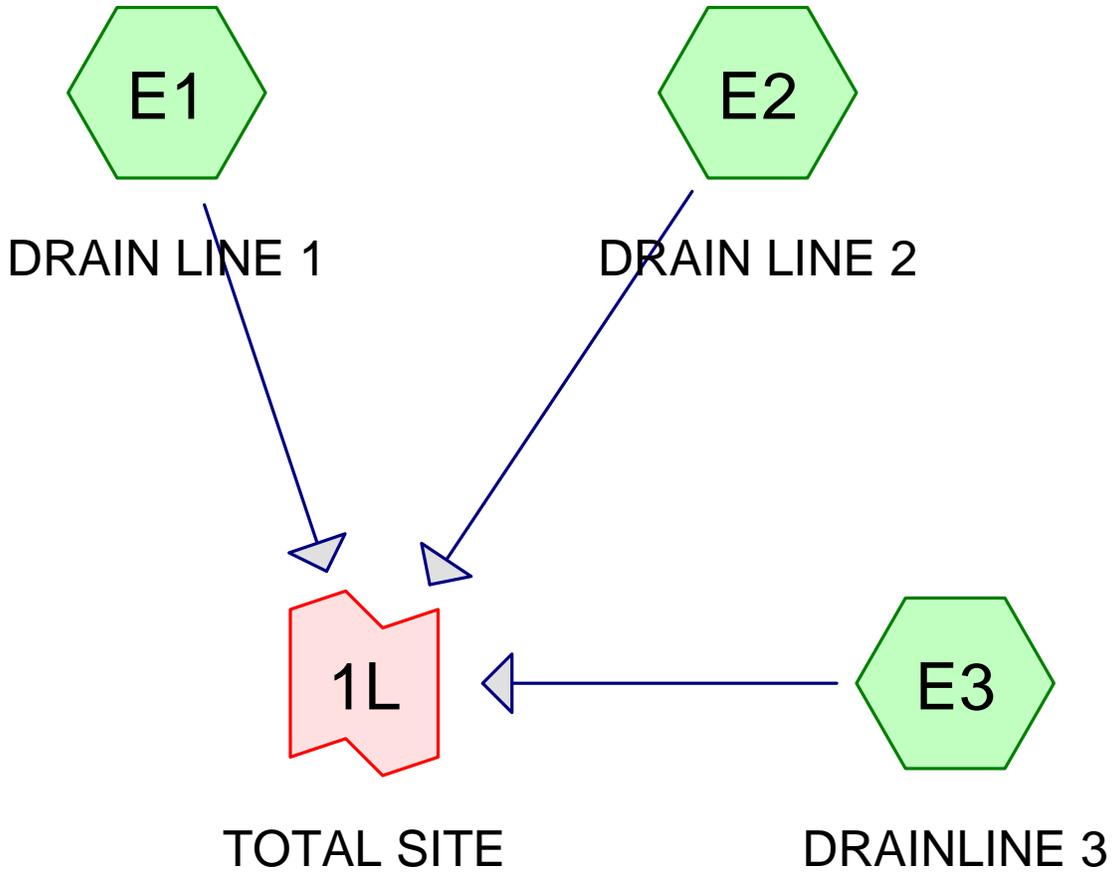
Component Percent Cutoff: None Specified

Tie-break Rule: Higher



Appendix B.

Pre-Construction Hydrology



Routing Diagram for PRE
 Prepared by {enter your company name here}, Printed 2/25/2016
 HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

PRE

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.063	61	>75% Grass cover, Good, HSG B (E2, E3)
3.692	98	Paved parking, HSG B (E1, E2, E3)
3.755	97	TOTAL AREA

PRE

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.063	0.000	0.000	0.000	0.063	>75% Grass cover, Good	E2, E3
0.000	3.692	0.000	0.000	0.000	3.692	Paved parking	E1, E2, E3
0.000	3.755	0.000	0.000	0.000	3.755	TOTAL AREA	

PRE

Type III 24-hr 2-YR Rainfall=3.40"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 4

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: DRAIN LINE 1 Runoff Area=22,292 sf 100.00% Impervious Runoff Depth>3.16"
Tc=6.0 min CN=98 Runoff=1.69 cfs 0.135 af

Subcatchment E2: DRAIN LINE 2 Runoff Area=4,438 sf 98.04% Impervious Runoff Depth>3.05"
Tc=6.0 min CN=97 Runoff=0.33 cfs 0.026 af

Subcatchment E3: DRAINLINE 3 Runoff Area=136,833 sf 98.05% Impervious Runoff Depth>3.05"
Tc=6.0 min CN=97 Runoff=10.24 cfs 0.799 af

Link 1L: TOTAL SITE Inflow=12.26 cfs 0.960 af
Primary=12.26 cfs 0.960 af

Total Runoff Area = 3.755 ac Runoff Volume = 0.960 af Average Runoff Depth = 3.07"
1.68% Pervious = 0.063 ac 98.32% Impervious = 3.692 ac

Summary for Subcatchment E1: DRAIN LINE 1

Runoff = 1.69 cfs @ 12.08 hrs, Volume= 0.135 af, Depth> 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
22,292	98	Paved parking, HSG B
22,292		100.00% Impervious Area

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

Summary for Subcatchment E2: DRAIN LINE 2

Runoff = 0.33 cfs @ 12.08 hrs, Volume= 0.026 af, Depth> 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
4,351	98	Paved parking, HSG B
87	61	>75% Grass cover, Good, HSG B
4,438	97	Weighted Average
87		1.96% Pervious Area
4,351		98.04% Impervious Area

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

Summary for Subcatchment E3: DRAINLINE 3

Runoff = 10.24 cfs @ 12.08 hrs, Volume= 0.799 af, Depth> 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
134,164	98	Paved parking, HSG B
2,669	61	>75% Grass cover, Good, HSG B
136,833	97	Weighted Average
2,669		1.95% Pervious Area
134,164		98.05% Impervious Area

PRE

Type III 24-hr 2-YR Rainfall=3.40"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 6

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

Summary for Link 1L: TOTAL SITE

Inflow Area = 3.755 ac, 98.32% Impervious, Inflow Depth > 3.07" for 2-YR event
 Inflow = 12.26 cfs @ 12.08 hrs, Volume= 0.960 af
 Primary = 12.26 cfs @ 12.08 hrs, Volume= 0.960 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

PRE

Type III 24-hr 10-YR Rainfall=4.70"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 7

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: DRAIN LINE 1 Runoff Area=22,292 sf 100.00% Impervious Runoff Depth>4.46"
Tc=6.0 min CN=98 Runoff=2.35 cfs 0.190 af

Subcatchment E2: DRAIN LINE 2 Runoff Area=4,438 sf 98.04% Impervious Runoff Depth>4.34"
Tc=6.0 min CN=97 Runoff=0.46 cfs 0.037 af

Subcatchment E3: DRAINLINE 3 Runoff Area=136,833 sf 98.05% Impervious Runoff Depth>4.34"
Tc=6.0 min CN=97 Runoff=14.32 cfs 1.137 af

Link 1L: TOTAL SITE Inflow=17.14 cfs 1.364 af
Primary=17.14 cfs 1.364 af

Total Runoff Area = 3.755 ac Runoff Volume = 1.364 af Average Runoff Depth = 4.36"
1.68% Pervious = 0.063 ac 98.32% Impervious = 3.692 ac

Summary for Subcatchment E1: DRAIN LINE 1

Runoff = 2.35 cfs @ 12.08 hrs, Volume= 0.190 af, Depth> 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
22,292	98	Paved parking, HSG B
22,292		100.00% Impervious Area

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

Summary for Subcatchment E2: DRAIN LINE 2

Runoff = 0.46 cfs @ 12.08 hrs, Volume= 0.037 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
4,351	98	Paved parking, HSG B
87	61	>75% Grass cover, Good, HSG B
4,438	97	Weighted Average
87		1.96% Pervious Area
4,351		98.04% Impervious Area

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

Summary for Subcatchment E3: DRAINLINE 3

Runoff = 14.32 cfs @ 12.08 hrs, Volume= 1.137 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
134,164	98	Paved parking, HSG B
2,669	61	>75% Grass cover, Good, HSG B
136,833	97	Weighted Average
2,669		1.95% Pervious Area
134,164		98.05% Impervious Area

PRE

Type III 24-hr 10-YR Rainfall=4.70"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 9

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

Summary for Link 1L: TOTAL SITE

Inflow Area = 3.755 ac, 98.32% Impervious, Inflow Depth > 4.36" for 10-YR event
 Inflow = 17.14 cfs @ 12.08 hrs, Volume= 1.364 af
 Primary = 17.14 cfs @ 12.08 hrs, Volume= 1.364 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

PRE

Type III 24-hr 100-YR Rainfall=7.00"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 10

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1: DRAIN LINE 1 Runoff Area=22,292 sf 100.00% Impervious Runoff Depth>6.76"
Tc=6.0 min CN=98 Runoff=3.51 cfs 0.288 af

Subcatchment E2: DRAIN LINE 2 Runoff Area=4,438 sf 98.04% Impervious Runoff Depth>6.64"
Tc=6.0 min CN=97 Runoff=0.70 cfs 0.056 af

Subcatchment E3: DRAINLINE 3 Runoff Area=136,833 sf 98.05% Impervious Runoff Depth>6.64"
Tc=6.0 min CN=97 Runoff=21.49 cfs 1.737 af

Link 1L: TOTAL SITE Inflow=25.70 cfs 2.082 af
Primary=25.70 cfs 2.082 af

Total Runoff Area = 3.755 ac Runoff Volume = 2.082 af Average Runoff Depth = 6.65"
1.68% Pervious = 0.063 ac 98.32% Impervious = 3.692 ac

Summary for Subcatchment E1: DRAIN LINE 1

Runoff = 3.51 cfs @ 12.08 hrs, Volume= 0.288 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
22,292	98	Paved parking, HSG B
22,292		100.00% Impervious Area

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

Summary for Subcatchment E2: DRAIN LINE 2

Runoff = 0.70 cfs @ 12.08 hrs, Volume= 0.056 af, Depth> 6.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
4,351	98	Paved parking, HSG B
87	61	>75% Grass cover, Good, HSG B
4,438	97	Weighted Average
87		1.96% Pervious Area
4,351		98.04% Impervious Area

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

Summary for Subcatchment E3: DRAINLINE 3

Runoff = 21.49 cfs @ 12.08 hrs, Volume= 1.737 af, Depth> 6.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
134,164	98	Paved parking, HSG B
2,669	61	>75% Grass cover, Good, HSG B
136,833	97	Weighted Average
2,669		1.95% Pervious Area
134,164		98.05% Impervious Area

PRE

Type III 24-hr 100-YR Rainfall=7.00"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 12

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

Summary for Link 1L: TOTAL SITE

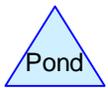
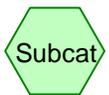
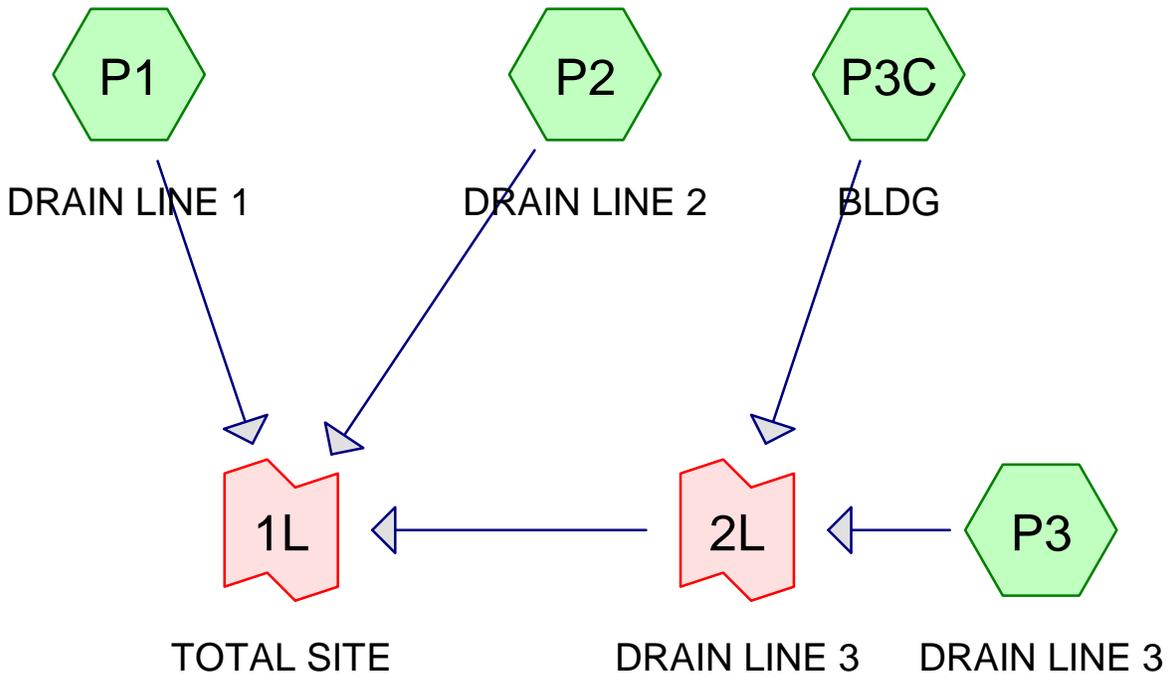
Inflow Area = 3.755 ac, 98.32% Impervious, Inflow Depth > 6.65" for 100-YR event
 Inflow = 25.70 cfs @ 12.08 hrs, Volume= 2.082 af
 Primary = 25.70 cfs @ 12.08 hrs, Volume= 2.082 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



Appendix C.

Post-Construction Hydrology



Routing Diagram for Post
 Prepared by {enter your company name here}, Printed 2/25/2016
 HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Post

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.207	61	>75% Grass cover, Good, HSG B (P1, P2, P3)
3.548	98	Paved parking, HSG B (P1, P2, P3, P3C)
3.755	96	TOTAL AREA

Post

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.207	0.000	0.000	0.000	0.207	>75% Grass cover, Good	P1, P2, P3
0.000	3.548	0.000	0.000	0.000	3.548	Paved parking	P1, P2, P3, P3C
0.000	3.755	0.000	0.000	0.000	3.755	TOTAL AREA	

Post

Type III 24-hr 2-YR Rainfall=3.40"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 4

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: DRAIN LINE 1 Runoff Area=22,143 sf 77.79% Impervious Runoff Depth>2.35"
Tc=6.0 min CN=90 Runoff=1.38 cfs 0.100 af

Subcatchment P2: DRAIN LINE 2 Runoff Area=6,510 sf 57.08% Impervious Runoff Depth>1.70"
Tc=6.0 min CN=82 Runoff=0.30 cfs 0.021 af

Subcatchment P3: DRAIN LINE 3 Runoff Area=32,584 sf 95.98% Impervious Runoff Depth>3.05"
Tc=6.0 min CN=97 Runoff=2.44 cfs 0.190 af

Subcatchment P3C: BLDG Runoff Area=102,326 sf 100.00% Impervious Runoff Depth>3.16"
Tc=6.0 min CN=98 Runoff=7.76 cfs 0.619 af

Link 1L: TOTAL SITE Inflow=11.88 cfs 0.930 af
Primary=11.88 cfs 0.930 af

Link 2L: DRAIN LINE 3 Inflow=10.20 cfs 0.810 af
Primary=10.20 cfs 0.810 af

Total Runoff Area = 3.755 ac Runoff Volume = 0.930 af Average Runoff Depth = 2.97"
5.52% Pervious = 0.207 ac 94.48% Impervious = 3.548 ac

Post

Type III 24-hr 2-YR Rainfall=3.40"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 5

Summary for Subcatchment P1: DRAIN LINE 1

Runoff = 1.38 cfs @ 12.09 hrs, Volume= 0.100 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
17,226	98	Paved parking, HSG B
22,143	90	Weighted Average
4,917		22.21% Pervious Area
17,226		77.79% Impervious Area

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

Summary for Subcatchment P2: DRAIN LINE 2

Runoff = 0.30 cfs @ 12.09 hrs, Volume= 0.021 af, Depth> 1.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
3,716	98	Paved parking, HSG B
2,794	61	>75% Grass cover, Good, HSG B
6,510	82	Weighted Average
2,794		42.92% Pervious Area
3,716		57.08% Impervious Area

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

Summary for Subcatchment P3: DRAIN LINE 3

Runoff = 2.44 cfs @ 12.08 hrs, Volume= 0.190 af, Depth> 3.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
31,274	98	Paved parking, HSG B
1,310	61	>75% Grass cover, Good, HSG B
32,584	97	Weighted Average
1,310		4.02% Pervious Area
31,274		95.98% Impervious Area

Post

Type III 24-hr 2-YR Rainfall=3.40"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 6

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

Summary for Subcatchment P3C: BLDG

Runoff = 7.76 cfs @ 12.08 hrs, Volume= 0.619 af, Depth> 3.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.40"

Area (sf)	CN	Description
102,326	98	Paved parking, HSG B
102,326		100.00% Impervious Area

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

Summary for Link 1L: TOTAL SITE

Inflow Area = 3.755 ac, 94.48% Impervious, Inflow Depth > 2.97" for 2-YR event
Inflow = 11.88 cfs @ 12.08 hrs, Volume= 0.930 af
Primary = 11.88 cfs @ 12.08 hrs, Volume= 0.930 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link 2L: DRAIN LINE 3

Inflow Area = 3.097 ac, 99.03% Impervious, Inflow Depth > 3.14" for 2-YR event
Inflow = 10.20 cfs @ 12.08 hrs, Volume= 0.810 af
Primary = 10.20 cfs @ 12.08 hrs, Volume= 0.810 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Post

Type III 24-hr 10-YR Rainfall=4.70"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 7

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: DRAIN LINE 1 Runoff Area=22,143 sf 77.79% Impervious Runoff Depth>3.58"
Tc=6.0 min CN=90 Runoff=2.07 cfs 0.152 af

Subcatchment P2: DRAIN LINE 2 Runoff Area=6,510 sf 57.08% Impervious Runoff Depth>2.81"
Tc=6.0 min CN=82 Runoff=0.49 cfs 0.035 af

Subcatchment P3: DRAIN LINE 3 Runoff Area=32,584 sf 95.98% Impervious Runoff Depth>4.34"
Tc=6.0 min CN=97 Runoff=3.41 cfs 0.271 af

Subcatchment P3C: BLDG Runoff Area=102,326 sf 100.00% Impervious Runoff Depth>4.46"
Tc=6.0 min CN=98 Runoff=10.79 cfs 0.873 af

Link 1L: TOTAL SITE Inflow=16.76 cfs 1.331 af
Primary=16.76 cfs 1.331 af

Link 2L: DRAIN LINE 3 Inflow=14.20 cfs 1.144 af
Primary=14.20 cfs 1.144 af

Total Runoff Area = 3.755 ac Runoff Volume = 1.331 af Average Runoff Depth = 4.25"
5.52% Pervious = 0.207 ac 94.48% Impervious = 3.548 ac

Post

Type III 24-hr 10-YR Rainfall=4.70"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 8

Summary for Subcatchment P1: DRAIN LINE 1

Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.152 af, Depth> 3.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
17,226	98	Paved parking, HSG B
22,143	90	Weighted Average
4,917		22.21% Pervious Area
17,226		77.79% Impervious Area

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

Summary for Subcatchment P2: DRAIN LINE 2

Runoff = 0.49 cfs @ 12.09 hrs, Volume= 0.035 af, Depth> 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
3,716	98	Paved parking, HSG B
2,794	61	>75% Grass cover, Good, HSG B
6,510	82	Weighted Average
2,794		42.92% Pervious Area
3,716		57.08% Impervious Area

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

Summary for Subcatchment P3: DRAIN LINE 3

Runoff = 3.41 cfs @ 12.08 hrs, Volume= 0.271 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
31,274	98	Paved parking, HSG B
1,310	61	>75% Grass cover, Good, HSG B
32,584	97	Weighted Average
1,310		4.02% Pervious Area
31,274		95.98% Impervious Area

Post

Type III 24-hr 10-YR Rainfall=4.70"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 9

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

Summary for Subcatchment P3C: BLDG

Runoff = 10.79 cfs @ 12.08 hrs, Volume= 0.873 af, Depth> 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.70"

Area (sf)	CN	Description
102,326	98	Paved parking, HSG B
102,326		100.00% Impervious Area

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

Summary for Link 1L: TOTAL SITE

Inflow Area = 3.755 ac, 94.48% Impervious, Inflow Depth > 4.25" for 10-YR event
Inflow = 16.76 cfs @ 12.08 hrs, Volume= 1.331 af
Primary = 16.76 cfs @ 12.08 hrs, Volume= 1.331 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link 2L: DRAIN LINE 3

Inflow Area = 3.097 ac, 99.03% Impervious, Inflow Depth > 4.43" for 10-YR event
Inflow = 14.20 cfs @ 12.08 hrs, Volume= 1.144 af
Primary = 14.20 cfs @ 12.08 hrs, Volume= 1.144 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Post

Type III 24-hr 100-YR Rainfall=7.00"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 10

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1: DRAIN LINE 1 Runoff Area=22,143 sf 77.79% Impervious Runoff Depth>5.82"
Tc=6.0 min CN=90 Runoff=3.27 cfs 0.246 af

Subcatchment P2: DRAIN LINE 2 Runoff Area=6,510 sf 57.08% Impervious Runoff Depth>4.91"
Tc=6.0 min CN=82 Runoff=0.85 cfs 0.061 af

Subcatchment P3: DRAIN LINE 3 Runoff Area=32,584 sf 95.98% Impervious Runoff Depth>6.64"
Tc=6.0 min CN=97 Runoff=5.12 cfs 0.414 af

Subcatchment P3C: BLDG Runoff Area=102,326 sf 100.00% Impervious Runoff Depth>6.76"
Tc=6.0 min CN=98 Runoff=16.13 cfs 1.322 af

Link 1L: TOTAL SITE Inflow=25.37 cfs 2.044 af
Primary=25.37 cfs 2.044 af

Link 2L: DRAIN LINE 3 Inflow=21.25 cfs 1.736 af
Primary=21.25 cfs 1.736 af

Total Runoff Area = 3.755 ac Runoff Volume = 2.044 af Average Runoff Depth = 6.53"
5.52% Pervious = 0.207 ac 94.48% Impervious = 3.548 ac

Post

Prepared by {enter your company name here}

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Type III 24-hr 100-YR Rainfall=7.00"

Printed 2/25/2016

Page 11

Summary for Subcatchment P1: DRAIN LINE 1

Runoff = 3.27 cfs @ 12.08 hrs, Volume= 0.246 af, Depth> 5.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
4,917	61	>75% Grass cover, Good, HSG B
17,226	98	Paved parking, HSG B
22,143	90	Weighted Average
4,917		22.21% Pervious Area
17,226		77.79% Impervious Area

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

Summary for Subcatchment P2: DRAIN LINE 2

Runoff = 0.85 cfs @ 12.09 hrs, Volume= 0.061 af, Depth> 4.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
3,716	98	Paved parking, HSG B
2,794	61	>75% Grass cover, Good, HSG B
6,510	82	Weighted Average
2,794		42.92% Pervious Area
3,716		57.08% Impervious Area

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

Summary for Subcatchment P3: DRAIN LINE 3

Runoff = 5.12 cfs @ 12.08 hrs, Volume= 0.414 af, Depth> 6.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
31,274	98	Paved parking, HSG B
1,310	61	>75% Grass cover, Good, HSG B
32,584	97	Weighted Average
1,310		4.02% Pervious Area
31,274		95.98% Impervious Area

Post

Type III 24-hr 100-YR Rainfall=7.00"

Prepared by {enter your company name here}

Printed 2/25/2016

HydroCAD® 10.00-16 s/n 02930 © 2015 HydroCAD Software Solutions LLC

Page 12

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

Summary for Subcatchment P3C: BLDG

Runoff = 16.13 cfs @ 12.08 hrs, Volume= 1.322 af, Depth> 6.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.00"

Area (sf)	CN	Description
102,326	98	Paved parking, HSG B
102,326		100.00% Impervious Area

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

Summary for Link 1L: TOTAL SITE

Inflow Area = 3.755 ac, 94.48% Impervious, Inflow Depth > 6.53" for 100-YR event

Inflow = 25.37 cfs @ 12.08 hrs, Volume= 2.044 af

Primary = 25.37 cfs @ 12.08 hrs, Volume= 2.044 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Link 2L: DRAIN LINE 3

Inflow Area = 3.097 ac, 99.03% Impervious, Inflow Depth > 6.73" for 100-YR event

Inflow = 21.25 cfs @ 12.08 hrs, Volume= 1.736 af

Primary = 21.25 cfs @ 12.08 hrs, Volume= 1.736 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs



Appendix D.

Water Quality Calculations

Avalon Hingham Shipyard II

For first 1-inch Runoff WQV

$$Q=(qu)(A)(WQV)$$

Q= peak flow rate associaed with 1-inch of runoff (in cubic feet per second)

qu= the unit peak discharge, in csm/in.

A= impervious surface drainage area (in square miles)

WQV= water quality volume in watershed inches (1.0-inches in this case)

	qu (csm/in.)	A (sq.mi.)	WQV (in.)	Q (cfs)
CB-1	773	0.000694	1	0.54
CB-2	773	0.000119	1	0.09
DMH-5	773	0.001113	1	0.86



Appendix E.

Closed Drainage System Calculations

**CLOSED DRAINAGE SYSTEM CALCULATIONS
10-YEAR FREQUENCY (PROPOSED CONDITION)**

Project: Avalon Hingham SY II
 Proj. #: 2015151
 Date: February 22,2016
 By: HV
 Ckd by: HH

Notes: n= 0.011
 c=0.95 (impervious areas)
 c=0.15 (for lawn/planting areas)

Line	From	To	Length (ft)	Area (acres)	Runoff C	CA	SUM CA	Time of Concen.	Rainfall I (in./hr.)	Req. Cap. Qd (cfs)	Pipe (in)	Slope (ft/ft)	Flow Full		Design Vel. Vd (fps)	Rim Elev.(ft)	Inv. Elevations		Q/Qf	Pipe Cover	Time in Pipe
													Qf (cfs)	Vf (fps)			Upper	Lower			
DP 1																					
CB 1	DMH 1		139	0.44	0.86	0.38	0.38	5.00	5.30	2.03	12.00	0.022	6.23	7.93	6.00	20.30	16.30	13.25	0.33	3.00	0.39
DP 2																					
CB 2	DMH 2		32	0.08	0.92	0.07	0.07	5.00	5.30	0.37	12.00	0.061	10.42	13.26	5.29	22.35	17.85	15.89	0.04	3.50	0.10
DP 3																					
CB 3	DMH 3		3	0.49	0.95	0.47	0.47	5.00	5.30	2.47	12.00	0.02	5.95	7.58	6.15	20.55	17.05	16.99	0.42	2.50	0.01
DMH 3	DMH 4		179	0.00	0.95	0.00	0.47	5.01	5.30	2.47	12.00	0.010	4.21	5.36	4.81	20.56	16.99	15.20	0.59	2.57	0.62
DMH 4	DMH 5		179	0.00	0.95	0.00	0.47	5.63	5.10	2.38	12.00	0.010	4.21	5.36	4.76	22.27	15.20	13.41	0.57	6.07	0.63
CB 4	DMH 5		3	0.22	0.95	0.21	0.21	5.00	5.30	1.11	12.00	0.050	9.44	12.02	6.77	20.46	13.57	13.41	0.12	5.89	0.01
DMH 5	DMH 6		158	0.00	0.95	0.00	0.68	6.25	5.00	3.38	12.00	0.033	7.66	9.76	8.06	20.55	13.51	8.28	0.44	6.04	0.33
RD-1	DMH 7		13	1.17	0.95	1.12	1.12	5.00	5.30	5.91	12.00	0.030	7.29	9.28	9.15	22.20	18.20	17.94	0.81	3.00	0.02
DMH 7	DMH 8		285	0.00	0.95	0.00	1.12	5.02	5.30	5.91	15.00	0.010	7.63	6.22	6.05	21.98	17.94	15.09	0.77	2.79	0.79
RD 2	DMH 8		13	1.17	0.95	1.12	1.12	5.00	5.30	5.91	12.00	0.057	10.09	12.85	11.52	21.84	15.84	15.09	0.59	5.00	0.02
DMH 8	DMH 9		77	0.00	0.95	0.00	2.23	5.02	5.30	11.83	18.00	0.010	12.46	7.05	7.27	21.48	15.09	14.32	0.95	4.89	0.18
DMH 9	DMH 6		18	0.00	0.95	0.00	2.23	5.20	5.30	11.83	15.00	0.046	16.30	13.28	12.67	22.22	14.32	13.50	0.73	6.65	0.02

Cn=

.74 (Pervious C) .98 (Impervious)

.38 (Pervious A)

ID	Total Area (ft²)	Acres	Pervious	Impervious	Weighted Cn
EX1	22,292	0.51	-	22,292	0.98
EX2	4,438	0.10	87	4,351	0.98
EX3	136,833	3.14	2,669	134,164	0.98
TOTALS	163,563		2,756	160,807	
ACRES	3.75		0.06	3.69	

WEIGHTED C CALCULATIONS

Project: Hingham
 Proj. #: 2015151
 Date: February 22, 2016
 By: HV
 Ckd by:

Notes:
 n= 0.012 RCP
 n= 0.01 PVC
 c= 0.95 impervious areas
 c= 0.15 lawn/planting areas

DRAINAGE AREA	A TOTAL (SF)	A TOTAL (ACRE)	A IMPERV (SF)	A IMPERV (ACRE)	IMPERV C FACTOR	IMPERV C X A	A GRASS (SF)	A GRASS (ACRE)	GRASS C FACTOR	GRASS C X A	WEIGHTED C FACTOR
DP1											
P1a	19,336.00	0.44	17,225.00	0.40	0.95	0.38	2,111.00	0.05	0.15	0.01	0.86
P1b	2,807.00	0.06	0.00	0.00	0.95	0.00	2,807.00	0.06	0.15	0.01	0.15
Total	22,143.00	0.51	17,225.00	0.40	0.95	0.38	4,918.00	0.11	0.15	0.02	0.77
DP2											
P2a	3,312.00	0.08	3,206.00	0.07	0.95	0.07	106.00	0.00	0.15	0.00	0.92
P2b	1,333.00	0.03	0.00	0.00	0.95	0.00	1,333.00	0.03	0.15	0.00	0.15
P2c	1,865.00	0.04	510.00	0.01	0.95	0.01	1,355.00	0.03	0.15	0.00	0.37
Total	6,510.00	0.15	3,716.00	0.09	0.95	0.08	2,794.00	0.06	0.15	0.01	0.61
DP3											
P3a	21,402.00	0.49	21,402.00	0.49	0.95	0.47	0.00	0.00	0.15	0.00	0.95
P3b	9,629.00	0.22	9,629.00	0.22	0.95	0.21	0.00	0.00	0.15	0.00	0.95
P3c1	102,326.00	2.35	102,326.00	2.35	0.95	2.23	0.00	0.00	0.15	0.00	0.95
P3c2	1,553.00	0.04	1,553.00	0.04	0.95	0.03	0.00	0.00	0.15	0.00	0.95
Total	134,910.00	3.10	134,910.00	3.10	0.95	2.94	0.00	0.00	0.15	0.00	0.95

53525.00 w/o roofs
 1.23
 TOTAL 163,563.00 155851.00
 ACRES 3.75 3.58

