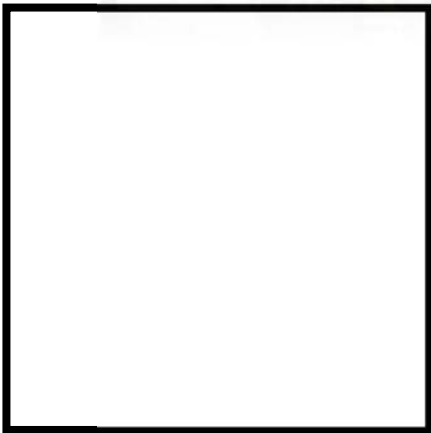




Stormwater Management Report



Hillside Commons

Located in Wakefield, Rhode Island

Applicant: Scot V. Hallberg

10-17-2018

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Executive Summary

On behalf of the Client, we are submitting drainage calculations for the proposed development at 76 Kelley Way in the Town of Wakefield, Rhode Island. The site is located on Assessors' Plat 57-2 Lot 59. The site exists today as a predominantly wooded lot, with a centralized grass clearing. The client proposes to construct an 18 unit condominium development consisting of mixture of multi and single-family homes serviced by a pervious access road.

The post development stormwater will be treated for water quality using Best Management Practices (BMPs). The Site has been designed to meet the Rhode Island Stormwater Design and Installation Standards Manual (RISDISM).

To mitigate post development flows on site, the main road as well as the sidewalks and driveways will consist of permeable pavement. A swale around the eastern perimeter of the site will capture and redirect off-site run-on to discharge in the northern portion of the site, allowing flow to disperse along the existing topography.

This report details how the site will show no net increase in stormwater runoff from pre development to post development conditions, and how the proposed BMPs will provide water quality treatment for stormwater runoff.

Pre development Conditions versus Post Development Conditions for each watershed are summarized below:

| Subwatershed (design point) | 1.2" Peak Flow | | 1-yr Peak Flow | | 10-yr Peak Flow | | 25-yr Peak Flow | | 100-yr Peak Flow | |
|--------------------------------|----------------|------|----------------|------|-----------------|------|-----------------|------|------------------|-------|
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| DP-1: | 0.03 | 0.03 | 1.35 | 0.60 | 4.83 | 2.07 | 7.16 | 3.04 | 12.09 | 5.10 |
| DP-2: | 0.24 | 0.23 | 1.12 | 1.05 | 3.21 | 3.00 | 4.52 | 4.22 | 7.21 | 6.74 |
| Totals: | 0.27 | 0.26 | 2.47 | 1.65 | 8.04 | 5.07 | 11.68 | 7.26 | 19.02 | 11.84 |

All flows in cubic feet per second (cfs)

1.0 Project Description

The purpose of this report is to specify a Storm Water Management System to be implemented in the new 18-unit condominium development at 76 Kelley Way in South Kingstown, Rhode Island.

The site totals 2.97 acres located on Assessor's Plat 57-2 Lot 59 in South Kingstown, Rhode Island. The site is located off of Kelley Way, which runs parallel to Route 1.

The proposed development is an 18-unit condominium development comprised of a combination of multi- and single-family homes. The site will be serviced by public water and sewer. Water is provided by Suez Water and sewer is provided by the Town of South Kingstown Wastewater Division.

The stormwater quality will be improved by utilizing Best Management Practices (BMPs) as established by the RISDISM for the treatment of storm water runoff from the proposed development. BMPs will consist of permeable pavement and an open channel swale. The system has been designed to meet the RISDISM

2.0 Site Conditions

2.1 SOILS

There are the following soil types within the analyzed area of the Site as mapped by the NRCS USDA Soil Conservation service:

| Soil Symbol | Description | Hydrologic Group |
|-------------|---|------------------|
| BrB | Broadbrook silt loam, 3 to 8 percent slopes | C |
| RaB | Rainbow silt loam, 3 to 8 percent slopes | C |

The onsite soils are Broadbrook and Rainbow silt loams both with 3 to 8 percent slopes (BrB and RaB, respectively). Soils surrounding the site also include BrA – Broadbrook silt loam with 0-3 percent slopes. BrA, BrB and RaB are all considered to be Hydrologic Group C. Onsite test holes indicated fine sandy loams onsite. Hydrologic Group C has been used for modeling the site.

Site specific soil evaluations can be found in Appendix A2.1.

2.2 EXISTING SITE CONDITIONS

The site is currently predominantly wooded with a large grassed clearing near the center of the site. On-site impervious area consists only of a small portion of abandoned driveway in the southeastern corner of the site. There are no wetlands or surface water bodies located on the site or in the immediate vicinity. The nearest water body, Indian Run Brook, is approximately 0.25 miles away.

The site is divided into two watersheds. The northern portion includes the majority of the site as well as some run-on from the eastern abutting lot and flows evenly from east to west across the site. The southern portion includes run-on from Kelley Way and the wooded southern portion of the site and flows overland towards a drainage swale in the RIDOT ROW along the southern perimeter of the site. None of the stormwater is treated prior to leaving the site.

2.3 POST SITE CONDITIONS

The proposed drainage analysis uses stormwater management systems to control and treat runoff from the proposed development. The following BMP's are used on site and have been designed to include the following elements:

- Open Channels (Swales)
 - Provide conveyance of stormwater
- Permeable Pavement
 - Provides water quality treatment
 - Infiltrates 100-yr storm event

The above elements will be used to meet the design standards of the Rhode Island Stormwater Design and Installation Standard.

The primary goal of increasing water quality treatment is accomplished by providing water quality BMPs. Stormwater runoff mitigation is provided through the use of permeable pavement. New impervious area on-site will consist only of the roofs from the 18 units and permeable pavement will be used for the main roadway, driveways, and sidewalks. The permeable pavement will include a robust crushed stone layer which will serve as a reservoir to create storage for on-site stormwater from all storm events up to and including the 100-year storm, which can then be fully infiltrated through a sand layer and into native soil. Off-site runoff will be collected in the grassed swale and redirected to discharge along the rear of the development, following the natural topography.

By reducing post development stormwater flow rate to a level no greater than the pre development rate, the second goal of the proposed drainage system is achieved. Any potential impacts from the proposed development on the abutting properties or existing drainage network have been mitigated.

3.0 Minimum Standards

The site has been designed to meet the minimum standards as outlined in the Rhode Island Stormwater Design and Installation Standards Manual (RISDISM). The following sections outline how the site meets and exceeds the minimum required standards.

3.1 Minimum Standard 1: LID Site Planning and Design Strategies

See “Appendix A: Stormwater Management Checklist” from the RISDISM provided at the beginning of this report.

3.2 Minimum Standard 2: Groundwater Recharge

Groundwater is to be recharged per watershed based on impervious area coverage in accordance with section 3.2.2 of the RISDISM.

Groundwater recharge is determined from the following equation:

$$Re_v = 1'' * F * I / 12$$

Where:

Re_v = Groundwater Recharge Volume (ac-ft)

F = Recharge Factor based on Hydrologic Soil Groups (HSG) (see table below)

I = Impervious Area (acres)

| HSG | Recharge Factor (F) |
|-----|---------------------|
| A | 0.60 |
| B | 0.35 |
| C | 0.25 |
| D | 0.10 |

Recharge volume for watersheds 1 and 2 are provided through the use of permeable pavement. See Table 2-1 of the Appendix A checklist for a summary of recharge values.

The required recharge volume is based on all impervious area, not just areas which are captured in the proposed BMPs.

HydroCAD printouts are available in Appendix A3.2 for the water quality storm. The water quality storm is calculated in HydroCAD using the ‘calculate separate Pervious/Impervious runoff’ option.

3.3 Minimum Standard 3: Water Quality

All stormwater is treated through an approved BMP before being discharged. This site has been designed to use permeable pavement to treat stormwater. On-site stormwater is fully infiltrated for all storm events up to and including the 100 year storm event. See permeable pavement design sheets for water quality requirements. There are no pollutant-specific requirements and/or pollutant removal efficiencies applicable to the site as the result of SAMP, TMDL, or other watershed-specific requirements.

3.4 Minimum Standard 4: Conveyance and Natural Channel Protection

3.4.1 Drainage Network Design Parameters:

OPEN CHANNELS SYSTEMS (SWALES)

- All open channels systems shall be grass channels unless otherwise noted
- Manning's coefficient =0.030
- Width, depth, slope and side slopes as noted on plans.
- The 100-year design storm is utilized for the open channel design to ensure that the drainage system contains and channels water to the BMP areas as shown on the plans.
- HydroCAD has been used to model the swales. See Appendix A3.5.4.4.

DRAINAGE PIPE

- Sized to handle 6.74 cfs of flow per the 100-yr storm for Node 201 in HydroCAD model
- 12" RCP with 4.65% slope can handle a maximum flow of 8.26 cfs

3.4.2 Channel Protection Volume:

The site has been designed to fully infiltrate the channel protection volume. The channel protection required has been met.

See table 4-1 of the Appendix A Checklist for a Summary of Channel Protection Volumes. HydroCAD printouts are available in Appendix A3.5.4.2 for the 1-year storm event.

3.5 Minimum Standard 5: Overbank Flood Protection & Downstream Analysis

3.5.1 Method of Analysis

USDA Soil Conservation Service Method as defined by Technical Release No. 20 (TR-20) determines Stormwater runoff rate and volume. Type III rainfall distribution is utilized. Time of concentration is determined using Technical Release No 55 (TR-55) methodology, through the computer program *HydroCAD ver. 10.0* by Applied Microcomputer Systems.

Permeable pavement has been modeled in HydroCAD with a 1.02 inches/hr infiltration rate per Section 5.5.4 of the Stormwater Regulations. Soil evaluations have been performed by DiPrete Engineering. The existing soil has a texture of fine sandy loam.

The drainage system has been designed to mitigate all stormwater flows for the 10, 25, and 100 year storm events.

3.5.2 Design Storm

Analysis of 1-year, 10-year, 25-year, and 100-year frequency storms are included. The following 24-hour rainfall intensities are obtained from the Rhode Island Stormwater Design and Installation Standards Manual,

Table 3-1 for Washington County.

| | |
|-----------|------------|
| 1 year = | 2.8 inches |
| 10 year = | 4.9 inches |
| 25 year = | 6.1 inches |
| 100 year= | 8.5 inches |

3.5.3 Design Point Breakdown

The site is analyzed as two watershed areas. In the pre development stage there are two subcatchments. In the post development stage there are seven subcatchments. Each watershed will demonstrate zero increase of runoff due to the proposed development. A description of each watershed and associated subcatchments are summarized as follows, with HydroCAD node numbers provided in parentheses:

Design Point 1:

In pre development conditions there is only one watershed to Design Point 1. Pre-01 (10) contains any water running onto or originating on the site that does not make it towards the bottom of the site. Stormwater from this design point is expected to flow overland towards Indian Run Brook.

In post development conditions, there are six watersheds:

Post-01 (101) accounts for off-site run-on flowing from the eastern portion of the site that is redirected through the use of a swale (102) to ultimately flow overland towards Indian Run Brook.

Post-02 (104) accounts for runoff from the roadway and sidewalks, which is then infiltrated through the permeable pavement (108). A relief point for the permeable pavement is located off the roadway between Units 9 and 10, through the use of a stone overflow area which is hydraulically linked to the stone reservoir under the permeable pavement in the roadway.

Post-03 (105) accounts for runoff from the wooded or landscaped areas of the site whose runoff will flow towards the permeable pavement (108).

Post-04 (106) accounts for runoff from the driveways, which is then infiltrated through the permeable pavement (108).

Post-05 (107) accounts for stormwater from the roofs of the buildings, which will be directed to infiltrate through the stone reservoir (108).

Post-06 (109) accounts for stormwater runoff that will flow overland from the rear yards of the units and be infiltrated at a rate that will not increase the runoff from the site between pre and post development conditions.

Below is a summary of the hydrologic parameters for the pre and post development sub-areas in Design Point-1.

| | Area (sf) | CN | Tc (min) |
|--------|-----------|----|----------|
| Pre-1 | 161,195 | 71 | 31.2 |
| Post-1 | 52,569 | 71 | 29.8 |
| Post-2 | 22,809 | 98 | 6.0 |
| Post-3 | 43,172 | 73 | 6.0 |
| Post-4 | 4,560 | 98 | 6.0 |
| Post-5 | 20,131 | 98 | 6.0 |
| Post-6 | 22,965 | 74 | 6.0 |

Design Point #2:

Watershed #2 flows to Design Point- 2 (DP-2), which is an RIDOT drainage swale located on the northern shoulder of Kelley Way. In pre and post conditions there is only one watershed to Design Point 2. This watershed consists of the mostly wooded southern portion of the site and a portion of Kelley Way. Stormwater reaches DP-2 (21/202) via an existing drainage swale with several culverts. In post development, a portion of the existing swale will be paved over to accommodate the entrance of the new development. An additional culvert has been added to maintain the hydrologic connectivity of the existing swale in this watershed.

Below is a summary of the hydrologic parameters for the pre and post development sub-areas in Design Point-2.

| | Area (sf) | CN | Tc (min) |
|--------|-----------|----|----------|
| Pre-2 | 62,860 | 77 | 15.5 |
| Post-7 | 57,846 | 77 | 14.8 |

3.5.5 Downstream Analysis

A downstream analysis is required under the following conditions:

| Area of Disturbance (Acres) | Impervious Cover (%) |
|-----------------------------|----------------------|
| >5 to 10 | >75 |
| >10 to 25 | >50 |
| >25 to 50 | >25 |
| >50 | All Projects |

The proposed project disturbs 2.31 acres and is 0.462 acres of impervious. This is approximately 20% impervious cover. A downstream analysis is not required.

3.5.6 Overbank Flood Protection Conclusion

The tables below presents a summary of the pre development flows vs. the mitigated post development flows. The table shows no increase in the rate of runoff for all storms included in the analysis.

Pre Development Flows vs. Post Development Flows Mitigated

| Subwatershed (design point) | 1.2" Peak Flow | | 1-yr Peak Flow | | 10-yr Peak Flow | | 25-yr Peak Flow | | 100-yr Peak Flow | |
|-----------------------------|----------------|------|----------------|------|-----------------|------|-----------------|------|------------------|-------|
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| DP-1: | 0.03 | 0.03 | 1.35 | 0.60 | 4.83 | 2.07 | 7.16 | 3.04 | 12.09 | 5.10 |
| DP-2: | 0.24 | 0.23 | 1.12 | 1.05 | 3.21 | 3.00 | 4.52 | 4.22 | 7.21 | 6.74 |
| Totals: | 0.27 | 0.26 | 2.47 | 1.65 | 8.04 | 5.07 | 11.68 | 7.26 | 19.02 | 11.84 |

All flows in cubic feet per second (cfs)

Pre Development Flows vs. Post Development Volumes

| Subwatershed (design point) | 1.2" Volume | | 1-yr Volume | | 10-yr Volume | | 25-yr Volume | | 100-yr Volume | |
|-----------------------------|-------------|-------|-------------|-------|--------------|-------|--------------|-------|---------------|-------|
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| DP-1: | 0.011 | 0.008 | 0.200 | 0.100 | 0.629 | 0.306 | 0.919 | 0.443 | 1.547 | 0.745 |
| DP-2: | 0.027 | 0.026 | 0.112 | 0.103 | 0.305 | 0.281 | 0.429 | 0.395 | 0.690 | 0.635 |
| Totals: | 0.038 | 0.034 | 0.312 | 0.203 | 0.934 | 0.587 | 1.348 | 0.838 | 2.237 | 1.380 |

All flows in acre feet (af)

As shown in the tables above, no increase in stormwater runoff flow will occur following the proposed construction during the 1 through 100 year storm events.

3.6 Minimum Standard 6: Redevelopment and Infill Projects.

The site is not classified as a redevelopment or infill project.

3.7 Minimum Standard 7: Pollution Prevention

A Soil Erosion and Sediment Control Plan (SESC) for this development can be found under a separate document. See the Soil Erosion and Sediment Control Plan for the development prepared by DiPrete Engineering. The SESC contains information for construction pollution prevention. For post construction pollution prevention see the Operations and Maintenance (O&M) document prepared for this development by DiPrete Engineering.

3.8 Minimum Standard 8: Land Uses with High Potential Pollutant Loads (LUHPPIs)

The site is not considered LUHHPL.

3.9 Minimum Standard 9: Illicit Discharges

There are no proposed Illicit Discharges on site. The site will be serviced by public water and sewer.

3.10 Minimum Standard 10: Construction Activity Soil Erosion, Runoff and Sedimentation and Pollution Prevention Control Measure Requirements

See the SESC for this development prepared by DiPrete Engineering.

3.11 Minimum Standard 11: Stormwater Management System Operation and Maintenance

See the O&M for this development prepared by DiPrete Engineering.

Appendix A

A2.1 Soil Evaluations



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment System Program



Site Evaluation Form
Part A - Soil Profile Description

Application Number NA

Property Owner: Scott V Hallberg

Property Location: Kelley Way (AP 57-2 Lot 59) South Kingstown, RI

Date of Test Hole: May 12, 2017

Soil Evaluator: Chris Sutter

License Number: D-4077

Weather: Mostly Cloudy, 50's

Shaded: Yes [] No [x] Time: 8:00 am

Table with 11 columns: TH Horizon, Depth, Horizon Boundaries (Dist, Topo), Soil Colors (Matrix, Re-Dox Features), Re-Dox (Ab., S., Contr.), Texture, Structure, Consistence, Soil Category. It contains two sections of soil profile data, TH 1 and TH 2.

TH 1 Soil Class Dense Till Total Depth 96" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 32" (og)

TH 2 Soil Class Dense Till Total Depth 96" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 24" (og)

Comments: [Blank lines for notes]



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

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License Number: D-4077

Weather: Mostly Cloudy, 50's

Shaded: Yes [] No [x] Time: 8:00 am

Table with 11 columns: TH Horizon, Depth, Horizon Boundaries (Dist, Topo), Soil Colors (Matrix, Re-Dox Features), Re-Dox (Ab., S., Contr.), Texture, Structure, Consistence, Soil Category. Contains data for TH 3 and TH 4 horizons.

TH 3 Soil Class Dense Till Total Depth 108" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 36" (og)

TH 4 Soil Class Dense Till Total Depth 96" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 24" (og)

Comments:



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment System Program



Site Evaluation Form
Part A - Soil Profile Description

Application Number NA

Property Owner: Scott V Hallberg

Property Location: Kelley Way (AP 57-2 Lot 59) South Kingstown, RI

Date of Test Hole: May 12, 2017

Soil Evaluator: Chris Sutter

License Number: D-4077

Weather: Mostly Cloudy, 50's

Shaded: Yes [] No [x] Time: 8:00 am

Table with 11 columns: TH Horizon, Depth, Horizon Boundaries (Dist, Topo), Soil Colors (Matrix, Re-Dox Features), Re-Dox (Ab., S., Contr.), Texture, Structure, Consistence, Soil Category. Contains data for TH 5 and TH 6 horizons.

TH 5 Soil Class Dense Till Total Depth 108" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 36" (og)

TH 6 Soil Class Dense Till Total Depth 96" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 24" (og)

Comments:



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment System Program



Site Evaluation Form
Part A - Soil Profile Description

Application Number NA

Property Owner: Scott V Hallberg

Property Location: Kelley Way (AP 57-2 Lot 59) South Kingstown, RI

Date of Test Hole: May 12, 2017

Soil Evaluator: Chris Sutter

License Number: D-4077

Weather: Mostly Cloudy, 50's

Shaded: Yes [] No [x] Time: 8:00 am

Table with 11 columns: TH Horizon, Depth, Horizon Boundaries (Dist, Topo), Soil Colors (Matrix, Re-Dox Features), Re-Dox (Ab., S., Contr.), Texture, Structure, Consistence, Soil Category. It contains two sections of soil profile data, TH 7 and TH 8.

TH 7 Soil Class Dense Till Total Depth 102" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 42" (og)

TH 8 Soil Class Dense Till Total Depth 102" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 48" (og)

Comments:



STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment System Program



Site Evaluation Form
Part A - Soil Profile Description

Application Number NA

Property Owner: Scott V Hallberg

Property Location: Kelley Way (AP 57-2 Lot 59) South Kingstown, RI

Date of Test Hole: May 12, 2017

Soil Evaluator: Chris Sutter

License Number: D-4077

Weather: Mostly Cloudy, 50's

Shaded: Yes [] No [x] Time: 8:00 am

Table with 11 columns: TH Horizon, Depth, Horizon Boundaries (Dist, Topo), Soil Colors (Matrix, Re-Dox Features), Re-Dox (Ab., S., Contr.), Texture, Structure, Consistence, Soil Category. Contains data for horizons Ap, Bw, C, and 2C.

TH 9 Soil Class Dense Till Total Depth 96" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth NA SHWT 48" (og)

TH Soil Class Total Depth Impervious/Limiting Layer Depth (og) GW Seepage Depth SHWT (og)

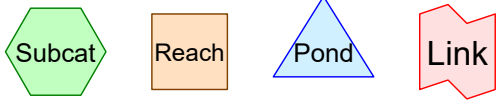
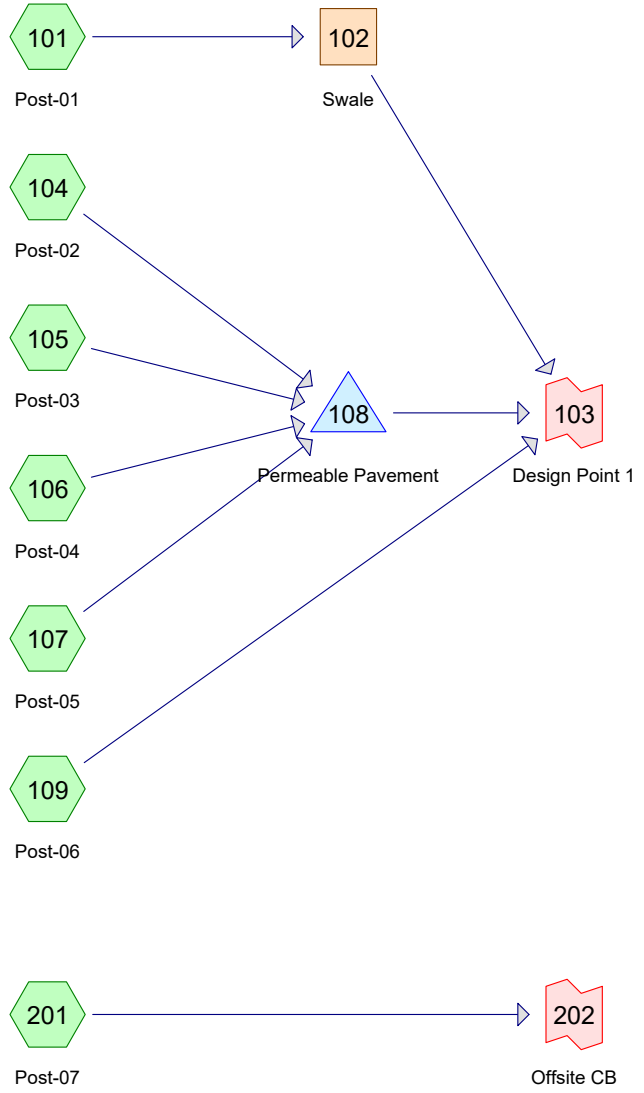
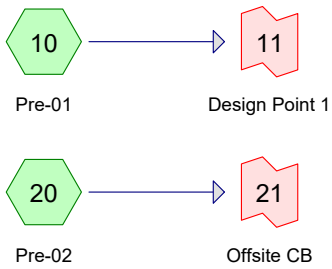
Comments:

A3.2 Water Quality HydroCAD Storm Analysis

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
 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 10: Pre-01 | Runoff Area=161,195 sf 1.19% Impervious Runoff Depth=0.04" Flow Length=463' Tc=31.2 min CN=70/98 Runoff=0.03 cfs 0.011 af |
| Subcatchment 20: Pre-02 | Runoff Area=62,860 sf 19.97% Impervious Runoff Depth=0.22" Flow Length=679' Tc=15.5 min CN=71/98 Runoff=0.24 cfs 0.027 af |
| Subcatchment 101: Post-01 | Runoff Area=52,569 sf 2.64% Impervious Runoff Depth=0.05" Flow Length=151' Tc=29.8 min CN=70/98 Runoff=0.02 cfs 0.005 af |
| Subcatchment 104: Post-02 | Runoff Area=22,809 sf 100.00% Impervious Runoff Depth=0.99" Tc=6.0 min CN=0/98 Runoff=0.57 cfs 0.043 af |
| Subcatchment 105: Post-03 | Runoff Area=43,172 sf 0.00% Impervious Runoff Depth=0.05" Tc=6.0 min CN=73/0 Runoff=0.01 cfs 0.004 af |
| Subcatchment 106: Post-04 | Runoff Area=4,560 sf 100.00% Impervious Runoff Depth=0.99" Tc=6.0 min CN=0/98 Runoff=0.11 cfs 0.009 af |
| Subcatchment 107: Post-05 | Runoff Area=20,131 sf 100.00% Impervious Runoff Depth=0.99" Tc=6.0 min CN=0/98 Runoff=0.51 cfs 0.038 af |
| Subcatchment 109: Post-06 | Runoff Area=22,965 sf 2.28% Impervious Runoff Depth=0.07" Tc=6.0 min CN=73/98 Runoff=0.01 cfs 0.003 af |
| Subcatchment 201: Post-07 | Runoff Area=57,847 sf 20.88% Impervious Runoff Depth=0.24" Flow Length=680' Tc=14.8 min CN=72/98 Runoff=0.23 cfs 0.026 af |
| Reach 102: Swale | Avg. Flow Depth=0.02' Max Vel=0.61 fps Inflow=0.02 cfs 0.005 af n=0.030 L=250.0' S=0.0407 '/' Capacity=9.48 cfs Outflow=0.02 cfs 0.005 af |
| Pond 108: Permeable Pavement | Peak Elev=96.96' Storage=538 cf Inflow=1.19 cfs 0.094 af Discarded=0.44 cfs 0.094 af Primary=0.00 cfs 0.000 af Outflow=0.44 cfs 0.094 af |
| Link 11: Design Point 1 | Inflow=0.03 cfs 0.011 af Primary=0.03 cfs 0.011 af |
| Link 21: Offsite CB | Inflow=0.24 cfs 0.027 af Primary=0.24 cfs 0.027 af |
| Link 103: Design Point 1 | Inflow=0.03 cfs 0.008 af Primary=0.03 cfs 0.008 af |
| Link 202: Offsite CB | Inflow=0.23 cfs 0.026 af Primary=0.23 cfs 0.026 af |

A3.5.4.1 HydroCAD Node Diagram



Routing Diagram for 1864-003-ALLS-INHS-20181012
 Prepared by DiPrete Engineering, Printed 10/15/2018
 HydroCAD® 10.00-20 s/n 01125 © 2017 HydroCAD Software Solutions LLC

1864-003-ALLS-INHS-20181012

Prepared by DiPrete Engineering

Printed 10/15/2018

HydroCAD® 10.00-20 s/n 01125 © 2017 HydroCAD Software Solutions LLC

Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|-----------------|-----------|--|
| 2.271 | 74 | >75% Grass cover, Good, HSG C (10, 20, 101, 105, 109, 201) |
| 0.105 | 98 | Driveways, HSG C (106) |
| 0.653 | 98 | Existing Impervious, HSG C (10, 20, 101, 109, 201) |
| 0.524 | 98 | Roads & Sidewalks, HSG C (104) |
| 0.462 | 98 | Roofs, HSG C (107) |
| 6.272 | 70 | Woods, Good, HSG C (10, 20, 101, 105, 109, 201) |
| 10.287 | 76 | TOTAL AREA |

A3.5.4.2 HydroCAD 1-Year Storm Analysis

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

| | |
|-------------------------------------|---|
| Subcatchment 10: Pre-01 | Runoff Area=161,195 sf 1.19% Impervious Runoff Depth=0.65" Flow Length=463' Tc=31.2 min CN=71 Runoff=1.35 cfs 0.200 af |
| Subcatchment 20: Pre-02 | Runoff Area=62,860 sf 19.97% Impervious Runoff Depth=0.93" Flow Length=679' Tc=15.5 min CN=77 Runoff=1.12 cfs 0.112 af |
| Subcatchment 101: Post-01 | Runoff Area=52,569 sf 2.64% Impervious Runoff Depth=0.65" Flow Length=151' Tc=29.8 min CN=71 Runoff=0.45 cfs 0.065 af |
| Subcatchment 104: Post-02 | Runoff Area=22,809 sf 100.00% Impervious Runoff Depth=2.57" Tc=6.0 min CN=98 Runoff=1.42 cfs 0.112 af |
| Subcatchment 105: Post-03 | Runoff Area=43,172 sf 0.00% Impervious Runoff Depth=0.74" Tc=6.0 min CN=73 Runoff=0.77 cfs 0.061 af |
| Subcatchment 106: Post-04 | Runoff Area=4,560 sf 100.00% Impervious Runoff Depth=2.57" Tc=6.0 min CN=98 Runoff=0.28 cfs 0.022 af |
| Subcatchment 107: Post-05 | Runoff Area=20,131 sf 100.00% Impervious Runoff Depth=2.57" Tc=6.0 min CN=98 Runoff=1.25 cfs 0.099 af |
| Subcatchment 109: Post-06 | Runoff Area=22,965 sf 2.28% Impervious Runoff Depth=0.78" Tc=6.0 min CN=74 Runoff=0.44 cfs 0.034 af |
| Subcatchment 201: Post-07 | Runoff Area=57,847 sf 20.88% Impervious Runoff Depth=0.93" Flow Length=680' Tc=14.8 min CN=77 Runoff=1.05 cfs 0.103 af |
| Reach 102: Swale | Avg. Flow Depth=0.10' Max Vel=1.91 fps Inflow=0.45 cfs 0.065 af n=0.030 L=250.0' S=0.0407 '/' Capacity=9.48 cfs Outflow=0.45 cfs 0.065 af |
| Pond 108: Permeable Pavement | Peak Elev=97.52' Storage=3,979 cf Inflow=3.71 cfs 0.294 af Discarded=0.44 cfs 0.294 af Primary=0.00 cfs 0.000 af Outflow=0.44 cfs 0.294 af |
| Link 11: Design Point 1 | Inflow=1.35 cfs 0.200 af Primary=1.35 cfs 0.200 af |
| Link 21: Offsite CB | Inflow=1.12 cfs 0.112 af Primary=1.12 cfs 0.112 af |
| Link 103: Design Point 1 | Inflow=0.60 cfs 0.100 af Primary=0.60 cfs 0.100 af |
| Link 202: Offsite CB | Inflow=1.05 cfs 0.103 af Primary=1.05 cfs 0.103 af |

A3.5.4.3 HydroCAD 10-Year Storm Analysis

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

| | |
|-------------------------------------|--|
| Subcatchment 10: Pre-01 | Runoff Area=161,195 sf 1.19% Impervious Runoff Depth=2.04" Flow Length=463' Tc=31.2 min CN=71 Runoff=4.83 cfs 0.629 af |
| Subcatchment 20: Pre-02 | Runoff Area=62,860 sf 19.97% Impervious Runoff Depth=2.54" Flow Length=679' Tc=15.5 min CN=77 Runoff=3.21 cfs 0.305 af |
| Subcatchment 101: Post-01 | Runoff Area=52,569 sf 2.64% Impervious Runoff Depth=2.04" Flow Length=151' Tc=29.8 min CN=71 Runoff=1.61 cfs 0.205 af |
| Subcatchment 104: Post-02 | Runoff Area=22,809 sf 100.00% Impervious Runoff Depth=4.66" Tc=6.0 min CN=98 Runoff=2.51 cfs 0.203 af |
| Subcatchment 105: Post-03 | Runoff Area=43,172 sf 0.00% Impervious Runoff Depth=2.20" Tc=6.0 min CN=73 Runoff=2.54 cfs 0.182 af |
| Subcatchment 106: Post-04 | Runoff Area=4,560 sf 100.00% Impervious Runoff Depth=4.66" Tc=6.0 min CN=98 Runoff=0.50 cfs 0.041 af |
| Subcatchment 107: Post-05 | Runoff Area=20,131 sf 100.00% Impervious Runoff Depth=4.66" Tc=6.0 min CN=98 Runoff=2.21 cfs 0.180 af |
| Subcatchment 109: Post-06 | Runoff Area=22,965 sf 2.28% Impervious Runoff Depth=2.28" Tc=6.0 min CN=74 Runoff=1.40 cfs 0.100 af |
| Subcatchment 201: Post-07 | Runoff Area=57,847 sf 20.88% Impervious Runoff Depth=2.54" Flow Length=680' Tc=14.8 min CN=77 Runoff=3.00 cfs 0.281 af |
| Reach 102: Swale | Avg. Flow Depth=0.20' Max Vel=2.86 fps Inflow=1.61 cfs 0.205 af n=0.030 L=250.0' S=0.0407 '/' Capacity=9.48 cfs Outflow=1.60 cfs 0.205 af |
| Pond 108: Permeable Pavement | Peak Elev=98.22' Storage=10,224 cf Inflow=7.76 cfs 0.606 af Discarded=0.65 cfs 0.606 af Primary=0.00 cfs 0.000 af Outflow=0.65 cfs 0.606 af |
| Link 11: Design Point 1 | Inflow=4.83 cfs 0.629 af Primary=4.83 cfs 0.629 af |
| Link 21: Offsite CB | Inflow=3.21 cfs 0.305 af Primary=3.21 cfs 0.305 af |
| Link 103: Design Point 1 | Inflow=2.07 cfs 0.306 af Primary=2.07 cfs 0.306 af |
| Link 202: Offsite CB | Inflow=3.00 cfs 0.281 af Primary=3.00 cfs 0.281 af |

A3.5.4.4 HydroCAD 25-Year Storm Analysis

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

| | |
|-------------------------------------|---|
| Subcatchment 10: Pre-01 | Runoff Area=161,195 sf 1.19% Impervious Runoff Depth=2.98" Flow Length=463' Tc=31.2 min CN=71 Runoff=7.16 cfs 0.919 af |
| Subcatchment 20: Pre-02 | Runoff Area=62,860 sf 19.97% Impervious Runoff Depth=3.57" Flow Length=679' Tc=15.5 min CN=77 Runoff=4.52 cfs 0.429 af |
| Subcatchment 101: Post-01 | Runoff Area=52,569 sf 2.64% Impervious Runoff Depth=2.98" Flow Length=151' Tc=29.8 min CN=71 Runoff=2.38 cfs 0.300 af |
| Subcatchment 104: Post-02 | Runoff Area=22,809 sf 100.00% Impervious Runoff Depth=5.86" Tc=6.0 min CN=98 Runoff=3.13 cfs 0.256 af |
| Subcatchment 105: Post-03 | Runoff Area=43,172 sf 0.00% Impervious Runoff Depth=3.17" Tc=6.0 min CN=73 Runoff=3.69 cfs 0.262 af |
| Subcatchment 106: Post-04 | Runoff Area=4,560 sf 100.00% Impervious Runoff Depth=5.86" Tc=6.0 min CN=98 Runoff=0.63 cfs 0.051 af |
| Subcatchment 107: Post-05 | Runoff Area=20,131 sf 100.00% Impervious Runoff Depth=5.86" Tc=6.0 min CN=98 Runoff=2.76 cfs 0.226 af |
| Subcatchment 109: Post-06 | Runoff Area=22,965 sf 2.28% Impervious Runoff Depth=3.27" Tc=6.0 min CN=74 Runoff=2.02 cfs 0.144 af |
| Subcatchment 201: Post-07 | Runoff Area=57,847 sf 20.88% Impervious Runoff Depth=3.57" Flow Length=680' Tc=14.8 min CN=77 Runoff=4.22 cfs 0.395 af |
| Reach 102: Swale | Avg. Flow Depth=0.25' Max Vel=3.22 fps Inflow=2.38 cfs 0.300 af n=0.030 L=250.0' S=0.0407 '/' Capacity=9.48 cfs Outflow=2.38 cfs 0.300 af |
| Pond 108: Permeable Pavement | Peak Elev=98.75' Storage=15,065 cf Inflow=10.20 cfs 0.795 af Discarded=0.65 cfs 0.795 af Primary=0.00 cfs 0.000 af Outflow=0.65 cfs 0.795 af |
| Link 11: Design Point 1 | Inflow=7.16 cfs 0.919 af Primary=7.16 cfs 0.919 af |
| Link 21: Offsite CB | Inflow=4.52 cfs 0.429 af Primary=4.52 cfs 0.429 af |
| Link 103: Design Point 1 | Inflow=3.04 cfs 0.443 af Primary=3.04 cfs 0.443 af |
| Link 202: Offsite CB | Inflow=4.22 cfs 0.395 af Primary=4.22 cfs 0.395 af |

A3.5.4.5 HydroCAD 100-Year Storm Analysis

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

| | |
|-------------------------------------|--|
| Subcatchment 10: Pre-01 | Runoff Area=161,195 sf 1.19% Impervious Runoff Depth=5.02" Flow Length=463' Tc=31.2 min CN=71 Runoff=12.09 cfs 1.547 af |
| Subcatchment 20: Pre-02 | Runoff Area=62,860 sf 19.97% Impervious Runoff Depth=5.73" Flow Length=679' Tc=15.5 min CN=77 Runoff=7.21 cfs 0.690 af |
| Subcatchment 101: Post-01 | Runoff Area=52,569 sf 2.64% Impervious Runoff Depth=5.02" Flow Length=151' Tc=29.8 min CN=71 Runoff=4.03 cfs 0.504 af |
| Subcatchment 104: Post-02 | Runoff Area=22,809 sf 100.00% Impervious Runoff Depth=8.26" Tc=6.0 min CN=98 Runoff=4.37 cfs 0.360 af |
| Subcatchment 105: Post-03 | Runoff Area=43,172 sf 0.00% Impervious Runoff Depth=5.26" Tc=6.0 min CN=73 Runoff=6.09 cfs 0.434 af |
| Subcatchment 106: Post-04 | Runoff Area=4,560 sf 100.00% Impervious Runoff Depth=8.26" Tc=6.0 min CN=98 Runoff=0.87 cfs 0.072 af |
| Subcatchment 107: Post-05 | Runoff Area=20,131 sf 100.00% Impervious Runoff Depth=8.26" Tc=6.0 min CN=98 Runoff=3.86 cfs 0.318 af |
| Subcatchment 109: Post-06 | Runoff Area=22,965 sf 2.28% Impervious Runoff Depth=5.38" Tc=6.0 min CN=74 Runoff=3.31 cfs 0.236 af |
| Subcatchment 201: Post-07 | Runoff Area=57,847 sf 20.88% Impervious Runoff Depth=5.73" Flow Length=680' Tc=14.8 min CN=77 Runoff=6.74 cfs 0.635 af |
| Reach 102: Swale | Avg. Flow Depth=0.33' Max Vel=3.74 fps Inflow=4.03 cfs 0.504 af n=0.030 L=250.0' S=0.0407 '/' Capacity=9.48 cfs Outflow=4.02 cfs 0.504 af |
| Pond 108: Permeable Pavement | Peak Elev=100.37' Storage=26,400 cf Inflow=15.19 cfs 1.185 af Discarded=0.65 cfs 1.180 af Primary=0.13 cfs 0.004 af Outflow=0.78 cfs 1.185 af |
| Link 11: Design Point 1 | Inflow=12.09 cfs 1.547 af Primary=12.09 cfs 1.547 af |
| Link 21: Offsite CB | Inflow=7.21 cfs 0.690 af Primary=7.21 cfs 0.690 af |
| Link 103: Design Point 1 | Inflow=5.10 cfs 0.745 af Primary=5.10 cfs 0.745 af |
| Link 202: Offsite CB | Inflow=6.74 cfs 0.635 af Primary=6.74 cfs 0.635 af |

Summary for Subcatchment 10: Pre-01

Runoff = 12.09 cfs @ 12.44 hrs, Volume= 1.547 af, Depth= 5.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.50"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 146,823 | 70 | Woods, Good, HSG C |
| * 1,912 | 98 | Existing Impervious, HSG C |
| 12,460 | 74 | >75% Grass cover, Good, HSG C |
| 161,195 | 71 | Weighted Average |
| 159,283 | 70 | 98.81% Pervious Area |
| 1,912 | 98 | 1.19% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 15.8 | 62 | 0.0638 | 0.07 | | Sheet Flow, 1A-1B Woods: Dense underbrush n= 0.800 P2= 3.30" |
| 10.0 | 27 | 0.0376 | 0.04 | | Sheet Flow, 1B-1C Woods: Dense underbrush n= 0.800 P2= 3.30" |
| 3.7 | 11 | 0.0737 | 0.05 | | Sheet Flow, 1C-1D Woods: Dense underbrush n= 0.800 P2= 3.30" |
| 0.6 | 110 | 0.0377 | 3.13 | | Shallow Concentrated Flow, 1D-1E Unpaved Kv= 16.1 fps |
| 1.1 | 253 | 0.0523 | 3.68 | | Shallow Concentrated Flow, 1E-1F Unpaved Kv= 16.1 fps |
| 31.2 | 463 | Total | | | |

Summary for Subcatchment 20: Pre-02

Runoff = 7.21 cfs @ 12.21 hrs, Volume= 0.690 af, Depth= 5.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.50"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 35,045 | 70 | Woods, Good, HSG C |
| * 12,553 | 98 | Existing Impervious, HSG C |
| 15,262 | 74 | >75% Grass cover, Good, HSG C |
| 62,860 | 77 | Weighted Average |
| 50,307 | 71 | 80.03% Pervious Area |
| 12,553 | 98 | 19.97% Impervious Area |

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Type III 24-hr 100-Year Rainfall=8.50"

Prepared by DiPrete Engineering

Printed 10/15/2018

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| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.2 | 100 | 0.0574 | 0.18 | | Sheet Flow, 2A-2B Grass: Dense n= 0.240 P2= 3.30" |
| 0.2 | 39 | 0.0574 | 3.86 | | Shallow Concentrated Flow, 2B-2C Unpaved Kv= 16.1 fps |
| 1.1 | 96 | 0.0633 | 1.45 | 0.04 | Trap/Vee/Rect Channel Flow, 2C-2D Bot.W=0.00' D=0.50' Z= 0.1 '/' Top.W=0.10' n= 0.022 Earth, clean & straight |
| 0.1 | 42 | 0.0412 | 11.97 | 9.40 | Pipe Channel, 2D-2E 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior |
| 0.7 | 78 | 0.0926 | 1.75 | 0.04 | Trap/Vee/Rect Channel Flow, 2E-2F Bot.W=0.00' D=0.50' Z= 0.1 '/' Top.W=0.10' n= 0.022 Earth, clean & straight |
| 0.1 | 60 | 0.0400 | 11.79 | 9.26 | Pipe Channel, 2F-2G 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior |
| 4.1 | 264 | 0.0356 | 1.09 | 0.03 | Trap/Vee/Rect Channel Flow, 2G-2H Bot.W=0.00' D=0.50' Z= 0.1 '/' Top.W=0.10' n= 0.022 Earth, clean & straight |
| 15.5 | 679 | Total | | | |

Summary for Subcatchment 101: Post-01

Runoff = 4.03 cfs @ 12.42 hrs, Volume= 0.504 af, Depth= 5.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.50"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 5,304 | 74 | >75% Grass cover, Good, HSG C |
| 45,879 | 70 | Woods, Good, HSG C |
| * 1,386 | 98 | Existing Impervious, HSG C |
| 52,569 | 71 | Weighted Average |
| 51,183 | 70 | 97.36% Pervious Area |
| 1,386 | 98 | 2.64% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 15.8 | 62 | 0.0638 | 0.07 | | Sheet Flow, 1A-1B Woods: Dense underbrush n= 0.800 P2= 3.30" |
| 10.0 | 27 | 0.0376 | 0.04 | | Sheet Flow, 1B-1C Woods: Dense underbrush n= 0.800 P2= 3.30" |
| 3.7 | 11 | 0.0737 | 0.05 | | Sheet Flow, 1C-1D Woods: Dense underbrush n= 0.800 P2= 3.30" |
| 0.3 | 51 | 0.0409 | 3.26 | | Shallow Concentrated Flow, 1D-1E Unpaved Kv= 16.1 fps |
| 29.8 | 151 | Total | | | |

Summary for Subcatchment 104: Post-02

Runoff = 4.37 cfs @ 12.08 hrs, Volume= 0.360 af, Depth= 8.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.50"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| * 22,809 | 98 | Roads & Sidewalks, HSG C |
| 22,809 | 98 | 100.00% Impervious Area |

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

Summary for Subcatchment 105: Post-03

Runoff = 6.09 cfs @ 12.09 hrs, Volume= 0.434 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.50"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 29,159 | 74 | >75% Grass cover, Good, HSG C |
| 14,013 | 70 | Woods, Good, HSG C |
| 43,172 | 73 | Weighted Average |
| 43,172 | 73 | 100.00% Pervious Area |

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

Summary for Subcatchment 106: Post-04

Runoff = 0.87 cfs @ 12.08 hrs, Volume= 0.072 af, Depth= 8.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.50"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| * 4,560 | 98 | Driveways, HSG C |
| 4,560 | 98 | 100.00% Impervious Area |

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

Summary for Subcatchment 107: Post-05

Runoff = 3.86 cfs @ 12.08 hrs, Volume= 0.318 af, Depth= 8.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.50"

| Area (sf) | CN | Description |
|-----------|----|-------------------------|
| * 20,131 | 98 | Roofs, HSG C |
| 20,131 | 98 | 100.00% Impervious Area |

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

Summary for Subcatchment 109: Post-06

Runoff = 3.31 cfs @ 12.09 hrs, Volume= 0.236 af, Depth= 5.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.50"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 19,261 | 74 | >75% Grass cover, Good, HSG C |
| 3,180 | 70 | Woods, Good, HSG C |
| * 524 | 98 | Existing Impervious, HSG C |
| 22,965 | 74 | Weighted Average |
| 22,441 | 73 | 97.72% Pervious Area |
| 524 | 98 | 2.28% Impervious Area |

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

Summary for Subcatchment 201: Post-07

Runoff = 6.74 cfs @ 12.20 hrs, Volume= 0.635 af, Depth= 5.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.50"

| Area (sf) | CN | Description |
|-----------|----|-------------------------------|
| 17,494 | 74 | >75% Grass cover, Good, HSG C |
| 28,275 | 70 | Woods, Good, HSG C |
| * 12,078 | 98 | Existing Impervious, HSG C |
| 57,847 | 77 | Weighted Average |
| 45,769 | 72 | 79.12% Pervious Area |
| 12,078 | 98 | 20.88% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|-------------|------------------|------------------|----------------------|-------------------|--|
| 9.2 | 100 | 0.0574 | 0.18 | | Sheet Flow, 2A-2B Grass: Dense n= 0.240 P2= 3.30" |
| 0.2 | 39 | 0.0574 | 3.86 | | Shallow Concentrated Flow, 2B-2C Unpaved Kv= 16.1 fps |
| 1.1 | 96 | 0.0633 | 1.45 | 0.04 | Trap/Vee/Rect Channel Flow, 2C-2D Bot.W=0.00' D=0.50' Z= 0.1 '/' Top.W=0.10' n= 0.022 Earth, clean & straight |
| 0.1 | 42 | 0.0412 | 11.97 | 9.40 | Pipe Channel, 2D-2E 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior |
| 0.7 | 78 | 0.0926 | 1.75 | 0.04 | Trap/Vee/Rect Channel Flow, 2E-2F Bot.W=0.00' D=0.50' Z= 0.1 '/' Top.W=0.10' n= 0.022 Earth, clean & straight |
| 0.1 | 60 | 0.0400 | 11.79 | 9.26 | Pipe Channel, 2F-2G 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior |
| 1.7 | 113 | 0.0356 | 1.09 | 0.03 | Trap/Vee/Rect Channel Flow, 2G-2H Bot.W=0.00' D=0.50' Z= 0.1 '/' Top.W=0.10' n= 0.022 Earth, clean & straight |
| 0.1 | 45 | 0.0356 | 11.13 | 8.74 | Pipe Channel, 2H-2I 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.010 PVC, smooth interior |
| 1.6 | 107 | 0.0356 | 1.09 | 0.03 | Trap/Vee/Rect Channel Flow, 2I-2J Bot.W=0.00' D=0.50' Z= 0.1 '/' Top.W=0.10' n= 0.022 |
| 14.8 | 680 | Total | | | |

Summary for Reach 102: Swale

Inflow Area = 1.207 ac, 2.64% Impervious, Inflow Depth = 5.02" for 100-Year event
 Inflow = 4.03 cfs @ 12.42 hrs, Volume= 0.504 af
 Outflow = 4.02 cfs @ 12.43 hrs, Volume= 0.504 af, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Max. Velocity= 3.74 fps, Min. Travel Time= 1.1 min
 Avg. Velocity = 1.34 fps, Avg. Travel Time= 3.1 min

Peak Storage= 269 cf @ 12.43 hrs
 Average Depth at Peak Storage= 0.33'
 Bank-Full Depth= 0.50' Flow Area= 2.0 sf, Capacity= 9.48 cfs

2.00' x 0.50' deep channel, n= 0.030 Earth, grassed & winding
 Side Slope Z-value= 4.0 '/' Top Width= 6.00'
 Length= 250.0' Slope= 0.0407 '/'
 Inlet Invert= 127.88', Outlet Invert= 117.71'



Summary for Pond 108: Permeable Pavement

Inflow Area = 2.082 ac, 52.39% Impervious, Inflow Depth = 6.83" for 100-Year event
 Inflow = 15.19 cfs @ 12.09 hrs, Volume= 1.185 af
 Outflow = 0.78 cfs @ 14.29 hrs, Volume= 1.185 af, Atten= 95%, Lag= 132.3 min
 Discarded = 0.65 cfs @ 11.73 hrs, Volume= 1.180 af
 Primary = 0.13 cfs @ 14.29 hrs, Volume= 0.004 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 100.37' @ 14.29 hrs Surf.Area= 27,369 sf Storage= 26,400 cf

Plug-Flow detention time= 368.8 min calculated for 1.184 af (100% of inflow)
 Center-of-Mass det. time= 368.8 min (1,136.9 - 768.1)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|---|
| #1 | 99.71' | 1,775 cf | Roadway Permeable Pavement (Prismatic) Listed below (Recalc) -Impervious 5,380 cf Overall x 33.0% Voids |
| #2 | 99.54' | 1,041 cf | Roadway Choker Course (Prismatic) Listed below (Recalc) -Impervious 3,153 cf Overall x 33.0% Voids |
| #3 | 97.54' | 12,243 cf | Roadway Crushed Stone (Prismatic) Listed below (Recalc) -Impervious 37,100 cf Overall x 33.0% Voids |
| #4 | 96.87' | 4,101 cf | Roadway Filter Course (Prismatic) Listed below (Recalc) 12,429 cf Overall x 33.0% Voids |
| #5 | 97.54' | 3,457 cf | Sidewalks (Prismatic) Listed below (Recalc) 10,477 cf Overall x 33.0% Voids |
| #6 | 97.54' | 3,702 cf | Driveways (Prismatic) Listed below (Recalc) 11,218 cf Overall x 33.0% Voids |
| #7 | 100.00' | 91 cf | Custom Stage Data (Prismatic) Listed below (Recalc) -Impervious |
| | | 26,411 cf | Total Available Storage |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|------------------|-------------------|------------------------|------------------------|
| 99.71 | 18,550 | 0 | 0 |
| 100.00 | 18,550 | 5,380 | 5,380 |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|------------------|-------------------|------------------------|------------------------|
| 99.54 | 18,550 | 0 | 0 |
| 99.71 | 18,550 | 3,153 | 3,153 |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|------------------|-------------------|------------------------|------------------------|
| 97.54 | 18,550 | 0 | 0 |
| 99.54 | 18,550 | 37,100 | 37,100 |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 96.87 | 18,550 | 0 | 0 |
| 97.54 | 18,550 | 12,429 | 12,429 |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 97.54 | 4,259 | 0 | 0 |
| 99.67 | 4,259 | 9,072 | 9,072 |
| 100.00 | 4,259 | 1,405 | 10,477 |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 97.54 | 4,560 | 0 | 0 |
| 99.67 | 4,560 | 9,713 | 9,713 |
| 100.00 | 4,560 | 1,505 | 11,218 |

| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---------------------|----------------------|---------------------------|---------------------------|
| 100.00 | 219 | 0 | 0 |
| 100.33 | 219 | 72 | 72 |
| 100.50 | 1 | 19 | 91 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Discarded | 96.87' | 1.020 in/hr Exfiltration over Surface area Phase-In= 0.01' |
| #2 | Primary | 100.33' | 5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) |

Discarded OutFlow Max=0.65 cfs @ 11.73 hrs HW=97.55' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.65 cfs)

Primary OutFlow Max=0.13 cfs @ 14.29 hrs HW=100.37' TW=0.00' (Dynamic Tailwater)

↑2=Sharp-Crested Rectangular Weir (Weir Controls 0.13 cfs @ 0.66 fps)

Summary for Link 11: Design Point 1

Inflow Area = 3.701 ac, 1.19% Impervious, Inflow Depth = 5.02" for 100-Year event
 Inflow = 12.09 cfs @ 12.44 hrs, Volume= 1.547 af
 Primary = 12.09 cfs @ 12.44 hrs, Volume= 1.547 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link 21: Offsite CB

Inflow Area = 1.443 ac, 19.97% Impervious, Inflow Depth = 5.73" for 100-Year event
 Inflow = 7.21 cfs @ 12.21 hrs, Volume= 0.690 af
 Primary = 7.21 cfs @ 12.21 hrs, Volume= 0.690 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link 103: Design Point 1

Inflow Area = 3.816 ac, 29.73% Impervious, Inflow Depth = 2.34" for 100-Year event
Inflow = 5.10 cfs @ 12.37 hrs, Volume= 0.745 af
Primary = 5.10 cfs @ 12.37 hrs, Volume= 0.745 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Link 202: Offsite CB

Inflow Area = 1.328 ac, 20.88% Impervious, Inflow Depth = 5.73" for 100-Year event
Inflow = 6.74 cfs @ 12.20 hrs, Volume= 0.635 af
Primary = 6.74 cfs @ 12.20 hrs, Volume= 0.635 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Watershed Maps

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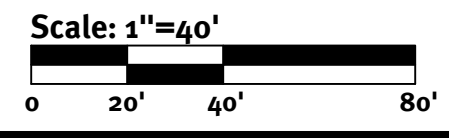


Legend

- Woods - C Soils
- Grass - C Soils
- Impervious

Legend

- Tc Line (With Elevations)
- Subcat Area
- Soil Boundary
- Subcatchment 100
- Swale 100
- Design Point DP



Pre-Watershed Map
Hillside Commons

Accession Plat 57-3 Lot 59
 South Kingstown, Rhode Island
 Applicant
Scot V. Hallberg
 57 Edgewood Farm Road
 Wakefield, RI 02879

This regulatory submission set shall not be used for construction purposes unless stamped 'Issued for Construction' and signed by a DiPrete Engineering representative.

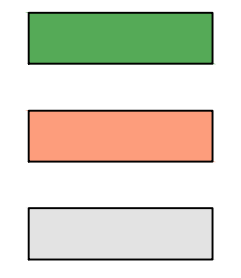
The contractor is responsible for all of the means, methods, safety precautions and requirements, and OSHA compliance in the implementation of this plan and design.

| Rev. | Date | Description | By | Design By |
|------|------------|------------------|----|-----------|
| 0 | 10/27/2018 | Permitting Plans | | M.I.D. |
| 1 | 10/27/2018 | Final | | M.I.D. |

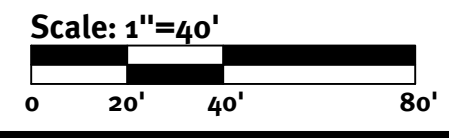
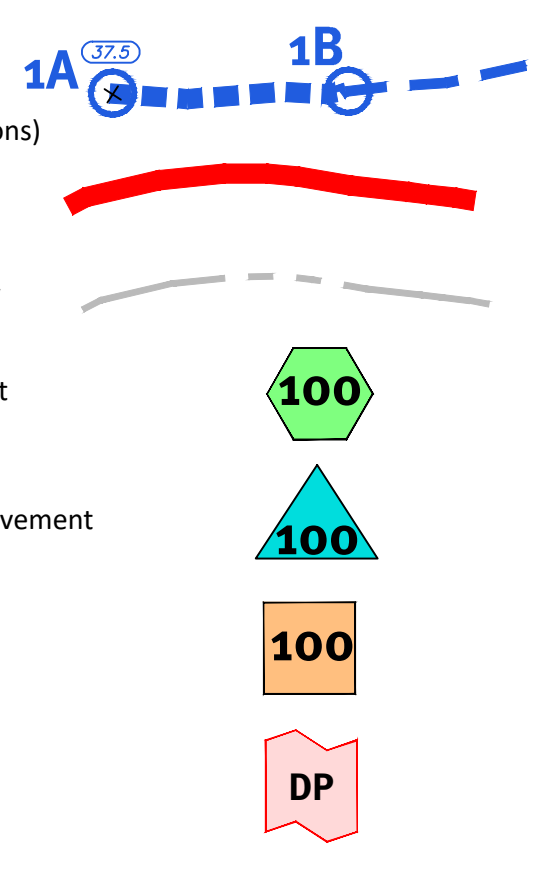
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Legend
Woods - C Soils
Grass - C Soils
Impervious



Legend
Tc Line (With Elevations)
Subcat Area
Soil Boundary
Subcatchment
Permeable Pavement
Swale
Design Point



Post-Watershed Map Hillside Commons

Accession Plat 57-2, Lot 59
South Kingstown, Rhode Island
Applicant
Scot V. Hallberg
57 Edgewood Farm Road
Wakefield, RI 02879

SHEET **2** OF 2

This regulatory submission set shall not be used for construction purposes unless stamped 'Issued for Construction' and signed by a DiPrete Engineering representative.

The contractor is responsible for all of the means, methods, safety precautions and requirements, and OSHA compliance in the implementation of this plan and design.

| Rev. | Date | Description | By | Design By |
|------|------------|------------------|----|-----------|
| 0 | 10/27/2018 | Permeable Pavers | | M.I.D. |
| 1 | 10/27/2018 | Design | | M.I.D. |

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