



**DiPrete Engineering**

# Stormwater Management Report



## Wilson & Tarn Street Development

Located in South Kingstown, Rhode Island  
Applicant: South County Post & Beam, Inc.

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## Executive Summary

On behalf of the applicant, we are submitting drainage calculations for the proposed 9 lot residential subdivision located off Oak Street on Wilson Street and Tarn Street in South Kingstown, RI. The site is located on Assessors' Plat 57-1 Lots 121, 122 and 146. The site exists today as entirely wooded, with a forested wetland less than 3 acres adjacent to the south west corner of the project site. The applicant proposes an 8 lot, 10 unit, subdivision which will be accessed by Oak Street off of Old Tower Hill Road. There are currently two unimproved platted roadways within the subdivision, Tarn Street and Wilson Street. The development will convert these two unimproved platted roadways into one roadway named Tarn Street. The proposed homes will have frontage along Tarn street and will be serviced by public water and public sewer. The development will be completed in one phase.

The site has an existing isolated wetland located on the south of the property. The north section of the property has a low point which was created in the past when gravel was removed from the site. The existing isolated wetland on the south has three drainage outlets from the Town drainage system. This includes two discharge points from Cleveland Street and one discharge point from Oak Street. The isolated wetland has a bottom elevation of approximately 32 and has a large storage area above this elevation. There is also a low point on the north section of the property which has two drainage outlets from the Town drainage system. One drainage outlet is located within private property on the abutting property owner to the north and another is from a catch basin located at the end of Wilson Street. The hydrologic analysis has been completed modeling the southern isolated wetland area and the northern low point as ponds. Analyzing these areas as ponds provided data that showed the approximate elevation of water during storm events.

The Town drainage systems cause ponding within the northern low point during large storm events. To mitigate this existing drainage problem, which is a nuisance to neighboring properties, we have proposed to excavate and expand the existing ponding area within proposed lot 1. This will allow water to infiltrate into the ground while reducing the ponding elevation from predevelopment to post development conditions.

All stormwater from proposed development areas is treated through an approved BMP before being discharged. Stormwater from the proposed lots is directed to one of two Infiltration Ponds. Infiltration Pond F is located at the corner of Tarn Street and Infiltration Pond D is located at the end of the shared driveway for lots 6 & 7. Pre Treatment of stormwater is provided from the roadside grass swale and a separate ponding chamber lined with ASTM C33 sand for water quality treatment is provided within each infiltration pond area. The infiltration ponds have been sized to fully infiltrate the remaining 1-100 year storm events. This has been included in the design to meet the South Kingstown land development regulations of no flow increase on downgradient areas to the maximum extent practicable. 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.

This report details how the site will show either no net runoff or only minimal increases in stormwater runoff from pre development to post development conditions, and how the proposed BMPs will provide water quality treatment for stormwater runoff. To the maximum extent practicable all 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).

Pre development Conditions versus Post Development Conditions for each watershed are summarized on the following sheets:

**Pre Development Flows vs. Post Development Flows Mitigated**

**Watershed #1: (DP-1: Existing Ponding North)**

<b>Flows</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.35 cfs	3.08 cfs	6.23 cfs	14.48 cfs
Post Dev Summation	0.35 cfs	3.06 cfs	6.28 cfs	14.58 cfs
<b>Net Change</b>	<b>0.00 cfs</b>	<b>-0.02 cfs</b>	<b>0.51 cfs</b>	<b>0.10 cfs</b>

(cfs = cubic feet per second)

<b>Volume</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.078 af	0.500 af	0.868 af	1.806 af
Post Dev Summation	0.077 af	0.505 af	0.875 af	1.792 af
<b>Net Change</b>	<b>-0.001 af</b>	<b>0.005 af</b>	<b>0.007 af</b>	<b>-0.014 af</b>

(af = acre-feet)

<b>Existing North Ponding Area Elevations</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	34.13	35.07	35.51	36.25
Post Dev Summation	32.00	32.64	33.92	36.06
<b>Net Change</b>	<b>-2.13'</b>	<b>-2.43'</b>	<b>-1.59'</b>	<b>-0.19'</b>

The proposed development will have no significant impacts and will improve the nuisance flooding within the north ponding area by expanding the existing ponding area. This is done by lowering the bottom to elevation 32 and improving the infiltration rate by exposing the sandy soils with the Lot 1

expanded ponding area. While the analysis shows minor increase for stormwater flow & volume it is important to note that all stormwater from the proposed development is infiltrated for the 1-100 year storm therefore there is essentially no contribution from the proposed development to any of these increases. These minor increases are due to slight changes in cover type and area within the hydrologic analysis from the pre to post development conditions and cannot be controlled by the proposed development. Any increases are minor and can be considered negligible.

**Watershed #2: (DP-2: South Wetland)**

<b>Flows (cfs)</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	1.40 cfs	12.55 cfs	22.01 cfs	44.19 cfs
Post Dev Summation	1.89 cfs	13.54 cfs	22.82 cfs	44.09 cfs
<b>Net Change</b>	<b>0.49 cfs</b>	<b>0.99 cfs</b>	<b>0.81 cfs</b>	<b>-0.10 cfs</b>

(cfs = cubic feet per second)

<b>Volume (acre-feet)</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.314 af	1.557 af	2.519 af	4.774 af
Post Dev Summation	0.362 af	1.614 af	2.553 af	4.713 af
<b>Net Change</b>	<b>0.048 af</b>	<b>0.057 af</b>	<b>0.034 af</b>	<b>-0.061 af</b>

(af = acre-feet)

<b>Wetland Elevations</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	32.02	32.62	33.09	34.01
Post Dev Summation	32.03	32.66	33.11	33.99
<b>Net Change</b>	<b>0.01'</b>	<b>0.04'</b>	<b>0.02'</b>	<b>-0.02'</b>

As with Design Point 1, the proposed improvements will have no negative impact on Design Point 2 the south wetland. The wetland design point is an isolated wetland with a large storage volume and an increase in flow or volume to the wetland will not have any negative impacts to the hydrology of the wetland system or the surrounding area. The bottom of this isolated wetland is at

approximately elevation of 32 and the lowest existing structure in the vicinity of the wetland is at elevation 39. During the 100-yr storm event the water level within the wetland is still approximately 4 plus feet below this existing structure which is a garage located on AP 57-1 Lot 125.

While the analysis shows minor increase for stormwater flow & volume is it important to note that all stormwater from the proposed development is infiltrated for the 1-100 year storm therefore there is essentially no contribution from the proposed development to any of these increases. These minor increases are due to slight changes in cover type and area within the hydrologic analysis from the pre to post development conditions and cannot be controlled by the proposed development. Any increases are minor and can be considered negligible. To the maximum extent practicable every effort has been made to mitigate impacts to the wetland while alleviating existing drainage problems caused by Town drainage.

**Watershed #3: (DP-3: Offsite)**

<b>Flows</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.00 cfs	0.00 cfs	0.01 cfs	0.18 cfs
Post Dev Summation	0.00 cfs	0.00 cfs	0.01 cfs	0.08 cfs
<b>Net Change</b>	<b>0.00 cfs</b>	<b>0.00 cfs</b>	<b>0.00 cfs</b>	<b>-0.10 cfs</b>

(cfs = cubic feet per second)

<b>Volume</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.00 af	0.002 af	0.008 af	0.030 af
Post Dev Summation	0.00 af	0.001 af	0.003 af	0.013 af
<b>Net Change</b>	<b>0.00 af</b>	<b>0.001 af</b>	<b>-0.005 af</b>	<b>-0.017 af</b>

(af = acre-feet)

This watershed shows no increase for the 1 through 100 year storms. In addition, the overall volume of stormwater which flows to the design line shows no net increase for the 1 - 100 year storms.

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## APPENDIX A: STORMWATER MANAGEMENT CHECKLIST

The first thing that applicants and designers must do before beginning a project is to make sure they are familiar with the 11 minimum standards listed in Manual Chapter Three, as all projects must meet each of the 11 standards unless otherwise exempted. Next, designers should review the available LID site planning and design strategies and BMPs in Manual Chapters Four through Seven to determine which would work best at their site. This checklist serves as a guide for engineers and designers to refer to during all stages of a project to ensure that they are meeting all applicable requirements. In addition, designers must include a completed checklist with their final stormwater management plan.

### A.1 STORMWATER SITE PLANNING, ANALYSIS, AND DESIGN

#### A.1.1 General Information

- Applicant name, mailing address, and telephone number
- Contact information for the licensed professional(s) responsible for site plans and stormwater management plan
- Common address and legal description of project site
- Vicinity map
- Existing zoning and land use at the project site
- Proposed land use – indicate if land use meets definition of a LUHPPL (see Manual Table 3-2)
- General Project Narrative
- Project type (new development or redevelopment)
- Site Disturbance  $\geq$  1 acre    or     Site Disturbance  $<$  1 acre

#### A.1.2 Existing and Proposed Mapping and Plans

- Existing and proposed mapping and plans (scale not greater than 1" = 40') with North arrow that illustrate at a minimum:
  - Existing and proposed site topography (2-foot contours required). 10-foot contours accepted for off-site areas.
  - Existing and proposed drainage area delineations and drainage flow paths, mapped according to the DEM *Guidance for Preparation of Drainage Area Maps* (included in Appendix K). Drainage area boundaries need to be complete; include off-site areas in both mapping and analyses, as applicable.

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- Perennial and intermittent streams, in addition to areas subject to storm flowage (ASSFs)
  - Mapping of predominant soils from USDA soil surveys, especially hydric soil groups as well as location of site-specific borings and/or test pits (on drainage area maps only – not site plans)
  - Boundaries of existing predominant vegetation and proposed limits of clearing
  - Location and field-verified boundaries of resource protection areas such as freshwater and coastal wetlands, lakes, ponds, coastal shoreline features and required setbacks (e.g., buffers, water supply wells, septic systems)
  - Location of floodplain and, if applicable, floodway limits and relationship of site to upstream and downstream properties and drainages
  - Location of existing and proposed roads, buildings, and other structures including limits of disturbance
  - Existing and proposed utilities (e.g., water, sewer, gas, electric) and easements
  - Location of existing and proposed conveyance systems such as grass channels, swales, and storm drains
  - Location and dimensions of channel modifications, such as bridge or culvert crossings **Not Applicable**
  - Location, size, and limits of proposed LID planning and site design techniques (type of practice, depth, area). LID techniques should be labeled clearly on the plan and a key should be provided that corresponds to a tabular description.
  - Location, size, and limits of disturbance of proposed stormwater treatment practices (type of practice, depth, area). Stormwater treatment practices (BMPs) should be labeled with numbers that correspond to Table A.2-1.
  - Soils information from test pits or borings at the location of proposed stormwater management facilities, including but not limited to soil descriptions, depth to seasonal high groundwater, depth to bedrock, and estimated hydraulic conductivity. Soils information will be based on site test pits or borings logged by a DEM-licensed Class IV soil evaluator or RI-registered P.E.

### A.1.3 Minimum Stormwater Management Standards

#### Minimum Standard 1: LID Site Planning and Design Strategies

Document specific LID site planning and design strategies and associated methods that were employed for the project in the following table. If a redevelopment project site has 40% or more existing impervious surface coverage, Minimum Standard 1: LID Site Planning and Design Strategies does not apply.

#### **Table A.1-1 LID Site Planning and Design Checklist**

The applicant must document specific LID site planning and design strategies applied for the project (see Manual Chapter Four and the *RI Community LID Guidance Manual* for more details regarding each strategy). If a particular strategy was not used, a justification and description of proposed alternatives must be provided. If a strategy is not applicable (N/A), applicants must describe why a certain method is not applicable at their site. For example, preserving wetland buffers may be not applicable for sites located outside any jurisdictional wetland buffers. In communities where conservation development or other low-impact development site planning and design processes exist, following the local community conservation development option may help a project achieve this standard.

### 1. Strategies to Avoid the Impacts

#### A. Preservation of Undisturbed Areas

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Limits of disturbance clearly marked on all construction plans.
- Mapped soils by Hydrologic Soil Group (HSG).
- Building envelopes avoid steep slopes, forest stands, riparian corridors, HSG D soils, and floodplains.
- New lots, to the extent practicable, have been kept out of freshwater and coastal wetland jurisdictional areas.
- Important natural areas (i.e., undisturbed forest, riparian corridors, and wetlands) identified and protected with permanent conservation easement.
- Percent of natural open space calculation is provided.
- Other (describe):

*Explain constraints when a strategy is applied and/or proposed alternatives in space below:*

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**Table A.1-1 LID Site Planning and Design Checklist**

**B. Preservation of Buffers and Floodplains**

Not Applied or N/A. *Use space below to explain why:*

*Select from the following:*

- Applicable vegetated buffers of coastal and freshwater wetlands and perennial and intermittent streams have been preserved, where possible.
- Limits of disturbance included on all construction plans that protect applicable buffers
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

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**C. Minimized Clearing and Grading**

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Site fingerprinting to extent needed for building footprints, construction access and safety (i.e., clearing and grading limited to 15 feet beyond building pad or 5 feet beyond road bed/shoulder).
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

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**D. Locating Sites in Less Sensitive Areas**

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- A site design process, such as conservation development, used to avoid or minimize impacts to sensitive resources such as floodplains, steep slopes, erodible soils, wetlands, hydric soils, surface waters, and their riparian buffers.
- Development located in areas with least hydrologic value (e.g., soil groups A and B)
- Development on steep slopes, grading and flattening of ridges has been avoided to the maximum extent practicable.
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

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**Table A.1-1 LID Site Planning and Design Checklist**

**E. Compact Development**

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- A site design technique (e.g., conservation development) used to concentrate development to preserve as much undisturbed open space as practicable and reduce impervious cover.
- Reduced setbacks, frontages, and right-of-way widths have been used where practicable.
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

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**F. Work with the Natural Landscape Conditions, Hydrology, and Soils**

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- Stormwater management system mimics pre-development hydrology to retain and attenuate runoff in upland areas (e.g., cuts and fills limited and BMPs distributed throughout site; trees used for interception and uptake).
- The post-development time of concentration ( $t_c$ ) should approximate pre-development  $t_c$ .
- Flow velocity in graded areas as low as practicable to avoid soil erosion (i.e., slope grade minimized). Velocities shall not exceed velocities in Appendix B, Table B-2.
- Plans show measures to prevent soil compaction in areas designated as Qualified Pervious Areas (QPAs) for better infiltration.
- Site designed to locate buildings, roadways and parking to minimize grading (cut and fill quantities)
- Other (describe):

*Explain constraints and/or proposed alternatives in space below:*

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**2. Strategies to Reduce the Impacts**

**A. Reduce Impervious Cover**

Not Applied or N/A. *Use space below to explain why:*

*Select from the following list:*

- |   |  |   |
|---|--|---|
| <input type="checkbox"/> Reduced roadway widths | <input type="checkbox"/> Reduce driveway areas | <input type="checkbox"/> Reduced building footprint |
| <input type="checkbox"/> Reduced sidewalk area  | <input type="checkbox"/> Reduced cul-de-sacs   | <input type="checkbox"/> Reduced parking lot area   |
| <input type="checkbox"/> Other (describe):      |  |   |

*Explain constraints and/or proposed alternatives in space below:*

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## Table A.1-1 LID Site Planning and Design Checklist

### 3. Strategies to Manage the Impacts

#### A. Disconnecting Impervious Area

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Impervious surfaces have been disconnected to QPAs to the extent possible.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

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#### B. Mitigation of Runoff at the point of generation

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Roof runoff has been directed to a QPA, such as a yard or vegetated area.
- Roof runoff has been directed to a lower impact practice such as a rain barrel or cistern.
- A green roof has been designed to reduce runoff.
- Small-scale BMPs applied at source.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

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#### C. Stream/Wetland Restoration

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Historic drainage patterns have been restored by removing closed drainage systems and/or restoring degraded stream channels and/or wetlands.
- Removal of invasive species.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

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**Table A.1-1 LID Site Planning and Design Checklist**

**D. Reforestation**

Not Applied or N/A. Use space below to explain why:

Select from the following list:

- Low maintenance, native vegetation has been proposed.
- Trees are proposed to be planted or conserved to reduce runoff volume, increase nutrient uptake, and provide shading and habitat.
- Other (describe):

Explain constraints and/or proposed alternatives in space below:

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\_\_\_\_\_

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**Table A.1-2 LID Stormwater Credit**

Description of stormwater credit, if applicable. Label qualifying pervious areas (QPAs) on the site map, and document that all stormwater credit requirements listed in Manual Section 4.6 are met. For each QPA, note the impervious area (in acres) that drains to it, and place a check in the appropriate box to demonstrate that it meets the following criteria:

	QPA 1	QPA 2	QPA 3	QPA 4
<b>Impervious Area Draining to QPA (acres)</b>				
<b>QPA Criteria</b>	<b>Criterion Met?</b>			
Construction vehicles shall not be allowed to drive over the QPA during construction. If the area becomes compacted, soil must be suitably amended, tilled, and revegetated once construction is complete to restore infiltration capacity.				
QPA infiltration area is at least 10ft from building foundation.				
Contributing impervious area does not exceed 1,000 ft <sup>2</sup> .				
Length of QPA in feet is equal to or greater than the contributing rooftop area in ft <sup>2</sup> divided by 13.3. The maximum contributing flow path from non-rooftop impervious areas is 75ft.				
QPA does not overlap any other QPA.				

	QPA 1	QPA 2	QPA 3	QPA 4
Lot is greater than 6,000 ft <sup>2</sup> .				
The slope of the QPA is less than or equal to 5.0%.				
Disconnected downspouts draining to QPA are at least 10 feet away from the nearest impervious surface.				
Runoff from rooftops without gutters / downspouts that drains to QPA flows away from the structure as low-velocity sheet flow.				
QPA is located on Hydrologic Soil Group (HSG) A or B soils.				
Depth to groundwater within QPA is 18 inches or greater (has been confirmed by evaluation by a DEM-licensed Class IV soil evaluator or RI-registered PE).				
Runoff is directed over soft shoulders, through curb cuts or level spreaders to QPA.				
Measures are employed at discharge point to prevent erosion and promote sheet flow.				
The flow path through the QPA complies with the setback requirements for structural infiltration BMPs.				
Rooftop runoff draining to QPA from LUHPPLs does not commingle with runoff from any paved surface or areas that may generate higher pollutant loads				
Inspection and maintenance of the QPA is included in the site Operation and Maintenance Plan (Minimum Standard 11).				
The QPA is owned or controlled by the property owner				
There is no history of groundwater seepage and / or basement flooding on the property				

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 **Minimum Standard 2: Groundwater Recharge**

Demonstrate that groundwater recharge criteria for the site have been met. Include:

- The required recharge volume ( $Re_v$ ) in acre-feet (See Manual Section 3.3.2)
- LID Stormwater Credit from Table A.1-2 to be applied to recharge requirement, if applicable, with the following calculations (See Manual Section 4.6.1):
  - the recharge area ( $Re_a$ ) in acres for the site
  - the site impervious area draining to QPAs
  - the new  $Re_v$  requirement
- Specific BMPs from Table A.2-1 that will be used to meet the recharge requirement. *Note: Only BMPs listed in Manual Table 3-5, List of BMPs Acceptable for Recharge may be used to meet the recharge requirement.*

 **Minimum Standard 3: Water Quality**

Demonstrate that the water quality criteria for the site have been met. Include:

- Required water quality volume ( $WQ_v$ ) in acre-feet or  $ft^3$  (see Manual Section 3.3.3).
- LID Stormwater Credit from Table A.1-2 to be applied to water quality requirement, if applicable, with the following calculations (see Manual Section 4.6.1):
  - the new impervious area (in acres) for the site
  - the new  $WQ_v$  in acre-feet or  $ft^3$
- Specific BMPs from Table A.2-1 that will be used to meet water quality volume requirement. *Note: Only BMPs listed in Manual Table 3-6, Acceptable BMPs for Water Quality Treatment may be used to meet the water quality requirement.*
- Specify any additional pollutant-specific requirements and/or pollutant removal efficiencies applicable to the site as the result of SAMP, TMDL, or other watershed-specific requirements.

 **Minimum Standard 4: Conveyance and Natural Channel Protection**

Demonstrate that the conveyance and natural channel protection criteria for the site have been met. Include:

- Justification for channel protection criterion waiver, if applicable (see Manual Section 3.3.4).
- Required channel protection volume ( $CP_v$ ) (see Manual Section 3.3.4).
- Specific BMPs from Table A.2-1 that will be used to meet the channel protection requirement. Hydrologic and hydraulic site evaluation as described

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in Manual Section 3.3.4 should be included in Table A.2-1 for each channel protection BMP.

**Minimum Standard 5: Overbank Flood Protection**

Demonstrate that the overbank flood protection criteria for the site have been met. Include:

- Justification for overbank flood protection criterion waiver, if applicable (see Manual Section 3.3.5).
- Pre- and post-development peak discharge rates.
- Specific BMPs from Table A.2-1 that will be used to meet the overbank flood protection requirement. Hydrologic and hydraulic site evaluation as described in Manual Section 3.3.5 should be included in Table A.2-1 for each overbank flood protection BMP.

**Minimum Standard 6: Redevelopment and Infill Projects**

Determine if project meets the criteria for redevelopment and/or infill projects. If applicable, include:

- Description of site that meets redevelopment/infill definition.
- Approved off-site location within watershed where stormwater management requirements will be met, if applicable (see Manual Section 3.2.6).
- Not Applicable.

**Minimum Standard 7: See page A-15**

**Minimum Standard 8: LUHPPLs**

Demonstrate that the project meets the criteria for LUHPPLs, if applicable. Include:

- Description of any land use activities considered stormwater LUHPPL (see Manual Table 3-2).
- Specific BMPs listed in Table A.2-1 that receive stormwater from LUHPPL drainage areas. These BMP types must be listed in Manual Table 3-3, "Acceptable BMPs for Use at LUHPPLs."
- Additional BMPs, if any, that meet RIPDES MSGP requirements.
- Not Applicable.

**Minimum Standard 9: Illicit Discharges**

Applicant asserts that no illicit discharges exist or are proposed to the stormwater



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- Hydrologic and hydraulic analysis, including:
    - Study design/analysis points. The existing and proposed condition analyses need to compare the same overall area; thus, common study points are needed for both existing and proposed conditions.
    - Existing condition analysis for drainage area boundaries, curve numbers, times of concentration, runoff rates, volumes, velocities, and water surface elevations showing methodologies used and supporting calculations.
    - Proposed condition analysis for drainage area boundaries, curve numbers, times of concentration, runoff rates, volumes, velocities, water surface elevations, and routing showing the methodologies used and supporting calculations.
    - Downstream Analysis, where required (see Manual Section 3.3.6).
    - Final sizing calculations for structural stormwater BMPs including, contributing drainage area, storage, and outlet configuration.
    - Stage-discharge or outlet rating curves and inflow and outflow hydrographs for storage facilities (e.g., detention, retention, or infiltration facilities).
    - Dam breach analysis, where necessary, for earthen embankments over six (6) feet in height, or a capacity of 15 acre-feet or more, and that is a significant or high hazard dam.
  - Drainage Area Maps prepared in accordance with DEM's *Guidance for Preparation of Drainage Area Maps* (included in Appendix K).
  - Representative cross-section and profile drawings, notes and details of structural stormwater management practices and conveyances (i.e., storm drains, open channels, swales, etc.), which include:
    - Locations, cross sections, and profiles of all streams and drainage swales and their method of stabilization.
    - Existing and proposed structural elevations (e.g., invert of pipes, manholes, etc.).
    - Design water surface elevations.
    - Structural details of outlet structures, embankments, spillways, stilling basins, grade control structures, conveyance channels, etc.
    - Logs of borings and/or test pit investigations along with supporting soils/geotechnical report.
  - Planting plans for structural stormwater BMPs, including:
    - Species, size, planting methods, and maintenance requirements of proposed planting.
  - Structural calculations, where necessary.
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- Applicable construction specifications.
  - Identification of all anticipated applicable local and State permits.
  - Identification of all anticipated legal agreements related to stormwater (e.g., off-site easements, deed restrictions, and covenants).

### **A.3 EROSION AND SEDIMENT CONTROL (ESC) AND STORMWATER POLLUTION PREVENTION PLANS (SWPPP)**

#### **A.3.1 All Projects**

##### **Minimum Standard 10: Construction Erosion and Sedimentation Control**

All projects must demonstrate that ESC practices will be used during the construction phase and land disturbing activities. Include:

- Description of temporary sediment trapping and conveyance practices, including sizing calculations and method of temporary and permanent stabilization (see Manual Section 3.2.10 and *the Rhode Island Soil Erosion and Sediment Control Handbook*).
- Description of sequence of construction. Activities should be phased to avoid compacting soil during construction, particularly in the location of infiltrating stormwater practices and qualifying pervious areas for stormwater credits.
- Location of construction staging and material stockpiling areas.

#### **A.3.2 Construction Projects Disturbing $\geq$ 1 Acre**

Demonstrate the project meets the criteria of the Rhode Island Pollutant Discharge Elimination System (RIPDES) General Permit for Stormwater Discharge Associated with Construction Activity (RIPDES Construction General Permit). A **Stormwater Pollution Prevention Plan (SWPPP)** must be kept on-site during the active construction phase of the project. Include:

- Estimates of the total area of the site and the total area of the site that is expected to undergo soil disturbance.
- A determination regarding whether or not the site is within or directly discharges to a Natural Heritage Area (NHA) or has discharge related activities that potentially affect a listed or proposed to be listed endangered or threatened species or its critical habitat. To determine if your site is within or directly discharges to an NHA complete the following steps:
  1. Go to <http://www.dem.ri.gov/maps/index.htm>
  2. Click on the "Environmental Resource Map" link.
  3. Open the "Regulatory Overlays" Group/Folder listed under the LAYERS heading.
  4. Select Natural Heritage Area – Rare Species as a visible layer from the menu and press the "Refresh Map" button (\*Note: Menu may not

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list all layers if scale factor is too large. If this is the case, then use the “zoom in” feature until all layers are listed in menu).

5. Select any other layer that may be useful in determining the location of the construction activity relative to a NHA (such as roads).
6. Check the appropriate box to indicate whether or not your site is located within or directly discharges to an NHA or has discharge related activities that potentially affect a listed or proposed to be listed endangered or threatened species or its critical habitat.

Yes or  No

If Yes, your project requires an additional review and approval by the DEM. In order to begin this process, the Stormwater Management Plan must include a specific request for NHA review and approval of the proposed project.

- Description of potential sources of pollution that may reasonably be expected to affect the quality of stormwater discharges from the site, such as exposed, unstabilized soil stockpiles.
- Existing data on the quality of any known discharges from the site if available.
- List of sources of allowable non-stormwater discharges, as described in Part I.B.2 of the 2008 RIPDES Construction General Permit (except flows from fire fighting activities). If allowable non-stormwater discharges are occurring at the site, then the SWPPP shall identify how such discharges shall be visually observed and recorded in accordance with the weekly inspection procedures contained in the 2008 RIPDES Construction General Permit.
- Description of how wastes generated at the site will be disposed of in a manner consistent with State Law and/or regulations.
- Spill Prevention and Response Procedure which meets the following minimum requirements: Areas where potential spills can occur, and their accompanying drainage points, shall be identified clearly in the Stormwater Pollution Prevention Plan (SWPPP). The potential for spills to enter the stormwater drainage system shall be eliminated wherever feasible. Where appropriate, specific material handling procedures, storage requirements, and procedures for cleaning up spills shall be identified in the SWPPP and made available to the appropriate personnel. The necessary equipment to implement a cleanup must also be made available to personnel.
- Description of how construction waste is managed and properly disposed of at the end of each working day and how the operator will minimize the exposure of construction debris to precipitation, including, but not limited to, insulation, wiring, paints and paint cans, solvents, wall board, etc.
- Graveled access entrance and exit drives and parking areas to reduce the tracking of sediment onto public and private roads in accordance with the Rhode Island Soil Erosion and Sediment Control Handbook, as amended.
- Appropriate vegetative practices on all disturbed areas as soon as possible,

but not more than fourteen (14) days after the construction activity in that area has temporarily or permanently ceased, unless the activity is to resume within twenty one (21) days.

- Provisions for all stormwater control measures, disturbed areas, areas used for the storage of materials that are exposed to precipitation (including unstabilized soil stockpiles), discharge locations, and locations where vehicles enter or exit the site to be inspected by or under the supervision of the applicant at least once every seven (7) calendar days and within twenty-four (24) hours after any storm event which generates at least 0.25 inches of rainfall per twenty four (24) hour period and/or after a significant amount of runoff.
- Procedures for maintaining inspection reports which summarize the inspection and corrective actions taken in accordance with Part II.B and C of the 2008 RIPDES Construction General Permit. These inspection reports and associated records must be retained for five (5) years from the date that the site has undergone final stabilization.

#### **A.4 OPERATION & MAINTENANCE AND POLLUTION PREVENTION PLANS**

##### **Minimum Standard 7: Pollution Prevention**

Demonstrate that the project meets the criteria for pollution prevention.

Include:

- Appendix G Pollution Prevention and Source Controls
- If applicable, a RIPDES Industrial Stormwater Pollution Prevention Plan as required by the Multi-Sector General Permit for Stormwater Discharge Associated with Industrial Activity.

##### **Minimum Standard 11: Stormwater Management System Operation and Maintenance (O&M) See Appendix E for guidance**

Provide a stormwater management system operation and maintenance plan that at a minimum includes:

- Name, address, and phone number of responsible parties for maintenance
- 8-1/2 X 11 inch plan depicting the locations of all BMPs requiring O&M as numbered in Table A.2-1.
- Description of annual maintenance tasks
- Description of applicable easements
- Description of funding source
- Minimum vegetative cover requirements
- Access and safety issues

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## 1.0 Project Description

The purpose of this report is to specify a “Storm Water Management System” to be implemented in the construction and maintenance of the Wilson & Tarn Street Development in South Kingstown, RI.

The site totals 2.91+/- acres located on Assessor’s Plat 57-1 Lots 121, 122 & 146 in South Kingstown, Rhode Island. Additionally, the Public ROW area which will be developed 0.66 +/- acres to provide access to the proposed development. The site is located off Oak Street, near the intersection of Old Tower Hill Road to the south, School Street to the north, and Cleveland Street to the west. The proposed development will include 8 new residential lots and the improvement of Wilson Street and Tarn Street, which are currently unimproved platted roadways within the subdivision. These two unimproved streets will be converted into one improved street which will be Tarn Street. 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.

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 consist of water quality infiltration ponds and an underground infiltration system. The site has been designed to meet the RIDEM Stormwater Design and Installations Standards Manual.

## 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
HkC	Hinckley gravelly sandy loam, rolling	A
MU	Merrimac-Urban land complex	A
SwA	Swansea Muck	B/D

The onsite soils contain Urban Land which does not offer a Hydrologic Group. Soils surrounding the site include MU – Merrimac Urban Land Complex and SwA –Swansea muck. MU is Hydrologic Group A soil and SwA is Hydrologic Group B/D. Onsite test holes indicated gravelly cobble, silt loam, coarse sand and very fine sand onsite. Hydrologic Group A has been used for modeling MU Soils. All SwA soils have been modeled ad D soils.

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

### 2.2 EXISTING SITE CONDITIONS

Currently the site is entirely wooded, with undulating topography ranging from elevation 44 at the high points, to elevation 32 at the low points. There is a small portion of a forested wetland, less than 3

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acres, within the subject property at the southwest corner. There is an existing low area located in the north of the site which extends offsite to the north. The site is bordered by residential lots on all sides of the subdivision

A large portion of stormwater from the site flows to the forested wetland, less than 3 acres, to the south west of the subject property. Also flowing to the existing wetland is the neighborhood & roadways located to the west of the site. A smaller portion of onsite stormwater flows to a low point in the north portion of the subject property. Also flowing to this north low point is drainage from the neighborhood located to the northwest of the subject property and to the north, the existing section of Wilson Street. Stormwater from the remaining portions of the site flows overland to town drainage systems within Oak Street to the east, Cleveland Street to the west, and School Street to the north.

### **2.3 POST SITE CONDITIONS**

The proposed development will include 11 new units. The site is to be serviced by public water and sewer. Rooftop areas for the homes will be collected by roof leader systems and directed to flow direct into the infiltration ponds or overland towards the roadway & grassed swales. The road and driveway areas will be directed to drain towards the drainage swales located along the roadway. These will flow to the two infiltration ponds designed to fully infiltrate the 1-100 year storm events. Water quality treatment is provided from the grassed swales and the water quality infiltration areas within the infiltration ponds. The BMPs are designed to meet the standards of the Rhode Island Stormwater Design and Installation Standards manual. In the area to the north an existing ponding area has been modified to address nuisance drainage issues from the neighboring areas. These areas are the western neighborhoods & the existing portions of Wilson Street to the north in addition to the north low point which infiltrates stormwater in existing conditions.

### **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) dated December 2010. 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. A groundwater recharge analysis has only been included for the proposed development.

Groundwater recharge is determined from the following equation:

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

Where:

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Re<sub>v</sub>=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

Watershed	HSG	F	I (Acres)	Re <sub>v</sub>	Re <sub>v</sub> Provided
2	A	0.60	0.891	0.045	0.073

\*Area includes pervious pavement areas.

Recharge volume for watershed 2 is provided through the water quality infiltration ponds.

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 1.2" 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 from proposed development areas is treated through an approved BMP before being discharged. This site has been designed to use water quality infiltration ponds with grass filter strips and grassed swales for pretreatment. The clean rooftop runoff is directed to overland flow to either the grassed swale or the water quality infiltration ponds. See Appendix A3.2 for the 1.2" storm event which demonstrates the sites ability to treat & infiltrate the water quality volume. 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.

The water quality infiltration ponds fully infiltrate the water quality storm event and utilizes an eighteen inch deep sand filter layer composed of ASTM C33 sand for treatment. Grassed filter strips and or grassed swales are used for pretreatment of stormwater. The roadway has been reduced to minimum widths in order to fit the largest practical grass filter strip. The filter strip ranges in width from 2' to 10'.

### 3.4 Minimum Standard 4: Conveyance and Natural Channel Protection

#### Drainage Network Design Parameters:

##### A. PIPES

- All drainage pipes are HDPE or equivalent unless otherwise noted.
- Manning's coefficient = 0.011 for HDPE Pipe
- Diameters & lengths as specified

- The 100-year design storm is utilized for the drainage pipe design to ensure that the drainage system contains and channels water to the BMP areas as shown on the plans.
- The rational method has been used for the closed drainage system.

**Channel Protection Volume:**

The post development peak discharge from the facility without attenuation is less than 2 cfs for the 1-year, 24-hour Type III design storm event and therefore the CP<sub>V</sub> criterion is waived as per Section 3.3.4 in the RISDISM.

**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.

The drainage system has been designed to mitigate all stormwater flows for the 1, 10, 25 and 100 year storm events. The emergency outlets have been sized to handle the 100 year storm event.

Infiltration Rates

A double ring infiltrometer test was conducted at three of the soil evaluation test holes (TH-2, TH-4 & TH-6). This was done to evaluate if a higher infiltration rate of the in situ soils may be used for the proposed infiltration ponds. TH-2 was closest to the two designed infiltration ponds D & F. At TH-2 the tested infiltration rate was found to be 32.4 in/hr and per appendix H a factor of safety of 2 was applied and an end infiltration rate of 16.2 in/hr has been used for infiltration ponds D & F. The double ring infiltrometer test results have been included in Appendix A2.1.

For the northern existing ponding area, the pre development infiltration rate modeled was 1.02 in/hr to account for the existing B horizon soils. In the post development conditions an infiltration rate of 8.27 in/hr was applied to account for the excavation of the existing ponding area on Lot 1 down to the existing C horizon sandy soils. This exfiltration rate is only applied to the lowest elevation of the expanded area, elevation 32. The double ring infiltrometer testing for TH 4 & 6 yielded results much higher than 8.27 in/hr but to keep the model conservative the RIDEM sandy soil infiltration rate of 8.27 in/hr was applied.

**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

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### 3.5.3 Design Point Breakdown

The site is analyzed as 3 watershed areas, the existing wetland complex, the low point in the north area of the site, and an eastern offsite area. In the pre development stage there are ten subcatchments. In the post development stage there are 14 subcatchments. A description of each watershed and associated subcatchments are summarized as follows, HydroCAD number have been shown in parenthesis:

#### Design Point #1 – Existing Ponding North:

Watershed #1 flows to Design Point- 1 (DP-1) which is the Existing North Ponding area. This area is located towards the northeastern part of the site. The Existing North Ponding Area has been modeled in HydroCAD as a pond node. An infiltration rate of 1.02 in/hr has been used for this analysis. Existing soils have a significantly higher infiltration rate, however to be conservative the lower rate has been used. This elevations of the existing ponding area vary greatly at the bottom causing small areas where stormwater can pond. To be conservative and to simplify the model, the summation of the bottom area has been used in the calculations for all of the ponding areas. Each ponding area has not been modeled. This means that during smaller storm events there is greater ponding in real world conditions than the model shows. This is because the stormwater needs to pond up to a higher elevation before reaching the next ponding area.

In pre-development conditions there are four subcatchments to Design Point 1.

Pre-9 (9) consists of the wooded area from the site that discharges to DP-1. This area is completely wooded.

Pre-10 (10) is located northwest of the site. Groundcover types associated with this sub catchment are grass, woods and small areas of impervious from existing residential lots and roads. Stormwater runoff is mainly collected on Cleveland Street via existing drainage network, where it is transported directly to the Existing Ponding North DP-1 (13).

Pre-11 (11) contains the offsite area to the northeast of the site. Groundcover types associated with this sub catchment are woods, grass, and areas of impervious from existing residential lots and roadways. The south eastern boundary of Pre-11 is the limit of disturbance for the project. This subcatchment in the predevelopment is mostly developed. Stormwater runoff travels overland via sheetflow where it flows directly to the Existing Ponding North DP-1 (13).

Pre-12 (12) contains the northeastern part of the site. Groundcover types associated with this sub catchment are grass and areas of impervious from existing residential lots and driveways. This subcatchment in the predevelopment is developed with small sections developed as single residential lots. Stormwater runoff is collected on Wilson Street via existing drainage network, where it is transported directly to the Existing Ponding North DP-1 (13).

In post development conditions there are three subcatchments to Design Line 1.

Post-100 (100) contains the northwestern part of the site. Groundcover types associated with this sub catchment are grass, woods and small areas of impervious from existing residential lots and roads. Stormwater runoff is mainly collected on Cleveland Street via existing drainage network, where it is flows to the Expanded Existing Ponding North DP-1 (121).

Post-110 (110) contains the northeastern part of the site and grassed lawn areas from Lot 2. Groundcover types associated with this sub catchment are woods, grass, and areas of impervious from existing residential lots and roadways. Stormwater runoff travels overland via sheet flow where it flows directly to the Expanded Existing Ponding North DP-1 (121).

Post-120 (120) contains the existing portion of Wilson St. Groundcover types associated with this sub catchment are grass and areas of impervious from existing residential lots and driveways. Stormwater runoff is collected on Wilson Street via existing drainage network, where it will continue to discharge to Expanded Existing Ponding North DP-1 (121) as it does today.

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

	Area (acres)	CN	Tc (min)
Pre-9 (9)	1.377	30	6.0
Pre-10 (10)	4.655	54	23.5
Pre-11 (11)	2.264	46	17.4
Pre-12 (12)	0.381	75	6.0
Post-100 (100)	4.655	54	23.5
Post-110 (110)	2.675	45	17.4
Post-120 (120)	0.381	75	6.0

Design Line #2:

Watershed #2 flows to Design Point-2 (DP-2) which is the existing South Wetland in the southern area of the site. This watershed contains the entire southern half of the site. The wetland has been modeled in HydroCAD as a pond node. An infiltration rate of 1.02 in/hr has been used for this analysis. Existing soils have a significantly higher infiltration rate, however to be conservative the lower rate has been used.

In pre-development conditions there are four subcatchments to Design Line 2. Pre-20 (20) contains the central western part of the site. Groundcover types associated with the sub catchment are grass, woods, and impervious area from existing residential lots and roadways. This subcatchment in the predevelopment is developed. Stormwater runoff is mainly collected on Hazard Street and Cleveland Street via existing drainage network, where it is transported directly to the South Wetland DP-2 (24).

Pre-21 (21) contains the area southwest of the site and contains mostly offsite areas. Groundcover types associated with the sub catchment are grass, woods, and impervious area from existing residential lots and roadways. Stormwater runoff is mainly collected on Hendrick Street and Cleveland Street via existing drainage network, where it is discharged to the South Wetland DP-2 (24).

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Pre-22 (22) contains the central southern part of the site. Groundcover types associated with the sub catchment are grass, woods, and impervious area from existing residential lots and driveways. This subcatchment in the predevelopment is mostly undeveloped, with some developed existing residential lots. Stormwater runoff flows overland via sheet flow, where it travels to the South Wetland DP-2 (24).

Pre-23 (23) contains the southeastern part of the site. Groundcover types associated with the sub catchment are grass, woods, and impervious area from existing residential lots and roadways. This subcatchment in the predevelopment is developed. Stormwater runoff is mainly collected on Oak Street via existing drainage network, where it is discharged to the South Wetland DP-2 (24).

In post development conditions, there are eleven subcatchments eventually discharging to Design Point 2.

Post-200 (200) contains the central western part of the site. Groundcover types associated with the sub catchment are grass, woods, and impervious area from existing residential lots and roadways. Stormwater runoff is mainly collected on Hazard Street and Cleveland Street via existing drainage network, where it is discharged to the South Wetland DP-2 (283). Post-200 is the same as Pre-20.

Post-210 (210) contains the southwestern part of the site. Groundcover types associated with the sub catchment are grass, woods, and impervious area from existing residential lots and roadways. Stormwater runoff is mainly collected on Hendrick Street and Cleveland Street via existing drainage network, where it is discharged to the South Wetland DP-2 (283). Post-210 is the same as Pre-21

Post-220 (220) contains the central southern part of the site. Groundcover types associated with the sub catchment are grass, woods, and impervious area from existing residential lots and driveways. Stormwater runoff flows overland via sheet flow, where it travels to the South Wetland DP-2 (283).

Post-230 (230) contains the southeastern part of the site. Groundcover types associated with the sub catchment are grass, woods, and impervious area from existing residential lots and roadways. This subcatchment in the predevelopment is developed. Stormwater runoff is mainly collected on Oak Street via existing drainage network, where it is discharged to the South Wetland DP-2 (283). Post-230 is the same as Pre-23.

Post-240 (240) contains the southeastern part of the site. Groundcover types associated with the sub catchment are grass and impervious areas from proposed residential lots, driveways and roadway. Stormwater flows overland to Infiltration Pond D (252.2).

Post-250 (250) consists of stormwater from the proposed Tarn Street and driveway runoff. Stormwater flows through a swale to a catch basin/pipe network and is infiltrated with Pond D (252.2).

Post-260 (260) contains stormwater runoff from the proposed homes along the north-south proposed Tarn Street. Stormwater is infiltrated within Pond F after being conveyed through a swale (261).

Node (263) has been provides to demonstrate that infiltration ponds D & F (252.2 & 262.2) fully infiltrate the 1-100 year storm event.

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

	Area (acres)	CN	Tc (min)
Pre-20 (20)	3.705	59	18.8
Pre-21 (21)	3.416	63	23.5
Pre-22 (22)	7.847	56	14.6
Pre-23 (23)	1.165	62	6.0
Post-200 (200)	3.704	59	18.8
Post-210 (210)	3.416	63	23.5
Post-220 (220)	6.461	61	12.3
Post-230 (230)	1.166	62	6.0
Post-240 (240)	0.965	51	16.1
Post-250 (250)	0.410	60	6.0
Post-260 (260)	1.210	63	6.0

Design Line #3:

Watershed #3 flows to Design Line- 3 (DL-3) which is stormwater that flows offsite towards Oak Street. This watershed consists of a small portion of the eastern side of the site.

In pre-development conditions there are two subcatchments to DL-3. Pre-30 (30) contains a small portion of the eastern side of the site. Groundcover types associated with the sub catchment are grass, woods and a small area of impervious from an existing shed. This subcatchment in the predevelopment is undeveloped with the exception of the small portion that is developed as a residential lot. Stormwater runoff travels overland via sheet flow to and offsite area.

Pre-31 (31) contains a small portion of the eastern side of the site. Groundcover types associated with the sub catchment are woods and a small area of impervious from an existing driveway. This subcatchment in the predevelopment is mostly undeveloped with the exception of the small portion that is developed as a residential lot. Stormwater runoff travels overland via sheet flow to and offsite area.

In post development conditions, there is one subcatchment to Design Line 3.

Post-300 (300) contains a small portion of the eastern side of the site. Groundcover types associated with the sub catchment are grass, woods and a small area of impervious from an existing shed. Stormwater runoff travels overland via sheet flow to and offsite area.

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

	Area (acres)	CN	Tc (min)
Pre-30 (30)	0.233	33	6.0
Pre-31 (31)	0.174	35	6.0
Post-300 (300)	0.174	34	6.0

### 3.5.4 Q<sub>p</sub> BMP Calculations

#### Outlet Protection

The system has been designed to safely convey the 100 year storm event. Flow discharged up to and including the 100 year storm is non erosive at less than 3 feet per second.

### 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 2.72 acres. The site does not meet the size requirement for a downstream analysis. 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 a decrease in the rate of runoff for all storms included in the analysis.

#### Pre Development Flows vs. Post Development Flows Mitigated

##### Watershed #1: (DP-1: Existing Ponding North)

<b>Flows</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.35 cfs	3.08 cfs	6.23 cfs	14.48 cfs
Post Dev Summation	0.35 cfs	3.06 cfs	6.28 cfs	14.58 cfs
<b>Net Change</b>	<b>0.00 cfs</b>	<b>-0.02 cfs</b>	<b>0.51 cfs</b>	<b>0.10 cfs</b>

(cfs = cubic feet per second)

<b>Volume</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.078 af	0.500 af	0.868 af	1.806 af
Post Dev Summation	0.077 af	0.505 af	0.875 af	1.792 af
<b>Net Change</b>	<b>-0.001 af</b>	<b>0.005 af</b>	<b>0.007 af</b>	<b>-0.014 af</b>

(af = acre-feet)

<b>Existing North Ponding Area Elevations</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	34.13	35.07	35.51	36.25
Post Dev Summation	32.00	32.64	33.92	36.06
<b>Net Change</b>	<b>-2.13'</b>	<b>-2.43'</b>	<b>-1.59'</b>	<b>-0.19'</b>

The proposed development will have no significant impacts and will improve the nuisance flooding within the north ponding area by expanding the existing ponding area. This is done by lowering the bottom to elevation 32 and improving the infiltration rate by exposing the sandy soils with the Lot 1 expanded ponding area. While the analysis shows minor increase for stormwater flow & volume it is important to note that all stormwater from the proposed development is infiltrated for the 1-100

year storm therefore there is essentially no contribution from the proposed development to any of these increases. These minor increases are due to slight changes in cover type and area within the hydrologic analysis from the pre to post development conditions and cannot be controlled by the proposed development. Any increases are minor and can be considered negligible.

**Watershed #2: (DP-2: South Wetland)**

<b>Flows (cfs)</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	1.40 cfs	12.55 cfs	22.01 cfs	44.19 cfs
Post Dev Summation	1.89 cfs	13.54 cfs	22.82 cfs	44.09 cfs
<b>Net Change</b>	<b>0.49 cfs</b>	<b>0.99 cfs</b>	<b>0.81 cfs</b>	<b>-0.10 cfs</b>

(cfs = cubic feet per second)

<b>Volume (acre-feet)</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.314 af	1.557 af	2.519 af	4.774 af
Post Dev Summation	0.362 af	1.614 af	2.553 af	4.713 af
<b>Net Change</b>	<b>0.048 af</b>	<b>0.057 af</b>	<b>0.034 af</b>	<b>-0.061 af</b>

(af = acre-feet)

<b>Wetland Elevations</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	32.02	32.62	33.09	34.01
Post Dev Summation	32.03	32.66	33.11	33.99
<b>Net Change</b>	<b>0.01'</b>	<b>0.04'</b>	<b>0.02'</b>	<b>-0.02'</b>

As with Design Point 1, the proposed improvements will have no negative impact on Design Point 2 the south wetland. The wetland design point is an isolated wetland with a large storage volume and an increase in flow or volume to the wetland will not have any negative impacts to the hydrology of the wetland system or the surrounding area. The bottom of this isolated wetland is at approximately elevation of 32 and the lowest existing structure in the vicinity of the wetland is at

elevation 39. During the 100-yr storm event the water level within the wetland is still approximately 4 plus feet below this existing structure which is a garage located on AP 57-1 Lot 125.

While the analysis shows minor increase for stormwater flow & volume is it important to note that all stormwater from the proposed development is infiltrated for the 1-100 year storm therefore there is essentially no contribution from the proposed development to any of these increases. These minor increases are due to slight changes in cover type and area within the hydrologic analysis from the pre to post development conditions and cannot be controlled by the proposed development. Any increases are minor and can be considered negligible. To the maximum extent practicable every effort has been made to mitigate impacts to the wetland while alleviating existing drainage problems caused by Town drainage.

**Watershed #3: (DP-3: Offsite)**

<b>Flows</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.00 cfs	0.00 cfs	0.01 cfs	0.18 cfs
Post Dev Summation	0.00 cfs	0.00 cfs	0.01 cfs	0.08 cfs
<b>Net Change</b>	<b>0.00 cfs</b>	<b>0.00 cfs</b>	<b>0.00 cfs</b>	<b>-0.10 cfs</b>

(cfs = cubic feet per second)

<b>Volume</b>				
Conditions	1-Year	10-Year	25-Year	100-Year
Pre Dev Summation	0.00 af	0.002 af	0.008 af	0.030 af
Post Dev Summation	0.00 af	0.001 af	0.003 af	0.013 af
<b>Net Change</b>	<b>0.00 af</b>	<b>0.001 af</b>	<b>-0.005 af</b>	<b>-0.017 af</b>

(af = acre-feet)

This watershed shows no increase for the 1 through 100 year storms. In addition, the overall volume of stormwater which flows to the design line shows no net increase for the 1 - 100 year storms.

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### **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 (LUHPPLs)**

The site is not considered a LUHPPL.

### **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 Erosion and Sedimentation Control**

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.

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## Appendix A

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## A2.1 Soil Evaluations & Double Ring Infiltrometer Test Results



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: Kenneth Bouvier
Property Location: Oak Street (AP 57-1 Lot 121, 122, &146) South Kingstown, RI
Date of Test Hole: May 1, 2015
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 50's Shaded: Yes No 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 main sections for TH 1 and TH 2 horizons with multiple rows of soil profile data.

TH 1 Soil Class Eolian/Outwash Total Depth 108" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth 102" SHWT 84" (og)
TH 2 Soil Class Eolian/Outwash Total Depth 108" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth 108" SHWT 84" (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: Kenneth Bouvier
Property Location: Oak Street (AP 57-1 Lot 121, 122, &146) South Kingstown, RI
Date of Test Hole: May 1, 2015
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 50's Shaded: Yes No 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 Eolian/Outwash Total Depth 108" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth 108" SHWT 96" (og)
TH 4 Soil Class Eolian/Outwash Total Depth 108" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth 108" SHWT 96" (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: Kenneth Bouvier
Property Location: Oak Street (AP 57-1 Lot 121, 122, &146) South Kingstown, RI
Date of Test Hole: May 1, 2015
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 50's Shaded: Yes No 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. Rows include horizons C1, C2, C3, C4, and TH 6.

TH 5 Soil Class Eolian/Outwash Total Depth 120" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth 80" SHWT 72" (og)
TH 6 Soil Class Eolian/Outwash Total Depth 120" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth 90" SHWT 72" (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: Kenneth Bouvier
Property Location: Oak Street (AP 57-1 Lot 121, 122, &146) South Kingstown, RI
Date of Test Hole: May 1, 2015
Soil Evaluator: Chris Sutter License Number: D-4077
Weather: Clear, 50's Shaded: Yes No 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 7 and TH 8 horizons.

TH 7 Soil Class Eolian/Outwash Total Depth 108" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth 108" SHWT 96" (og)

TH 8 Soil Class Eolian/Outwash Total Depth 108" Impervious/Limiting Layer Depth NA (og) GW Seepage Depth 108" SHWT 96" (og)

Comments:

## Double Ring Infiltrometer Field Data Sheet

Project Name: <i>OAK STREET</i>	Date: <i>8/20/18</i>		Diameter	H2O depth
Test Location: <i>AT TH #2</i>			Inner Ring	<i>12"</i>
Water Source: <i>SUPPLIED TANK</i>			Outer Ring	<i>24"</i>
Field Personnel: <i>CHRIS SWITER, TINA KEEFE</i>				
Ring Depth (in.): Inner: <i>5"</i> Outer: <i>6"</i>				
Depth to WT: <i>84"</i>				

### Presoak Data

Start Time	End Time	Starting Water Level	Ending Water Level	Gal. Used
<i>8:30</i>	<i>9:00</i>	<i>10"</i>	<i>10"</i>	<i>45+</i>

\*Determine reading intervals based on drop in water level during presoak (Ex. If water level drops 4" in 2 min, then use 2 min. intervals.

If drop is faster, then use one minute reading intervals) \* *2 MIN INTERVALS USED*

Trial #		Time	Elapsed	Flow Reading				Liquid	Remarks
				Inner Ring		Outer Ring		Temp	
				in.	Δ in.	in.	Δ in.	(F)	
1	START	<i>9:02</i>	<i>/</i>	<i>6.0</i>	<i>1.5</i>	<i>6.0</i>	<i>1.75</i>	<i>78°</i>	<i>LIGHT RAIN, 70°</i>
	END	<i>9:04</i>	<i>2MIN</i>	<i>4.5</i>		<i>4.25</i>			
2	START	<i>9:06</i>	<i>/</i>	<i>6.0</i>	<i>1.25</i>	<i>6.0</i>	<i>1.5</i>		
	END	<i>9:08</i>	<i>2MIN</i>	<i>4.75</i>		<i>4.5</i>			
3	START	<i>9:09</i>	<i>/</i>	<i>6.0</i>	<i>1.0</i>	<i>5.0</i>	<i>1.25</i>		
	END	<i>9:11</i>	<i>2MIN</i>	<i>5.0</i>		<i>3.75</i>			
4	START	<i>9:13</i>	<i>/</i>	<i>6.0</i>	<i>1.0</i>	<i>6.0</i>	<i>1.25</i>		
	END	<i>9:15</i>	<i>2MIN</i>	<i>5.0</i>		<i>4.75</i>			
5	START	<i>9:25</i>	<i>/</i>	<i>6.0</i>	<i>1.0</i>	<i>5.0</i>	<i>1.0</i>		
	END	<i>9:27</i>	<i>2MIN</i>	<i>5.0</i>		<i>4.0</i>			
6	START	<i>9:28</i>	<i>/</i>	<i>6.0</i>	<i>1.25</i>	<i>5.0</i>	<i>1.0</i>		
	END	<i>9:30</i>	<i>2MIN</i>	<i>4.75</i>		<i>4.0</i>			
7	START	<i>9:32</i>	<i>/</i>	<i>6.0</i>	<i>1.0</i>	<i>5.0</i>	<i>1.25</i>		
	END	<i>9:34</i>	<i>2MIN</i>	<i>5.0</i>		<i>3.75</i>			
8	START	<i>9:36</i>	<i>/</i>	<i>6.0</i>	<i>1.0</i>	<i>5.0</i>	<i>1.0</i>		
	END	<i>9:38</i>	<i>2MIN</i>	<i>5.0</i>		<i>4.0</i>			
9	START	<i>9:40</i>	<i>/</i>	<i>6.0</i>	<i>1.0</i>	<i>5.0</i>	<i>1.0</i>		
	END	<i>9:42</i>	<i>2MIN</i>	<i>5.0</i>		<i>4.0</i>			
10	START	<i>9:44</i>	<i>/</i>	<i>6.0</i>	<i>1.0</i>	<i>5.0</i>	<i>1.25</i>		
	END	<i>9:46</i>	<i>2MIN</i>	<i>5.0</i>		<i>3.75</i>			
11	START	<i>9:48</i>	<i>/</i>	<i>6.0</i>	<i>1.0</i>	<i>5.0</i>	<i>1.25</i>		
	END	<i>9:50</i>	<i>2MIN</i>	<i>5.0</i>		<i>3.75</i>			
12	START	<i>9:52</i>	<i>/</i>	<i>6.0</i>	<i>1.0</i>	<i>5.0</i>	<i>1.0</i>		
	END	<i>9:54</i>	<i>2MIN</i>	<i>5.0</i>		<i>4.0</i>			
13	START								
	END								
14	START								
	END								
15	START								
	END								

- TEST CONDUCTED AT 40" DEPTH FROM EXISTING GRADE IN 2C HORIZON

INFILTRATION RATE:  $1.08 \text{ in} / 2 \text{ MIN} = 0.54 \text{ in} / \text{MIN} = 32.4 \text{ in} / \text{HOUR}$

Refill  
TANK

## Double Ring Infiltrometer Field Data Sheet

Project Name: <i>OAK STREET</i>	Date: <i>8/20/18</i>		Diameter	H2O depth
Test Location: <i>AT TH #4</i>			Inner Ring	<i>12"</i>
Water Source: <i>SUPPLIED TANK</i>			Outer Ring	<i>24"</i>
Field Personnel: <i>CHRIS SWITZER, TIM KEEFE</i>				
Ring Depth (in.): Inner: <i>5"</i> Outer: <i>6"</i>				
Depth to WT: <i>96"</i>				

### Presoak Data

Start Time	End Time	Starting Water Level	Ending Water Level	Gal. Used
<i>10:25</i>	<i>10:45</i>	<i>8"</i>	<i>0"</i>	<i>65</i>

\*Determine reading intervals based on drop in water level during presoak (Ex. If water level drops 4" in 2 min, then use 2 min. intervals.

If drop is faster, then use one minute reading intervals) \* *2 MIN. INTERVALS USED*

Trial #		Time	Elapsed	Flow Reading				Liquid	Remarks
				Inner Ring		Outer Ring		Temp	
				in.	Δ in.	in.	Δ in.	(F)	
1	START	<i>10:47</i>	<i>/</i>	<i>6.0</i>	<i>1.75</i>	<i>6.0</i>	<i>2.0</i>	<i>78°</i>	<i>OVERCAST, 70°F</i>
	END	<i>10:49</i>	<i>2 MIN</i>	<i>4.25</i>		<i>4.0</i>			
2	START	<i>10:50</i>	<i>/</i>	<i>6.0</i>	<i>1.75</i>	<i>6.0</i>	<i>2.0</i>		
	END	<i>10:52</i>	<i>2 MIN</i>	<i>4.25</i>		<i>4.0</i>			
3	START	<i>10:53</i>	<i>/</i>	<i>6.0</i>	<i>1.75</i>	<i>6.0</i>	<i>2.0</i>		
	END	<i>10:55</i>	<i>2 MIN</i>	<i>4.25</i>		<i>4.0</i>			
4	START	<i>10:56</i>	<i>/</i>	<i>6.0</i>	<i>2.0</i>	<i>6.0</i>	<i>2.0</i>		
	END	<i>10:58</i>	<i>2 MIN</i>	<i>4.0</i>		<i>4.0</i>			
5	START	<i>11:00</i>	<i>/</i>	<i>6.0</i>	<i>2.0</i>	<i>5.0</i>	<i>2.0</i>		
	END	<i>11:02</i>	<i>2 MIN</i>	<i>4.0</i>		<i>3.0</i>			
6	START	<i>11:04</i>	<i>/</i>	<i>6.0</i>	<i>2.0</i>	<i>5.0</i>	<i>2.0</i>		
	END	<i>11:06</i>	<i>2 MIN</i>	<i>4.0</i>		<i>3.0</i>			
7	START	<i>11:07</i>	<i>/</i>	<i>6.0</i>	<i>2.0</i>	<i>5.0</i>	<i>2.0</i>		
	END	<i>11:09</i>	<i>2 MIN</i>	<i>4.0</i>		<i>3.0</i>			
8	START	<i>11:11</i>	<i>/</i>	<i>6.0</i>	<i>2.0</i>	<i>5.0</i>	<i>2.0</i>		
	END	<i>11:13</i>	<i>2 MIN</i>	<i>4.0</i>		<i>3.0</i>			
9	START	<i>11:14</i>	<i>/</i>	<i>6.0</i>	<i>2.0</i>	<i>5.0</i>	<i>2.0</i>		
	END	<i>11:16</i>	<i>2 MIN</i>	<i>4.0</i>		<i>3.0</i>			
10	START	<i>11:18</i>	<i>/</i>	<i>6.0</i>	<i>2.0</i>	<i>5.0</i>	<i>2.0</i>		
	END	<i>11:20</i>	<i>2 MIN</i>	<i>4.0</i>		<i>3.0</i>			
11	START	<i>11:22</i>	<i>/</i>	<i>6.0</i>	<i>2.0</i>	<i>5.0</i>	<i>2.0</i>		
	END	<i>11:24</i>	<i>2 MIN</i>	<i>4.0</i>		<i>3.0</i>			
12	START	<i>11:26</i>	<i>/</i>	<i>6.0</i>	<i>2.0</i>	<i>5.0</i>	<i>2.0</i>		
	END	<i>11:28</i>	<i>2 MIN</i>	<i>4.0</i>		<i>3.0</i>			
13	START								
	END								
14	START								
	END								
15	START								
	END								

*- TEST CONDUCTED AT 36" DEPTH FROM EXISTING GROUND IN C HORIZON*

*INFILTRATION RATE: 1.94 in/2 min = 0.97 in/min = 58.2 in./hour*

## Double Ring Infiltrometer Field Data Sheet

Project Name: <i>OAK STREET</i>	Date: <i>8/20/18</i>		Diameter	H2O depth
Test Location: <i>AT TH #6</i>			Inner Ring	<i>12"</i>
Water Source: <i>SUPPLIED TANK</i>			Outer Ring	<i>24"</i>
Field Personnel: <i>CHRIS SLOTER, TIM KEEFE</i>				
Ring Depth (in.): Inner: <i>5"</i> Outer: <i>6"</i>				
Depth to WT: <i>96"</i>				

**Presoak Data**

Start Time	End Time	Starting Water Level	Ending Water Level	Gal. Used
<i>11:35</i>	<i>12:00</i>	<i>10"</i>	<i>0"</i>	<i>65</i>

\*Determine reading intervals based on drop in water level during presoak (Ex. If water level drops 4" in 2 min, then use 2 min. intervals.

If drop is faster, then use one minute reading intervals) \* *1 MINUTE INTERVALS USED*

Trial #		Time	Elapsed	Flow Reading				Liquid	Remarks
				Inner Ring		Outer Ring		Temp	
				in.	Δ in.	in.	Δ in.	(F)	
1	START	<i>12:10</i>	<i>/</i>	<i>6.0</i>	<i>2.5</i>	<i>6.0</i>	<i>3.0</i>	<i>78°</i>	<i>OVERCAST, 70'</i>
	END	<i>12:11</i>	<i>1MIN</i>	<i>3.5</i>		<i>3.0</i>			
2	START	<i>12:12</i>	<i>/</i>	<i>6.0</i>	<i>2.5</i>	<i>6.0</i>	<i>2.75</i>		
	END	<i>12:13</i>	<i>1MIN</i>	<i>3.5</i>		<i>3.25</i>			
3	START	<i>12:15</i>	<i>/</i>	<i>6.0</i>	<i>2.75</i>	<i>6.0</i>	<i>2.75</i>		
	END	<i>12:16</i>	<i>1MIN</i>	<i>3.25</i>		<i>3.25</i>			
4	START	<i>12:18</i>	<i>/</i>	<i>6.0</i>	<i>3.0</i>	<i>6.0</i>	<i>2.75</i>		
	END	<i>12:19</i>	<i>1MIN</i>	<i>3.0</i>		<i>3.25</i>			
5	START	<i>12:21</i>	<i>/</i>	<i>6.0</i>	<i>2.75</i>	<i>6.0</i>	<i>3.0</i>		
	END	<i>12:22</i>	<i>1MIN</i>	<i>3.25</i>		<i>3.0</i>			
6	START	<i>12:23</i>	<i>/</i>	<i>6.0</i>	<i>2.75</i>	<i>6.0</i>	<i>3.0</i>		
	END	<i>12:24</i>	<i>1MIN</i>	<i>3.25</i>		<i>3.0</i>			
7	START	<i>12:26</i>	<i>/</i>	<i>6.0</i>	<i>2.75</i>	<i>6.0</i>	<i>3.0</i>		
	END	<i>12:27</i>	<i>1MIN</i>	<i>3.25</i>		<i>3.0</i>			
8	START	<i>1:00</i>	<i>/</i>	<i>6.0</i>	<i>3.0</i>	<i>5.0</i>	<i>3.0</i>		
	END	<i>1:01</i>	<i>1MIN</i>	<i>3.0</i>		<i>2.0</i>			
9	START	<i>1:02</i>	<i>/</i>	<i>6.0</i>	<i>3.0</i>	<i>5.0</i>	<i>3.0</i>		
	END	<i>1:03</i>	<i>1MIN</i>	<i>3.0</i>		<i>2.0</i>			
10	START	<i>1:04</i>	<i>/</i>	<i>6.0</i>	<i>2.75</i>	<i>5.0</i>	<i>3.0</i>		
	END	<i>1:05</i>	<i>1MIN</i>	<i>3.25</i>		<i>2.0</i>			
11	START	<i>1:06</i>	<i>/</i>	<i>6.0</i>	<i>2.5</i>	<i>5.0</i>	<i>3.0</i>		
	END	<i>1:07</i>	<i>1MIN</i>	<i>3.5</i>		<i>2.0</i>			
12	START	<i>1:09</i>	<i>/</i>	<i>6.0</i>	<i>2.5</i>	<i>5.0</i>	<i>3.0</i>		
	END	<i>1:10</i>	<i>1MIN</i>	<i>3.5</i>		<i>2.0</i>			
13	START	<i>1:13</i>	<i>/</i>	<i>6.0</i>	<i>2.25</i>	<i>5.0</i>	<i>2.75</i>		
	END	<i>1:14</i>	<i>1MIN</i>	<i>3.75</i>		<i>2.25</i>			
14	START	<i>1:16</i>	<i>/</i>	<i>6.0</i>	<i>2.5</i>	<i>5.0</i>	<i>2.5</i>		
	END	<i>1:17</i>	<i>1MIN</i>	<i>3.5</i>		<i>2.5</i>			
15	START	<i>1:18</i>	<i>/</i>	<i>6.0</i>	<i>2.5</i>	<i>5.0</i>	<i>2.5</i>		
	END	<i>1:19</i>	<i>1MIN</i>	<i>3.5</i>		<i>2.5</i>			

*REFILL TANK*

*TEST CONDUCTED AT 12" DEPTH FROM EXISTING GRADE IN HORIZAN*

*INFILTRATION RATE: 2.67 IN/MIN = 160.2 IN/HOUR*

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### A3.2 Water Quality HydroCAD 1.2” Storm Analysis

**2214-001-PHCD-INHS**

Type III 24-hr 1.2" Storm Rainfall=1.20"

Prepared by DiPrete Engineering

Printed 11/28/2018

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Page 1

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 240: Post-240** Runoff Area=0.965 ac 25.08% Impervious Runoff Depth=0.25"  
Flow Length=131' Tc=16.1 min CN=35/98 Runoff=0.20 cfs 0.020 af

**Subcatchment 250: Post-250** Runoff Area=0.410 ac 36.34% Impervious Runoff Depth=0.36"  
Tc=6.0 min CN=39/98 Runoff=0.16 cfs 0.012 af

**Reach 251: Tarn Street Swale (East to** Avg. Flow Depth=0.06' Max Vel=1.22 fps Inflow=0.16 cfs 0.012 af  
n=0.030 L=173.0' S=0.0300 '/ Capacity=30.54 cfs Outflow=0.16 cfs 0.012 af

**Pond 252.1: WQ Area - Infiltration Pond D** Peak Elev=36.96' Storage=422 cf Inflow=0.32 cfs 0.032 af  
Discarded=0.08 cfs 0.032 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.032 af

**Pond 252.2: Infiltration Pond D** Peak Elev=35.50' Storage=0 cf Inflow=0.00 cfs 0.000 af  
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

**Subcatchment 260: Post-260** Runoff Area=1.210 ac 41.32% Impervious Runoff Depth=0.41"  
Tc=6.0 min CN=39/98 Runoff=0.55 cfs 0.041 af

**Reach 261: Tarn Street Swale (North to** Avg. Flow Depth=0.16' Max Vel=1.29 fps Inflow=0.55 cfs 0.041 af  
n=0.030 L=205.0' S=0.0100 '/ Capacity=9.58 cfs Outflow=0.52 cfs 0.041 af

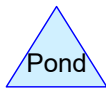
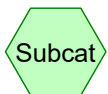
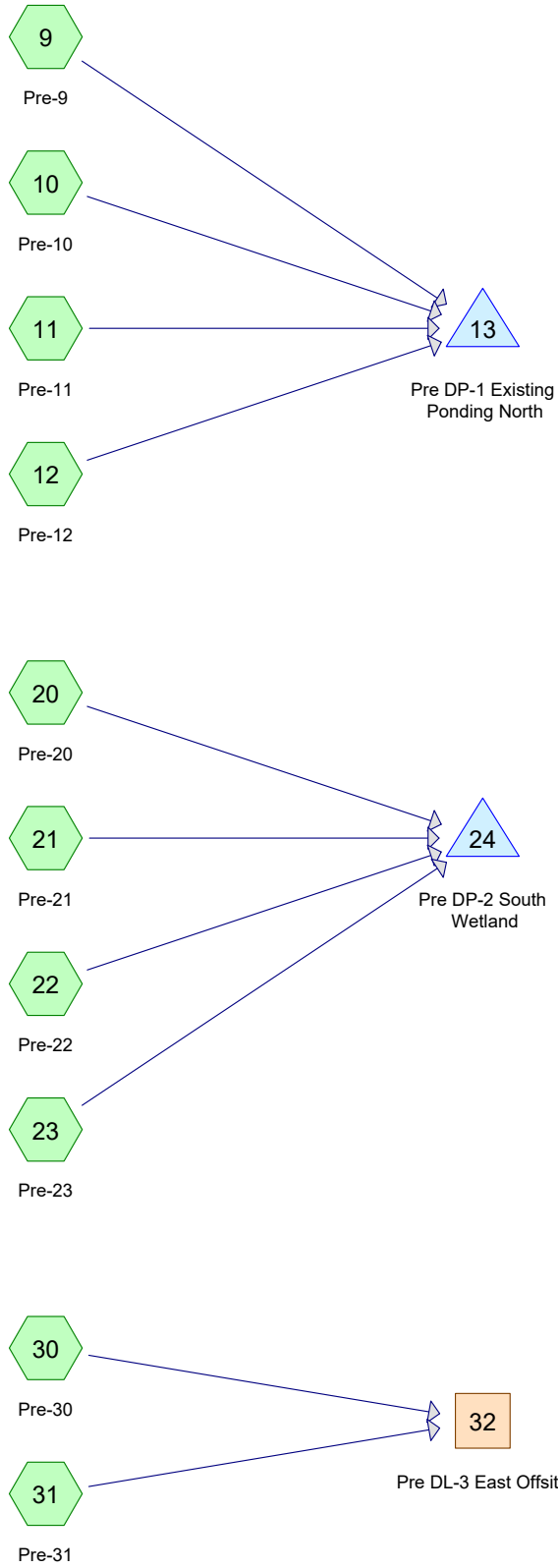
**Pond 262.1: WQ Area - Infiltration Pond F** Peak Elev=35.87' Storage=592 cf Inflow=0.52 cfs 0.041 af  
Discarded=0.07 cfs 0.041 af Primary=0.00 cfs 0.000 af Outflow=0.07 cfs 0.041 af

**Pond 262.2: Infiltration Pond F** Peak Elev=33.50' Storage=0 cf Inflow=0.00 cfs 0.000 af  
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

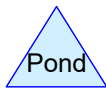
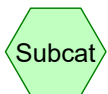
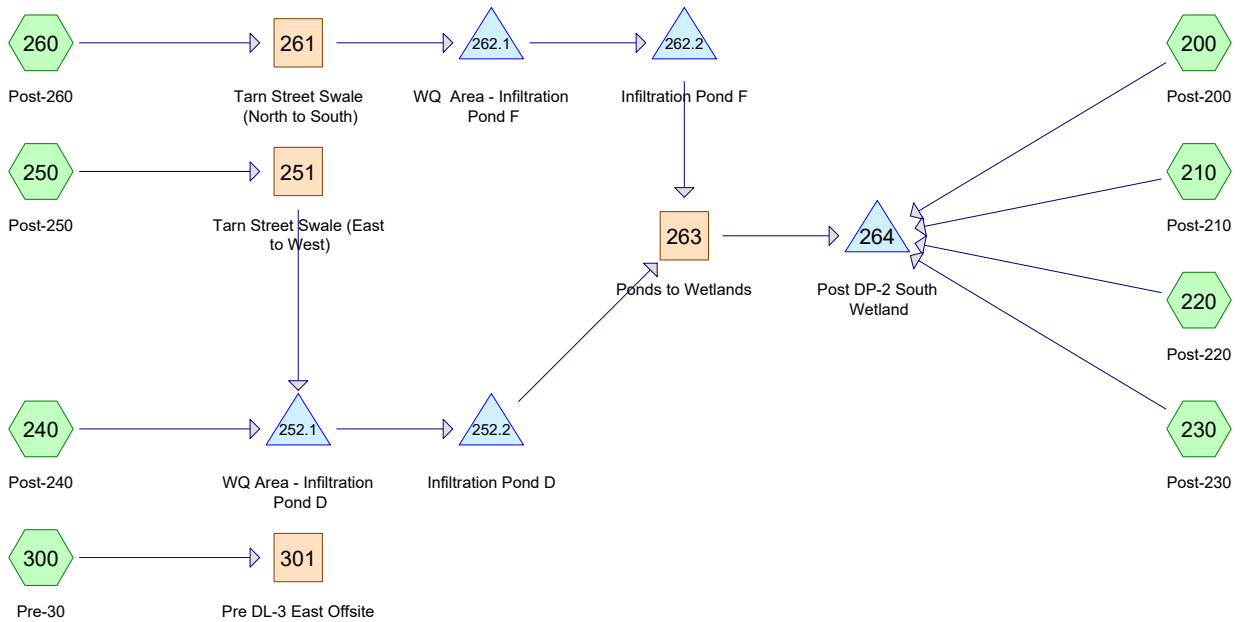
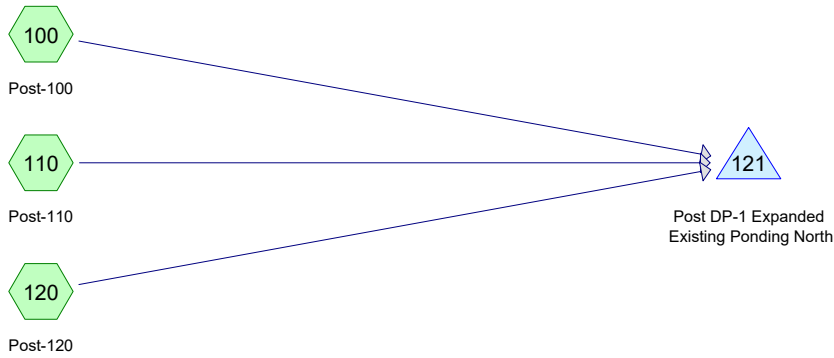
**Reach 263: Ponds to Wetlands** Inflow=0.00 cfs 0.000 af  
Outflow=0.00 cfs 0.000 af

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### A3.5.4.1 HydroCAD Node Diagram



**Routing Diagram for 2214-001-EHCD-INHS**  
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**Routing Diagram for 2214-001-PHCD-INHS**  
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#### A3.5.4.2 HydroCAD 1-Year Storm Analysis

**2214-001-EHCD-INHS**

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**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
10.502	39	>75% Grass cover, Good, HSG A (10, 11, 12, 20, 21, 22, 23, 30)
0.460	80	>75% Grass cover, Good, HSG D (22)
6.304	98	Paved parking, HSG A (10, 11, 12, 20, 21, 22, 23, 30, 31)
6.224	30	Woods, Good, HSG A (9, 10, 11, 20, 21, 22, 23, 30, 31)
1.727	77	Woods, Good, HSG D (22)
<b>25.217</b>	<b>55</b>	<b>TOTAL AREA</b>

**2214-001-EHCD-INHS**

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Type III 24-hr 1-Year Rainfall=2.80"

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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

<b>Subcatchment9: Pre-9</b>	Runoff Area=1.377 ac 0.00% Impervious Runoff Depth=0.00" Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af
<b>Subcatchment10: Pre-10</b>	Runoff Area=4.655 ac 27.69% Impervious Runoff Depth=0.13" Flow Length=461' Tc=23.5 min CN=54 Runoff=0.10 cfs 0.048 af
<b>Subcatchment11: Pre-11</b>	Runoff Area=2.264 ac 16.61% Impervious Runoff Depth=0.02" Flow Length=250' Tc=17.4 min CN=46 Runoff=0.00 cfs 0.003 af
<b>Subcatchment12: Pre-12</b>	Runoff Area=0.381 ac 61.42% Impervious Runoff Depth=0.83" Tc=6.0 min CN=75 Runoff=0.35 cfs 0.026 af
<b>Pond 13: Pre DP-1 Existing Ponding North</b>	Peak Elev=34.13' Storage=483 cf Inflow=0.35 cfs 0.078 af Outflow=0.10 cfs 0.078 af
<b>Subcatchment20: Pre-20</b>	Runoff Area=3.705 ac 35.33% Impervious Runoff Depth=0.24" Flow Length=718' Tc=18.8 min CN=59 Runoff=0.33 cfs 0.073 af
<b>Subcatchment21: Pre-21</b>	Runoff Area=3.416 ac 41.77% Impervious Runoff Depth=0.35" Flow Length=436' Tc=23.5 min CN=63 Runoff=0.56 cfs 0.100 af
<b>Subcatchment22: Pre-22</b>	Runoff Area=7.847 ac 15.02% Impervious Runoff Depth=0.17" Flow Length=317' Tc=14.6 min CN=56 Runoff=0.38 cfs 0.109 af
<b>Subcatchment23: Pre-23</b>	Runoff Area=1.165 ac 40.34% Impervious Runoff Depth=0.32" Tc=6.0 min CN=62 Runoff=0.22 cfs 0.031 af
<b>Pond 24: Pre DP-2 South Wetland</b>	Peak Elev=32.02' Storage=679 cf Inflow=1.40 cfs 0.314 af Outflow=1.04 cfs 0.314 af
<b>Subcatchment30: Pre-30</b>	Runoff Area=0.233 ac 2.58% Impervious Runoff Depth=0.00" Tc=6.0 min CN=33 Runoff=0.00 cfs 0.000 af
<b>Subcatchment31: Pre-31</b>	Runoff Area=0.174 ac 8.05% Impervious Runoff Depth=0.00" Tc=6.0 min CN=35 Runoff=0.00 cfs 0.000 af
<b>Reach 32: Pre DL-3 East Offsite</b>	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

**Total Runoff Area = 25.217 ac Runoff Volume = 0.392 af Average Runoff Depth = 0.19"**  
**75.00% Pervious = 18.913 ac 25.00% Impervious = 6.304 ac**

**2214-001-PHCD-INHS**

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**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
12.224	39	>75% Grass cover, Good, HSG A (100, 110, 120, 200, 210, 220, 230, 240, 250, 260, 300)
0.460	80	>75% Grass cover, Good, HSG D (220)
0.897	98	Impervious (240, 250, 260, 300)
6.244	98	Paved parking, HSG A (100, 110, 120, 200, 210, 220, 230)
3.665	30	Woods, Good, HSG A (100, 110, 200, 210, 220, 230, 240, 260, 300)
1.727	77	Woods, Good, HSG D (220)
<b>25.217</b>	<b>58</b>	<b>TOTAL AREA</b>

**2214-001-PHCD-INHS**

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Type III 24-hr 1-Year Rainfall=2.80"

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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 100: Post-100** Runoff Area=4.655 ac 27.69% Impervious Runoff Depth=0.13"  
 Flow Length=461' Tc=23.5 min CN=54 Runoff=0.10 cfs 0.048 af

**Subcatchment 110: Post-110** Runoff Area=2.675 ac 14.06% Impervious Runoff Depth=0.01"  
 Flow Length=250' Tc=17.4 min CN=45 Runoff=0.00 cfs 0.002 af

**Subcatchment 120: Post-120** Runoff Area=0.381 ac 61.42% Impervious Runoff Depth=0.83"  
 Tc=6.0 min CN=75 Runoff=0.35 cfs 0.026 af

**Pond 121: Post DP-1 Expanded Existing** Peak Elev=32.00' Storage=18 cf Inflow=0.35 cfs 0.077 af  
 Outflow=0.34 cfs 0.077 af

**Subcatchment 200: Post-200** Runoff Area=3.704 ac 35.31% Impervious Runoff Depth=0.24"  
 Flow Length=718' Tc=18.8 min CN=59 Runoff=0.33 cfs 0.073 af

**Subcatchment 210: Post-210** Runoff Area=3.416 ac 41.77% Impervious Runoff Depth=0.35"  
 Flow Length=436' Tc=23.5 min CN=63 Runoff=0.56 cfs 0.100 af

**Subcatchment 220: Post-220** Runoff Area=6.461 ac 17.64% Impervious Runoff Depth=0.29"  
 Flow Length=181' Tc=12.3 min CN=61 Runoff=0.89 cfs 0.157 af

**Subcatchment 230: Post-230** Runoff Area=1.166 ac 40.31% Impervious Runoff Depth=0.32"  
 Tc=6.0 min CN=62 Runoff=0.22 cfs 0.031 af

**Subcatchment 240: Post-240** Runoff Area=0.965 ac 25.08% Impervious Runoff Depth=0.07"  
 Flow Length=131' Tc=16.1 min CN=51 Runoff=0.01 cfs 0.006 af

**Subcatchment 250: Post-250** Runoff Area=0.410 ac 36.34% Impervious Runoff Depth=0.26"  
 Tc=6.0 min CN=60 Runoff=0.05 cfs 0.009 af

**Reach 251: Tarn Street Swale (East to** Avg. Flow Depth=0.03' Max Vel=0.80 fps Inflow=0.05 cfs 0.009 af  
 n=0.030 L=173.0' S=0.0300 '/' Capacity=30.54 cfs Outflow=0.05 cfs 0.009 af

**Pond 252.1: WQ Area - Infiltration Pond D** Peak Elev=35.57' Storage=14 cf Inflow=0.05 cfs 0.015 af  
 Discarded=0.04 cfs 0.015 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.015 af

**Pond 252.2: Infiltration Pond D** Peak Elev=35.50' Storage=0 cf Inflow=0.00 cfs 0.000 af  
 Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

**Subcatchment 260: Post-260** Runoff Area=1.210 ac 41.32% Impervious Runoff Depth=0.35"  
 Tc=6.0 min CN=63 Runoff=0.28 cfs 0.036 af

**Reach 261: Tarn Street Swale (North to** Avg. Flow Depth=0.11' Max Vel=1.02 fps Inflow=0.28 cfs 0.036 af  
 n=0.030 L=205.0' S=0.0100 '/' Capacity=9.58 cfs Outflow=0.25 cfs 0.036 af

**Pond 262.1: WQ Area - Infiltration Pond F** Peak Elev=35.06' Storage=313 cf Inflow=0.25 cfs 0.036 af  
 Discarded=0.06 cfs 0.036 af Primary=0.00 cfs 0.000 af Outflow=0.06 cfs 0.036 af

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Type III 24-hr 1-Year Rainfall=2.80"

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**Pond 262.2: Infiltration Pond F**

Peak Elev=33.50' Storage=0 cf Inflow=0.00 cfs 0.000 af  
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

**Reach 263: Ponds to Wetlands**

Inflow=0.00 cfs 0.000 af  
Outflow=0.00 cfs 0.000 af

**Pond 264: Post DP-2 South Wetland**

Peak Elev=32.03' Storage=1,430 cf Inflow=1.89 cfs 0.362 af  
Outflow=1.04 cfs 0.362 af

**Subcatchment 300: Pre-30**

Runoff Area=0.174 ac 3.45% Impervious Runoff Depth=0.00"  
Tc=6.0 min CN=34 Runoff=0.00 cfs 0.000 af

**Reach 301: Pre DL-3 East Offsite**

Inflow=0.00 cfs 0.000 af  
Outflow=0.00 cfs 0.000 af

**Total Runoff Area = 25.217 ac Runoff Volume = 0.490 af Average Runoff Depth = 0.23"**  
**71.68% Pervious = 18.076 ac 28.32% Impervious = 7.141 ac**

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### 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

<b>Subcatchment9: Pre-9</b>	Runoff Area=1.377 ac 0.00% Impervious Runoff Depth=0.00" Tc=6.0 min CN=30 Runoff=0.00 cfs 0.000 af
<b>Subcatchment10: Pre-10</b>	Runoff Area=4.655 ac 27.69% Impervious Runoff Depth=0.87" Flow Length=461' Tc=23.5 min CN=54 Runoff=2.30 cfs 0.338 af
<b>Subcatchment11: Pre-11</b>	Runoff Area=2.264 ac 16.61% Impervious Runoff Depth=0.46" Flow Length=250' Tc=17.4 min CN=46 Runoff=0.43 cfs 0.086 af
<b>Subcatchment12: Pre-12</b>	Runoff Area=0.381 ac 61.42% Impervious Runoff Depth=2.37" Tc=6.0 min CN=75 Runoff=1.05 cfs 0.075 af
<b>Pond 13: Pre DP-1 Existing Ponding North</b>	Peak Elev=35.07' Storage=9,888 cf Inflow=3.08 cfs 0.500 af Outflow=0.40 cfs 0.500 af
<b>Subcatchment20: Pre-20</b>	Runoff Area=3.705 ac 35.33% Impervious Runoff Depth=1.18" Flow Length=718' Tc=18.8 min CN=59 Runoff=3.06 cfs 0.364 af
<b>Subcatchment21: Pre-21</b>	Runoff Area=3.416 ac 41.77% Impervious Runoff Depth=1.45" Flow Length=436' Tc=23.5 min CN=63 Runoff=3.37 cfs 0.412 af
<b>Subcatchment22: Pre-22</b>	Runoff Area=7.847 ac 15.02% Impervious Runoff Depth=0.99" Flow Length=317' Tc=14.6 min CN=56 Runoff=5.57 cfs 0.648 af
<b>Subcatchment23: Pre-23</b>	Runoff Area=1.165 ac 40.34% Impervious Runoff Depth=1.38" Tc=6.0 min CN=62 Runoff=1.72 cfs 0.134 af
<b>Pond 24: Pre DP-2 South Wetland</b>	Peak Elev=32.62' Storage=30,613 cf Inflow=12.55 cfs 1.557 af Outflow=1.32 cfs 1.557 af
<b>Subcatchment30: Pre-30</b>	Runoff Area=0.233 ac 2.58% Impervious Runoff Depth=0.03" Tc=6.0 min CN=33 Runoff=0.00 cfs 0.001 af
<b>Subcatchment31: Pre-31</b>	Runoff Area=0.174 ac 8.05% Impervious Runoff Depth=0.07" Tc=6.0 min CN=35 Runoff=0.00 cfs 0.001 af
<b>Reach 32: Pre DL-3 East Offsite</b>	Inflow=0.00 cfs 0.002 af Outflow=0.00 cfs 0.002 af

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

<b>Subcatchment 100: Post-100</b>	Runoff Area=4.655 ac 27.69% Impervious Runoff Depth=0.87" Flow Length=461' Tc=23.5 min CN=54 Runoff=2.30 cfs 0.338 af
<b>Subcatchment 110: Post-110</b>	Runoff Area=2.675 ac 14.06% Impervious Runoff Depth=0.41" Flow Length=250' Tc=17.4 min CN=45 Runoff=0.42 cfs 0.092 af
<b>Subcatchment 120: Post-120</b>	Runoff Area=0.381 ac 61.42% Impervious Runoff Depth=2.37" Tc=6.0 min CN=75 Runoff=1.05 cfs 0.075 af
<b>Pond 121: Post DP-1 Expanded Existing</b>	Peak Elev=32.64' Storage=3,756 cf Inflow=3.06 cfs 0.505 af Outflow=1.08 cfs 0.505 af
<b>Subcatchment 200: Post-200</b>	Runoff Area=3.704 ac 35.31% Impervious Runoff Depth=1.18" Flow Length=718' Tc=18.8 min CN=59 Runoff=3.06 cfs 0.364 af
<b>Subcatchment 210: Post-210</b>	Runoff Area=3.416 ac 41.77% Impervious Runoff Depth=1.45" Flow Length=436' Tc=23.5 min CN=63 Runoff=3.37 cfs 0.412 af
<b>Subcatchment 220: Post-220</b>	Runoff Area=6.461 ac 17.64% Impervious Runoff Depth=1.31" Flow Length=181' Tc=12.3 min CN=61 Runoff=7.22 cfs 0.705 af
<b>Subcatchment 230: Post-230</b>	Runoff Area=1.166 ac 40.31% Impervious Runoff Depth=1.38" Tc=6.0 min CN=62 Runoff=1.73 cfs 0.134 af
<b>Subcatchment 240: Post-240</b>	Runoff Area=0.965 ac 25.08% Impervious Runoff Depth=0.70" Flow Length=131' Tc=16.1 min CN=51 Runoff=0.38 cfs 0.057 af
<b>Subcatchment 250: Post-250</b>	Runoff Area=0.410 ac 36.34% Impervious Runoff Depth=1.24" Tc=6.0 min CN=60 Runoff=0.53 cfs 0.042 af
<b>Reach 251: Tarn Street Swale (East to</b>	Avg. Flow Depth=0.12' Max Vel=1.87 fps Inflow=0.53 cfs 0.042 af n=0.030 L=173.0' S=0.0300 '/ Capacity=30.54 cfs Outflow=0.52 cfs 0.042 af
<b>Pond 252.1: WQ Area - Infiltration Pond D</b>	Peak Elev=37.03' Storage=451 cf Inflow=0.70 cfs 0.099 af Discarded=0.08 cfs 0.065 af Primary=0.62 cfs 0.034 af Outflow=0.70 cfs 0.099 af
<b>Pond 252.2: Infiltration Pond D</b>	Peak Elev=35.58' Storage=97 cf Inflow=0.62 cfs 0.034 af Discarded=0.47 cfs 0.034 af Primary=0.00 cfs 0.000 af Outflow=0.47 cfs 0.034 af
<b>Subcatchment 260: Post-260</b>	Runoff Area=1.210 ac 41.32% Impervious Runoff Depth=1.45" Tc=6.0 min CN=63 Runoff=1.90 cfs 0.146 af
<b>Reach 261: Tarn Street Swale (North to</b>	Avg. Flow Depth=0.32' Max Vel=1.90 fps Inflow=1.90 cfs 0.146 af n=0.030 L=205.0' S=0.0100 '/ Capacity=9.58 cfs Outflow=1.84 cfs 0.146 af
<b>Pond 262.1: WQ Area - Infiltration Pond F</b>	Peak Elev=36.09' Storage=672 cf Inflow=1.84 cfs 0.146 af Discarded=0.07 cfs 0.075 af Primary=1.78 cfs 0.071 af Outflow=1.85 cfs 0.146 af

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Type III 24-hr 10-Year Rainfall=4.90"

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**Pond 262.2: Infiltration Pond F**

Peak Elev=33.74' Storage=501 cf Inflow=1.78 cfs 0.071 af  
Discarded=0.79 cfs 0.071 af Primary=0.00 cfs 0.000 af Outflow=0.79 cfs 0.071 af

**Reach 263: Ponds to Wetlands**

Inflow=0.00 cfs 0.000 af  
Outflow=0.00 cfs 0.000 af

**Pond 264: Post DP-2 South Wetland**

Peak Elev=32.66' Storage=32,798 cf Inflow=13.54 cfs 1.614 af  
Outflow=1.34 cfs 1.614 af

**Subcatchment 300: Pre-30**

Runoff Area=0.174 ac 3.45% Impervious Runoff Depth=0.05"  
Tc=6.0 min CN=34 Runoff=0.00 cfs 0.001 af

**Reach 301: Pre DL-3 East Offsite**

Inflow=0.00 cfs 0.001 af  
Outflow=0.00 cfs 0.001 af

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#### 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

<b>Subcatchment9: Pre-9</b>	Runoff Area=1.377 ac 0.00% Impervious Runoff Depth=0.08" Tc=6.0 min CN=30 Runoff=0.01 cfs 0.010 af
<b>Subcatchment10: Pre-10</b>	Runoff Area=4.655 ac 27.69% Impervious Runoff Depth=1.50" Flow Length=461' Tc=23.5 min CN=54 Runoff=4.50 cfs 0.581 af
<b>Subcatchment11: Pre-11</b>	Runoff Area=2.264 ac 16.61% Impervious Runoff Depth=0.91" Flow Length=250' Tc=17.4 min CN=46 Runoff=1.16 cfs 0.171 af
<b>Subcatchment12: Pre-12</b>	Runoff Area=0.381 ac 61.42% Impervious Runoff Depth=3.37" Tc=6.0 min CN=75 Runoff=1.51 cfs 0.107 af
<b>Pond 13: Pre DP-1 Existing Ponding North</b>	Peak Elev=35.51' Storage=19,354 cf Inflow=6.23 cfs 0.868 af Outflow=0.62 cfs 0.868 af
<b>Subcatchment20: Pre-20</b>	Runoff Area=3.705 ac 35.33% Impervious Runoff Depth=1.90" Flow Length=718' Tc=18.8 min CN=59 Runoff=5.33 cfs 0.587 af
<b>Subcatchment21: Pre-21</b>	Runoff Area=3.416 ac 41.77% Impervious Runoff Depth=2.25" Flow Length=436' Tc=23.5 min CN=63 Runoff=5.47 cfs 0.640 af
<b>Subcatchment22: Pre-22</b>	Runoff Area=7.847 ac 15.02% Impervious Runoff Depth=1.66" Flow Length=317' Tc=14.6 min CN=56 Runoff=10.46 cfs 1.083 af
<b>Subcatchment23: Pre-23</b>	Runoff Area=1.165 ac 40.34% Impervious Runoff Depth=2.16" Tc=6.0 min CN=62 Runoff=2.84 cfs 0.210 af
<b>Pond 24: Pre DP-2 South Wetland</b>	Peak Elev=33.09' Storage=59,798 cf Inflow=22.01 cfs 2.519 af Outflow=1.57 cfs 2.519 af
<b>Subcatchment30: Pre-30</b>	Runoff Area=0.233 ac 2.58% Impervious Runoff Depth=0.19" Tc=6.0 min CN=33 Runoff=0.01 cfs 0.004 af
<b>Subcatchment31: Pre-31</b>	Runoff Area=0.174 ac 8.05% Impervious Runoff Depth=0.27" Tc=6.0 min CN=35 Runoff=0.01 cfs 0.004 af
<b>Reach 32: Pre DL-3 East Offsite</b>	Inflow=0.01 cfs 0.008 af Outflow=0.01 cfs 0.008 af

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

<b>Subcatchment 100: Post-100</b>	Runoff Area=4.655 ac 27.69% Impervious Runoff Depth=1.50" Flow Length=461' Tc=23.5 min CN=54 Runoff=4.50 cfs 0.581 af
<b>Subcatchment 110: Post-110</b>	Runoff Area=2.675 ac 14.06% Impervious Runoff Depth=0.84" Flow Length=250' Tc=17.4 min CN=45 Runoff=1.21 cfs 0.188 af
<b>Subcatchment 120: Post-120</b>	Runoff Area=0.381 ac 61.42% Impervious Runoff Depth=3.37" Tc=6.0 min CN=75 Runoff=1.51 cfs 0.107 af
<b>Pond 121: Post DP-1 Expanded Existing</b>	Peak Elev=33.92' Storage=12,427 cf Inflow=6.28 cfs 0.875 af Outflow=1.08 cfs 0.875 af
<b>Subcatchment 200: Post-200</b>	Runoff Area=3.704 ac 35.31% Impervious Runoff Depth=1.90" Flow Length=718' Tc=18.8 min CN=59 Runoff=5.32 cfs 0.587 af
<b>Subcatchment 210: Post-210</b>	Runoff Area=3.416 ac 41.77% Impervious Runoff Depth=2.25" Flow Length=436' Tc=23.5 min CN=63 Runoff=5.47 cfs 0.640 af
<b>Subcatchment 220: Post-220</b>	Runoff Area=6.461 ac 17.64% Impervious Runoff Depth=2.07" Flow Length=181' Tc=12.3 min CN=61 Runoff=12.15 cfs 1.116 af
<b>Subcatchment 230: Post-230</b>	Runoff Area=1.166 ac 40.31% Impervious Runoff Depth=2.16" Tc=6.0 min CN=62 Runoff=2.84 cfs 0.210 af
<b>Subcatchment 240: Post-240</b>	Runoff Area=0.965 ac 25.08% Impervious Runoff Depth=1.27" Flow Length=131' Tc=16.1 min CN=51 Runoff=0.86 cfs 0.102 af
<b>Subcatchment 250: Post-250</b>	Runoff Area=0.410 ac 36.34% Impervious Runoff Depth=1.99" Tc=6.0 min CN=60 Runoff=0.91 cfs 0.068 af
<b>Reach 251: Tarn Street Swale (East to</b>	Avg. Flow Depth=0.16' Max Vel=2.23 fps Inflow=0.91 cfs 0.068 af n=0.030 L=173.0' S=0.0300 '/' Capacity=30.54 cfs Outflow=0.89 cfs 0.068 af
<b>Pond 252.1: WQ Area - Infiltration Pond D</b>	Peak Elev=37.06' Storage=461 cf Inflow=1.44 cfs 0.170 af Discarded=0.08 cfs 0.079 af Primary=1.36 cfs 0.091 af Outflow=1.44 cfs 0.170 af
<b>Pond 252.2: Infiltration Pond D</b>	Peak Elev=36.19' Storage=971 cf Inflow=1.36 cfs 0.091 af Discarded=0.63 cfs 0.091 af Primary=0.00 cfs 0.000 af Outflow=0.63 cfs 0.091 af
<b>Subcatchment 260: Post-260</b>	Runoff Area=1.210 ac 41.32% Impervious Runoff Depth=2.25" Tc=6.0 min CN=63 Runoff=3.09 cfs 0.227 af
<b>Reach 261: Tarn Street Swale (North to</b>	Avg. Flow Depth=0.42' Max Vel=2.19 fps Inflow=3.09 cfs 0.227 af n=0.030 L=205.0' S=0.0100 '/' Capacity=9.58 cfs Outflow=3.01 cfs 0.227 af
<b>Pond 262.1: WQ Area - Infiltration Pond F</b>	Peak Elev=36.12' Storage=685 cf Inflow=3.01 cfs 0.227 af Discarded=0.07 cfs 0.087 af Primary=2.94 cfs 0.140 af Outflow=3.01 cfs 0.227 af

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Type III 24-hr 25-Year Rainfall=6.10"

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**Pond 262.2: Infiltration Pond F** Peak Elev=34.34' Storage=1,786 cf Inflow=2.94 cfs 0.140 af  
Discarded=0.83 cfs 0.140 af Primary=0.00 cfs 0.000 af Outflow=0.83 cfs 0.140 af

**Reach 263: Ponds to Wetlands** Inflow=0.00 cfs 0.000 af  
Outflow=0.00 cfs 0.000 af

**Pond 264: Post DP-2 South Wetland** Peak Elev=33.11' Storage=61,158 cf Inflow=22.82 cfs 2.553 af  
Outflow=1.58 cfs 2.553 af

**Subcatchment 300: Pre-30** Runoff Area=0.174 ac 3.45% Impervious Runoff Depth=0.23"  
Tc=6.0 min CN=34 Runoff=0.01 cfs 0.003 af

**Reach 301: Pre DL-3 East Offsite** Inflow=0.01 cfs 0.003 af  
Outflow=0.01 cfs 0.003 af

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#### 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

<b>Subcatchment9: Pre-9</b>	Runoff Area=1.377 ac 0.00% Impervious Runoff Depth=0.54" Tc=6.0 min CN=30 Runoff=0.26 cfs 0.062 af
<b>Subcatchment10: Pre-10</b>	Runoff Area=4.655 ac 27.69% Impervious Runoff Depth=3.02" Flow Length=461' Tc=23.5 min CN=54 Runoff=9.95 cfs 1.170 af
<b>Subcatchment11: Pre-11</b>	Runoff Area=2.264 ac 16.61% Impervious Runoff Depth=2.12" Flow Length=250' Tc=17.4 min CN=46 Runoff=3.50 cfs 0.399 af
<b>Subcatchment12: Pre-12</b>	Runoff Area=0.381 ac 61.42% Impervious Runoff Depth=5.50" Tc=6.0 min CN=75 Runoff=2.44 cfs 0.174 af
<b>Pond 13: Pre DP-1 Existing Ponding North</b>	Peak Elev=36.25' Storage=45,378 cf Inflow=14.48 cfs 1.806 af Outflow=1.09 cfs 1.806 af
<b>Subcatchment20: Pre-20</b>	Runoff Area=3.705 ac 35.33% Impervious Runoff Depth=3.60" Flow Length=718' Tc=18.8 min CN=59 Runoff=10.62 cfs 1.110 af
<b>Subcatchment21: Pre-21</b>	Runoff Area=3.416 ac 41.77% Impervious Runoff Depth=4.07" Flow Length=436' Tc=23.5 min CN=63 Runoff=10.18 cfs 1.157 af
<b>Subcatchment22: Pre-22</b>	Runoff Area=7.847 ac 15.02% Impervious Runoff Depth=3.25" Flow Length=317' Tc=14.6 min CN=56 Runoff=22.12 cfs 2.123 af
<b>Subcatchment23: Pre-23</b>	Runoff Area=1.165 ac 40.34% Impervious Runoff Depth=3.95" Tc=6.0 min CN=62 Runoff=5.36 cfs 0.383 af
<b>Pond 24: Pre DP-2 South Wetland</b>	Peak Elev=34.01' Storage=131,416 cf Inflow=44.19 cfs 4.774 af Outflow=2.11 cfs 4.774 af
<b>Subcatchment30: Pre-30</b>	Runoff Area=0.233 ac 2.58% Impervious Runoff Depth=0.80" Tc=6.0 min CN=33 Runoff=0.09 cfs 0.015 af
<b>Subcatchment31: Pre-31</b>	Runoff Area=0.174 ac 8.05% Impervious Runoff Depth=0.98" Tc=6.0 min CN=35 Runoff=0.10 cfs 0.014 af
<b>Reach 32: Pre DL-3 East Offsite</b>	Inflow=0.18 cfs 0.030 af Outflow=0.18 cfs 0.030 af

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

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**Summary for Subcatchment 9: Pre-9**

Runoff = 0.26 cfs @ 12.38 hrs, Volume= 0.062 af, Depth= 0.54"

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 (ac)	CN	Description
1.377	30	Woods, Good, HSG A
1.377	30	100.00% Pervious Area

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

**Summary for Subcatchment 10: Pre-10**

Runoff = 9.95 cfs @ 12.35 hrs, Volume= 1.170 af, Depth= 3.02"

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 (ac)	CN	Description
1.289	98	Paved parking, HSG A
0.766	30	Woods, Good, HSG A
2.600	39	>75% Grass cover, Good, HSG A
4.655	54	Weighted Average
3.366	37	72.31% Pervious Area
1.289	98	27.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0200	0.08		<b>Sheet Flow, 10A-10B</b> Grass: Bermuda n= 0.410 P2= 3.30"
1.9	361	0.0400	3.22		<b>Shallow Concentrated Flow, 10B-10C</b> Unpaved Kv= 16.1 fps
23.5	461	Total			

**Summary for Subcatchment 11: Pre-11**

Runoff = 3.50 cfs @ 12.27 hrs, Volume= 0.399 af, Depth= 2.12"

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"

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

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Area (ac)	CN	Description
0.376	98	Paved parking, HSG A
0.703	30	Woods, Good, HSG A
1.185	39	>75% Grass cover, Good, HSG A
2.264	46	Weighted Average
1.888	36	83.39% Pervious Area
0.376	98	16.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	100	0.0400	0.10		<b>Sheet Flow, 12A-12B</b> Grass: Bermuda n= 0.410 P2= 3.30"
1.1	150	0.0200	2.28		<b>Shallow Concentrated Flow, 12B-12C</b> Unpaved Kv= 16.1 fps
17.4	250	Total			

**Summary for Subcatchment 12: Pre-12**

Runoff = 2.44 cfs @ 12.09 hrs, Volume= 0.174 af, Depth= 5.50"

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 (ac)	CN	Description
0.234	98	Paved parking, HSG A
0.147	39	>75% Grass cover, Good, HSG A
0.381	75	Weighted Average
0.147	39	38.58% Pervious Area
0.234	98	61.42% Impervious Area

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

**Summary for Pond 13: Pre DP-1 Existing Ponding North**

Inflow Area = 8.677 ac, 21.89% Impervious, Inflow Depth = 2.50" for 100-Year event  
 Inflow = 14.48 cfs @ 12.32 hrs, Volume= 1.806 af  
 Outflow = 1.09 cfs @ 16.30 hrs, Volume= 1.806 af, Atten= 92%, Lag= 239.0 min  
 Discarded = 1.09 cfs @ 16.30 hrs, Volume= 1.806 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 36.25' @ 16.30 hrs Surf.Area= 46,239 sf Storage= 45,378 cf

Plug-Flow detention time= 573.7 min calculated for 1.805 af (100% of inflow)  
 Center-of-Mass det. time= 573.8 min ( 1,447.6 - 873.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	189,854 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
34.00	3,180	490.0	0	0	3,180
36.00	38,125	1,683.0	34,877	34,877	209,487
38.00	125,240	2,491.0	154,976	189,854	477,902

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=1.09 cfs @ 16.30 hrs HW=36.25' (Free Discharge)  
 ↑**1=Exfiltration** (Exfiltration Controls 1.09 cfs)

**Summary for Subcatchment 20: Pre-20**

Runoff = 10.62 cfs @ 12.26 hrs, Volume= 1.110 af, Depth= 3.60"

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 (ac)	CN	Description
1.309	98	Paved parking, HSG A
0.280	30	Woods, Good, HSG A
2.116	39	>75% Grass cover, Good, HSG A
3.705	59	Weighted Average
2.396	38	64.67% Pervious Area
1.309	98	35.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	100	0.0400	0.10		<b>Sheet Flow, 20A-20B</b> Grass: Bermuda n= 0.410 P2= 3.30"
1.4	226	0.0300	2.79		<b>Shallow Concentrated Flow, 20B-20C</b> Unpaved Kv= 16.1 fps
1.1	392	0.0800	5.74		<b>Shallow Concentrated Flow, 20C-20D</b> Paved Kv= 20.3 fps
18.8	718	Total			

**Summary for Subcatchment 21: Pre-21**

Runoff = 10.18 cfs @ 12.33 hrs, Volume= 1.157 af, Depth= 4.07"

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 (ac)	CN	Description
1.427	98	Paved parking, HSG A
0.158	30	Woods, Good, HSG A
1.831	39	>75% Grass cover, Good, HSG A
3.416	63	Weighted Average
1.989	38	58.23% Pervious Area
1.427	98	41.77% Impervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0200	0.08		<b>Sheet Flow, 21A-21B</b>
					Grass: Bermuda n= 0.410 P2= 3.30"
1.1	107	0.0100	1.61		<b>Shallow Concentrated Flow, 21B-21C</b>
					Unpaved Kv= 16.1 fps
0.8	229	0.0500	4.54		<b>Shallow Concentrated Flow, 21C-21D</b>
					Paved Kv= 20.3 fps
23.5	436	Total			

**Summary for Subcatchment 22: Pre-22**

Runoff = 22.12 cfs @ 12.21 hrs, Volume= 2.123 af, Depth= 3.25"

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 (ac)	CN	Description
1.179	98	Paved parking, HSG A
2.514	30	Woods, Good, HSG A
1.967	39	>75% Grass cover, Good, HSG A
1.727	77	Woods, Good, HSG D
0.460	80	>75% Grass cover, Good, HSG D
7.847	56	Weighted Average
6.668	48	84.98% Pervious Area
1.179	98	15.02% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.9	100	0.0600	0.12		<b>Sheet Flow, 22A-22B</b>
					Grass: Bermuda n= 0.410 P2= 3.30"
0.7	217	0.0900	4.83		<b>Shallow Concentrated Flow, 22B-22C</b>
					Unpaved Kv= 16.1 fps
14.6	317	Total			

**Summary for Subcatchment 23: Pre-23**

Runoff = 5.36 cfs @ 12.09 hrs, Volume= 0.383 af, Depth= 3.95"

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 (ac)	CN	Description
0.470	98	Paved parking, HSG A
0.068	30	Woods, Good, HSG A
0.627	39	>75% Grass cover, Good, HSG A
1.165	62	Weighted Average
0.695	38	59.66% Pervious Area
0.470	98	40.34% Impervious Area

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

**Summary for Pond 24: Pre DP-2 South Wetland**

Inflow Area = 16.133 ac, 27.18% Impervious, Inflow Depth = 3.55" for 100-Year event  
 Inflow = 44.19 cfs @ 12.24 hrs, Volume= 4.774 af  
 Outflow = 2.11 cfs @ 17.21 hrs, Volume= 4.774 af, Atten= 95%, Lag= 298.4 min  
 Discarded = 2.11 cfs @ 17.21 hrs, Volume= 4.774 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 34.01' @ 17.21 hrs Surf.Area= 89,553 sf Storage= 131,416 cf

Plug-Flow detention time= 727.9 min calculated for 4.773 af (100% of inflow)  
 Center-of-Mass det. time= 728.0 min ( 1,583.8 - 855.8 )

Volume	Invert	Avail.Storage	Storage Description		
#1	32.00'	609,999 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
32.00	43,560	1,513.0	0	0	43,560
34.00	89,342	1,681.1	130,191	130,191	86,407
36.00	122,709	1,545.8	211,170	341,361	121,300
38.00	146,274	1,624.0	268,638	609,999	141,278

Device	Routing	Invert	Outlet Devices	
#1	Discarded	32.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'	

**Discarded OutFlow** Max=2.11 cfs @ 17.21 hrs HW=34.01' (Free Discharge)  
 ↑**1=Exfiltration** (Exfiltration Controls 2.11 cfs)

**Summary for Subcatchment 30: Pre-30**

Runoff = 0.09 cfs @ 12.29 hrs, Volume= 0.015 af, Depth= 0.80"

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 (ac)	CN	Description
0.006	98	Paved parking, HSG A
0.198	30	Woods, Good, HSG A
0.029	39	>75% Grass cover, Good, HSG A
0.233	33	Weighted Average
0.227	31	97.42% Pervious Area
0.006	98	2.58% Impervious Area

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

**Summary for Subcatchment 31: Pre-31**

Runoff = 0.10 cfs @ 12.14 hrs, Volume= 0.014 af, Depth= 0.98"

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 (ac)	CN	Description
0.014	98	Paved parking, HSG A
0.160	30	Woods, Good, HSG A
0.174	35	Weighted Average
0.160	30	91.95% Pervious Area
0.014	98	8.05% Impervious Area

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

**Summary for Reach 32: Pre DL-3 East Offsite**

Inflow Area = 0.407 ac, 4.91% Impervious, Inflow Depth = 0.88" for 100-Year event  
 Inflow = 0.18 cfs @ 12.15 hrs, Volume= 0.030 af  
 Outflow = 0.18 cfs @ 12.15 hrs, Volume= 0.030 af, Atten= 0%, Lag= 0.0 min

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

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

<b>Subcatchment 100: Post-100</b>	Runoff Area=4.655 ac 27.69% Impervious Runoff Depth=3.02" Flow Length=461' Tc=23.5 min CN=54 Runoff=9.95 cfs 1.170 af
<b>Subcatchment 110: Post-110</b>	Runoff Area=2.675 ac 14.06% Impervious Runoff Depth=2.01" Flow Length=250' Tc=17.4 min CN=45 Runoff=3.85 cfs 0.447 af
<b>Subcatchment 120: Post-120</b>	Runoff Area=0.381 ac 61.42% Impervious Runoff Depth=5.50" Tc=6.0 min CN=75 Runoff=2.44 cfs 0.174 af
<b>Pond 121: Post DP-1 Expanded Existing</b>	Peak Elev=36.06' Storage=41,083 cf Inflow=14.58 cfs 1.792 af Outflow=1.08 cfs 1.792 af
<b>Subcatchment 200: Post-200</b>	Runoff Area=3.704 ac 35.31% Impervious Runoff Depth=3.60" Flow Length=718' Tc=18.8 min CN=59 Runoff=10.61 cfs 1.110 af
<b>Subcatchment 210: Post-210</b>	Runoff Area=3.416 ac 41.77% Impervious Runoff Depth=4.07" Flow Length=436' Tc=23.5 min CN=63 Runoff=10.18 cfs 1.157 af
<b>Subcatchment 220: Post-220</b>	Runoff Area=6.461 ac 17.64% Impervious Runoff Depth=3.83" Flow Length=181' Tc=12.3 min CN=61 Runoff=23.38 cfs 2.062 af
<b>Subcatchment 230: Post-230</b>	Runoff Area=1.166 ac 40.31% Impervious Runoff Depth=3.95" Tc=6.0 min CN=62 Runoff=5.37 cfs 0.384 af
<b>Subcatchment 240: Post-240</b>	Runoff Area=0.965 ac 25.08% Impervious Runoff Depth=2.67" Flow Length=131' Tc=16.1 min CN=51 Runoff=2.08 cfs 0.215 af
<b>Subcatchment 250: Post-250</b>	Runoff Area=0.410 ac 36.34% Impervious Runoff Depth=3.71" Tc=6.0 min CN=60 Runoff=1.77 cfs 0.127 af
<b>Reach 251: Tarn Street Swale (East to</b>	Avg. Flow Depth=0.23' Max Vel=2.75 fps Inflow=1.77 cfs 0.127 af n=0.030 L=173.0' S=0.0300 '/' Capacity=30.54 cfs Outflow=1.75 cfs 0.127 af
<b>Pond 252.1: WQ Area - Infiltration Pond D</b>	Peak Elev=37.31' Storage=566 cf Inflow=3.24 cfs 0.342 af Discarded=0.08 cfs 0.094 af Primary=3.16 cfs 0.248 af Outflow=3.24 cfs 0.342 af
<b>Pond 252.2: Infiltration Pond D</b>	Peak Elev=37.31' Storage=3,444 cf Inflow=3.16 cfs 0.248 af Discarded=1.03 cfs 0.248 af Primary=0.00 cfs 0.000 af Outflow=1.03 cfs 0.248 af
<b>Subcatchment 260: Post-260</b>	Runoff Area=1.210 ac 41.32% Impervious Runoff Depth=4.07" Tc=6.0 min CN=63 Runoff=5.75 cfs 0.410 af
<b>Reach 261: Tarn Street Swale (North to</b>	Avg. Flow Depth=0.58' Max Vel=2.61 fps Inflow=5.75 cfs 0.410 af n=0.030 L=205.0' S=0.0100 '/' Capacity=9.58 cfs Outflow=5.64 cfs 0.410 af
<b>Pond 262.1: WQ Area - Infiltration Pond F</b>	Peak Elev=36.18' Storage=708 cf Inflow=5.64 cfs 0.410 af Discarded=0.07 cfs 0.098 af Primary=5.56 cfs 0.312 af Outflow=5.64 cfs 0.410 af

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**Pond 262.2: Infiltration Pond F**

Peak Elev=35.78' Storage=5,131 cf Inflow=5.56 cfs 0.312 af  
Discarded=0.91 cfs 0.312 af Primary=0.00 cfs 0.000 af Outflow=0.91 cfs 0.312 af

**Reach 263: Ponds to Wetlands**

Inflow=0.00 cfs 0.000 af  
Outflow=0.00 cfs 0.000 af

**Pond 264: Post DP-2 South Wetland**

Peak Elev=33.99' Storage=129,577 cf Inflow=44.09 cfs 4.713 af  
Outflow=2.11 cfs 4.713 af

**Subcatchment 300: Pre-30**

Runoff Area=0.174 ac 3.45% Impervious Runoff Depth=0.89"  
Tc=6.0 min CN=34 Runoff=0.08 cfs 0.013 af

**Reach 301: Pre DL-3 East Offsite**

Inflow=0.08 cfs 0.013 af  
Outflow=0.08 cfs 0.013 af

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**Summary for Subcatchment 100: Post-100**

Runoff = 9.95 cfs @ 12.35 hrs, Volume= 1.170 af, Depth= 3.02"

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 (ac)	CN	Description
1.289	98	Paved parking, HSG A
0.766	30	Woods, Good, HSG A
2.600	39	>75% Grass cover, Good, HSG A
4.655	54	Weighted Average
3.366	37	72.31% Pervious Area
1.289	98	27.69% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0200	0.08		<b>Sheet Flow, 1A-1B</b> Grass: Bermuda n= 0.410 P2= 3.30"
1.9	361	0.0400	3.22		<b>Shallow Concentrated Flow, 1B-1C</b> Unpaved Kv= 16.1 fps
23.5	461	Total			

**Summary for Subcatchment 110: Post-110**

Runoff = 3.85 cfs @ 12.28 hrs, Volume= 0.447 af, Depth= 2.01"

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 (ac)	CN	Description
0.376	98	Paved parking, HSG A
0.617	30	Woods, Good, HSG A
1.682	39	>75% Grass cover, Good, HSG A
2.675	45	Weighted Average
2.299	37	85.94% Pervious Area
0.376	98	14.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	100	0.0400	0.10		<b>Sheet Flow, 120A-120B</b> Grass: Bermuda n= 0.410 P2= 3.30"
1.1	150	0.0200	2.28		<b>Shallow Concentrated Flow, 120B-120C</b> Unpaved Kv= 16.1 fps
17.4	250	Total			

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**Summary for Subcatchment 120: Post-120**

Runoff = 2.44 cfs @ 12.09 hrs, Volume= 0.174 af, Depth= 5.50"

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 (ac)	CN	Description
0.234	98	Paved parking, HSG A
0.147	39	>75% Grass cover, Good, HSG A
0.381	75	Weighted Average
0.147	39	38.58% Pervious Area
0.234	98	61.42% Impervious Area

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

**Summary for Pond 121: Post DP-1 Expanded Existing Ponding North**

Inflow Area = 7.711 ac, 24.63% Impervious, Inflow Depth = 2.79" for 100-Year event  
 Inflow = 14.58 cfs @ 12.32 hrs, Volume= 1.792 af  
 Outflow = 1.08 cfs @ 11.86 hrs, Volume= 1.792 af, Atten= 93%, Lag= 0.0 min  
 Discarded = 1.08 cfs @ 11.86 hrs, Volume= 1.792 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 36.06' @ 16.27 hrs Surf.Area= 21,843 sf Storage= 41,083 cf

Plug-Flow detention time= 404.3 min calculated for 1.792 af (100% of inflow)  
 Center-of-Mass det. time= 404.3 min ( 1,275.8 - 871.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	32.00'	147,288 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
32.00	5,614	359.0	0	0	5,614
34.00	7,464	396.0	13,034	13,034	7,962
36.00	20,346	756.0	26,756	39,790	40,984
38.00	96,574	1,440.0	107,498	147,288	160,535

Device	Routing	Invert	Outlet Devices
#1	Discarded	32.00'	<b>8.270 in/hr Exfiltration over Surface area from 31.99' - 32.01'</b> Excluded Surface area = 0 sf Phase-In= 0.01'

**Discarded OutFlow** Max=1.08 cfs @ 11.86 hrs HW=32.07' (Free Discharge)  
 ↑**1=Exfiltration** (Exfiltration Controls 1.08 cfs)

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

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**Summary for Subcatchment 200: Post-200**

Runoff = 10.61 cfs @ 12.26 hrs, Volume= 1.110 af, Depth= 3.60"

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 (ac)	CN	Description
1.308	98	Paved parking, HSG A
0.280	30	Woods, Good, HSG A
2.116	39	>75% Grass cover, Good, HSG A
3.704	59	Weighted Average
2.396	38	64.69% Pervious Area
1.308	98	35.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	100	0.0400	0.10		<b>Sheet Flow, 200A-200B</b> Grass: Bermuda n= 0.410 P2= 3.30"
1.4	226	0.0300	2.79		<b>Shallow Concentrated Flow, 200B-200C</b> Unpaved Kv= 16.1 fps
1.1	392	0.0800	5.74		<b>Shallow Concentrated Flow, 200C-200D</b> Paved Kv= 20.3 fps
18.8	718	Total			

**Summary for Subcatchment 210: Post-210**

Runoff = 10.18 cfs @ 12.33 hrs, Volume= 1.157 af, Depth= 4.07"

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 (ac)	CN	Description
1.427	98	Paved parking, HSG A
0.158	30	Woods, Good, HSG A
1.831	39	>75% Grass cover, Good, HSG A
3.416	63	Weighted Average
1.989	38	58.23% Pervious Area
1.427	98	41.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0200	0.08		<b>Sheet Flow, 210A-210B</b> Grass: Bermuda n= 0.410 P2= 3.30"
1.1	107	0.0100	1.61		<b>Shallow Concentrated Flow, 210B-210C</b> Unpaved Kv= 16.1 fps
0.8	229	0.0500	4.54		<b>Shallow Concentrated Flow, 210C-210D</b> Paved Kv= 20.3 fps
23.5	436	Total			

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**Summary for Subcatchment 220: Post-220**

Runoff = 23.38 cfs @ 12.18 hrs, Volume= 2.062 af, Depth= 3.83"

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 (ac)	CN	Description
1.727	77	Woods, Good, HSG D
0.460	80	>75% Grass cover, Good, HSG D
1.140	98	Paved parking, HSG A
1.294	30	Woods, Good, HSG A
1.840	39	>75% Grass cover, Good, HSG A
6.461	61	Weighted Average
5.321	53	82.36% Pervious Area
1.140	98	17.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	100	0.0800	0.14		<b>Sheet Flow, 220A-220B</b> Woods: Light underbrush n= 0.400 P2= 3.30"
0.2	81	0.1200	5.58		<b>Shallow Concentrated Flow, 220B-220C</b> Unpaved Kv= 16.1 fps
12.3	181	Total			

**Summary for Subcatchment 230: Post-230**

Runoff = 5.37 cfs @ 12.09 hrs, Volume= 0.384 af, Depth= 3.95"

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 (ac)	CN	Description
0.470	98	Paved parking, HSG A
0.069	30	Woods, Good, HSG A
0.627	39	>75% Grass cover, Good, HSG A
1.166	62	Weighted Average
0.696	38	59.69% Pervious Area
0.470	98	40.31% Impervious Area

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

**Summary for Subcatchment 240: Post-240**

Runoff = 2.08 cfs @ 12.24 hrs, Volume= 0.215 af, Depth= 2.67"

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"

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Area (ac)	CN	Description
0.387	39	>75% Grass cover, Good, HSG A
0.336	30	Woods, Good, HSG A
* 0.242	98	Impervious
0.965	51	Weighted Average
0.723	35	74.92% Pervious Area
0.242	98	25.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.0	100	0.0400	0.10		<b>Sheet Flow, 12A-12B</b> Woods: Light underbrush n= 0.400 P2= 3.30"
0.1	31	0.0600	3.94		<b>Shallow Concentrated Flow, 12B-12C</b> Unpaved Kv= 16.1 fps
16.1	131	Total			

**Summary for Subcatchment 250: Post-250**

Runoff = 1.77 cfs @ 12.09 hrs, Volume= 0.127 af, Depth= 3.71"

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 (ac)	CN	Description
0.261	39	>75% Grass cover, Good, HSG A
* 0.149	98	Impervious
0.410	60	Weighted Average
0.261	39	63.66% Pervious Area
0.149	98	36.34% Impervious Area

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

**Summary for Reach 251: Tarn Street Swale (East to West)**

Inflow Area = 0.410 ac, 36.34% Impervious, Inflow Depth = 3.71" for 100-Year event  
 Inflow = 1.77 cfs @ 12.09 hrs, Volume= 0.127 af  
 Outflow = 1.75 cfs @ 12.10 hrs, Volume= 0.127 af, Atten= 1%, Lag= 0.7 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Max. Velocity= 2.75 fps, Min. Travel Time= 1.0 min  
 Avg. Velocity = 0.86 fps, Avg. Travel Time= 3.3 min

Peak Storage= 110 cf @ 12.10 hrs  
 Average Depth at Peak Storage= 0.23'  
 Bank-Full Depth= 1.00' Flow Area= 5.0 sf, Capacity= 30.54 cfs

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2.00' x 1.00' deep channel, n= 0.030 Earth, grassed & winding  
 Side Slope Z-value= 3.0 '/' Top Width= 8.00'  
 Length= 173.0' Slope= 0.0300 '/'  
 Inlet Invert= 42.00', Outlet Invert= 36.81'



**Summary for Pond 252.1: WQ Area - Infiltration Pond D**

Inflow Area = 1.375 ac, 28.44% Impervious, Inflow Depth = 2.98" for 100-Year event  
 Inflow = 3.24 cfs @ 12.15 hrs, Volume= 0.342 af  
 Outflow = 3.24 cfs @ 12.16 hrs, Volume= 0.342 af, Atten= 0%, Lag= 0.1 min  
 Discarded = 0.08 cfs @ 12.66 hrs, Volume= 0.094 af  
 Primary = 3.16 cfs @ 12.16 hrs, Volume= 0.248 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 37.31' @ 12.66 hrs Surf.Area= 441 sf Storage= 566 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)  
 Center-of-Mass det. time= 24.3 min ( 887.2 - 862.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	35.50'	1,176 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
35.50	185	0	0
38.00	540	906	906
38.50	540	270	1,176

Device	Routing	Invert	Outlet Devices
#1	Discarded	35.50'	<b>8.270 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	37.00'	<b>40.0' long x 3.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

**Discarded OutFlow** Max=0.08 cfs @ 12.66 hrs HW=37.31' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.08 cfs)

**Primary OutFlow** Max=3.16 cfs @ 12.16 hrs HW=37.10' TW=36.38' (Dynamic Tailwater)  
 ↑2=Broad-Crested Rectangular Weir (Weir Controls 3.16 cfs @ 0.78 fps)

**Summary for Pond 252.2: Infiltration Pond D**

Inflow Area = 1.375 ac, 28.44% Impervious, Inflow Depth = 2.16" for 100-Year event  
 Inflow = 3.16 cfs @ 12.16 hrs, Volume= 0.248 af  
 Outflow = 1.03 cfs @ 12.65 hrs, Volume= 0.248 af, Atten= 67%, Lag= 29.9 min  
 Discarded = 1.03 cfs @ 12.65 hrs, Volume= 0.248 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 37.31' @ 12.65 hrs Surf.Area= 2,755 sf Storage= 3,444 cf

Plug-Flow detention time= 32.4 min calculated for 0.248 af (100% of inflow)  
 Center-of-Mass det. time= 32.4 min ( 839.0 - 806.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	35.50'	5,590 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
35.50	1,218	0	0
36.00	1,485	676	676
38.00	3,429	4,914	5,590

Device	Routing	Invert	Outlet Devices
#1	Discarded	35.50'	<b>16.200 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	37.60'	<b>10.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=1.03 cfs @ 12.65 hrs HW=37.31' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 1.03 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=35.50' TW=0.00' (Dynamic Tailwater)  
 ↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

**Summary for Subcatchment 260: Post-260**

Runoff = 5.75 cfs @ 12.09 hrs, Volume= 0.410 af, Depth= 4.07"

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 (ac)	CN	Description
0.500	98	Impervious
0.704	39	>75% Grass cover, Good, HSG A
0.006	30	Woods, Good, HSG A
1.210	63	Weighted Average
0.710	39	58.68% Pervious Area
0.500	98	41.32% Impervious Area

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

**Summary for Reach 261: Tarn Street Swale (North to South)**

Inflow Area = 1.210 ac, 41.32% Impervious, Inflow Depth = 4.07" for 100-Year event  
 Inflow = 5.75 cfs @ 12.09 hrs, Volume= 0.410 af  
 Outflow = 5.64 cfs @ 12.11 hrs, Volume= 0.410 af, Atten= 2%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Max. Velocity= 2.61 fps, Min. Travel Time= 1.3 min  
 Avg. Velocity = 0.84 fps, Avg. Travel Time= 4.1 min

Peak Storage= 443 cf @ 12.11 hrs  
 Average Depth at Peak Storage= 0.58'  
 Bank-Full Depth= 0.75' Flow Area= 3.2 sf, Capacity= 9.58 cfs

2.00' x 0.75' deep channel, n= 0.030  
 Side Slope Z-value= 3.0 ' Top Width= 6.50'  
 Length= 205.0' Slope= 0.0100 '  
 Inlet Invert= 40.00', Outlet Invert= 37.95'



**Summary for Pond 262.1: WQ Area - Infiltration Pond F**

Inflow Area = 1.210 ac, 41.32% Impervious, Inflow Depth = 4.07" for 100-Year event  
 Inflow = 5.64 cfs @ 12.11 hrs, Volume= 0.410 af  
 Outflow = 5.64 cfs @ 12.11 hrs, Volume= 0.410 af, Atten= 0%, Lag= 0.1 min  
 Discarded = 0.07 cfs @ 11.60 hrs, Volume= 0.098 af  
 Primary = 5.56 cfs @ 12.11 hrs, Volume= 0.312 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 36.18' @ 12.11 hrs Surf.Area= 372 sf Storage= 708 cf

Plug-Flow detention time= 31.3 min calculated for 0.410 af (100% of inflow)  
 Center-of-Mass det. time= 31.3 min ( 870.6 - 839.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	34.00'	826 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
34.00	268	0	0
36.00	372	640	640
36.50	372	186	826

Device	Routing	Invert	Outlet Devices
#1	Discarded	34.00'	<b>8.270 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	36.00'	<b>29.0' long x 3.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

**Discarded OutFlow** Max=0.07 cfs @ 11.60 hrs HW=36.02' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.07 cfs)

**Primary OutFlow** Max=5.56 cfs @ 12.11 hrs HW=36.18' TW=34.45' (Dynamic Tailwater)

↳ **2=Broad-Crested Rectangular Weir** (Weir Controls 5.56 cfs @ 1.05 fps)

**Summary for Pond 262.2: Infiltration Pond F**

Inflow Area = 1.210 ac, 41.32% Impervious, Inflow Depth = 3.09" for 100-Year event  
 Inflow = 5.56 cfs @ 12.11 hrs, Volume= 0.312 af  
 Outflow = 0.91 cfs @ 12.62 hrs, Volume= 0.312 af, Atten= 84%, Lag= 30.5 min  
 Discarded = 0.91 cfs @ 12.62 hrs, Volume= 0.312 af  
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 35.78' @ 12.62 hrs Surf.Area= 2,436 sf Storage= 5,131 cf

Plug-Flow detention time= 47.5 min calculated for 0.312 af (100% of inflow)  
 Center-of-Mass det. time= 47.5 min ( 845.8 - 798.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	33.50'	7,079 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
33.50	2,053	0	0
34.00	2,156	1,052	1,052
36.00	2,471	4,627	5,679
36.50	3,128	1,400	7,079

Device	Routing	Invert	Outlet Devices
#1	Discarded	33.50'	<b>16.200 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'
#2	Primary	36.00'	<b>14.0' long x 10.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

**Discarded OutFlow** Max=0.91 cfs @ 12.62 hrs HW=35.78' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.91 cfs)

**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=33.50' TW=0.00' (Dynamic Tailwater)

↑2=Broad-Crested Rectangular Weir ( Controls 0.00 cfs)

**Summary for Reach 263: Ponds to Wetlands**

Inflow Area = 2.585 ac, 34.47% Impervious, Inflow Depth = 0.00" for 100-Year event  
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af  
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

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

**Summary for Pond 264: Post DP-2 South Wetland**

Inflow Area = 17.332 ac, 30.21% Impervious, Inflow Depth = 3.26" for 100-Year event  
 Inflow = 44.09 cfs @ 12.20 hrs, Volume= 4.713 af  
 Outflow = 2.11 cfs @ 17.01 hrs, Volume= 4.713 af, Atten= 95%, Lag= 288.4 min  
 Discarded = 2.11 cfs @ 17.01 hrs, Volume= 4.713 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs  
 Peak Elev= 33.99' @ 17.01 hrs Surf.Area= 89,157 sf Storage= 129,577 cf

Plug-Flow detention time= 717.9 min calculated for 4.712 af (100% of inflow)  
 Center-of-Mass det. time= 718.0 min ( 1,568.0 - 850.0 )

Volume	Invert	Avail.Storage	Storage Description			
#1	32.00'	609,999 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
32.00	43,560	1,513.0	0	0	43,560	
34.00	89,342	1,681.1	130,191	130,191	86,407	
36.00	122,709	1,545.8	211,170	341,361	121,300	
38.00	146,274	1,624.0	268,638	609,999	141,278	

Device	Routing	Invert	Outlet Devices	
#1	Discarded	32.00'	<b>1.020 in/hr Exfiltration over Surface area</b> Phase-In= 0.01'	

**Discarded OutFlow** Max=2.11 cfs @ 17.01 hrs HW=33.99' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 2.11 cfs)

**Summary for Subcatchment 300: Pre-30**

Runoff = 0.08 cfs @ 12.15 hrs, Volume= 0.013 af, Depth= 0.89"

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"

**2214-001-PHCD-INHS**

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

Prepared by DiPrete Engineering

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Area (ac)	CN	Description
* 0.006	98	Impervious
0.139	30	Woods, Good, HSG A
0.029	39	>75% Grass cover, Good, HSG A
0.174	34	Weighted Average
0.168	32	96.55% Pervious Area
0.006	98	3.45% Impervious Area

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

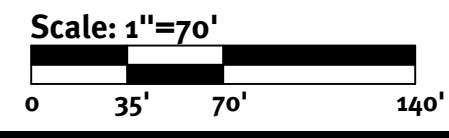
**Summary for Reach 301: Pre DL-3 East Offsite**

Inflow Area = 0.174 ac, 3.45% Impervious, Inflow Depth = 0.89" for 100-Year event  
 Inflow = 0.08 cfs @ 12.15 hrs, Volume= 0.013 af  
 Outflow = 0.08 cfs @ 12.15 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

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

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## Watershed Maps



Legend

- Woods - A Soils
- Grass - A Soils
- Impervious
- Woods - D Soils
- Grass - D Soils

Legend

- Tc Line (With Elevations)  1A  1B
- Subcat Area
- Soil Boundary
- Subcatchment 100
- Drainage Area 100
- Design Point 100

Pre Watershed Map  
**Wilson & Tarn Street Development**

Assessors: R187 571, Lots 221, 222 & 446  
 South Kingstown, Rhode Island  
 Prepared for:  
**South County Post & Beam Inc.**  
 521 Liberty Lane  
 West Kingstown, RI 02892  
 Tel: (401) 763-4415

**DiPrete Engineering**

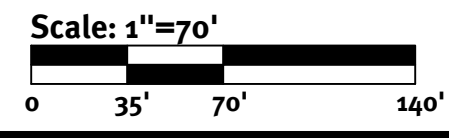
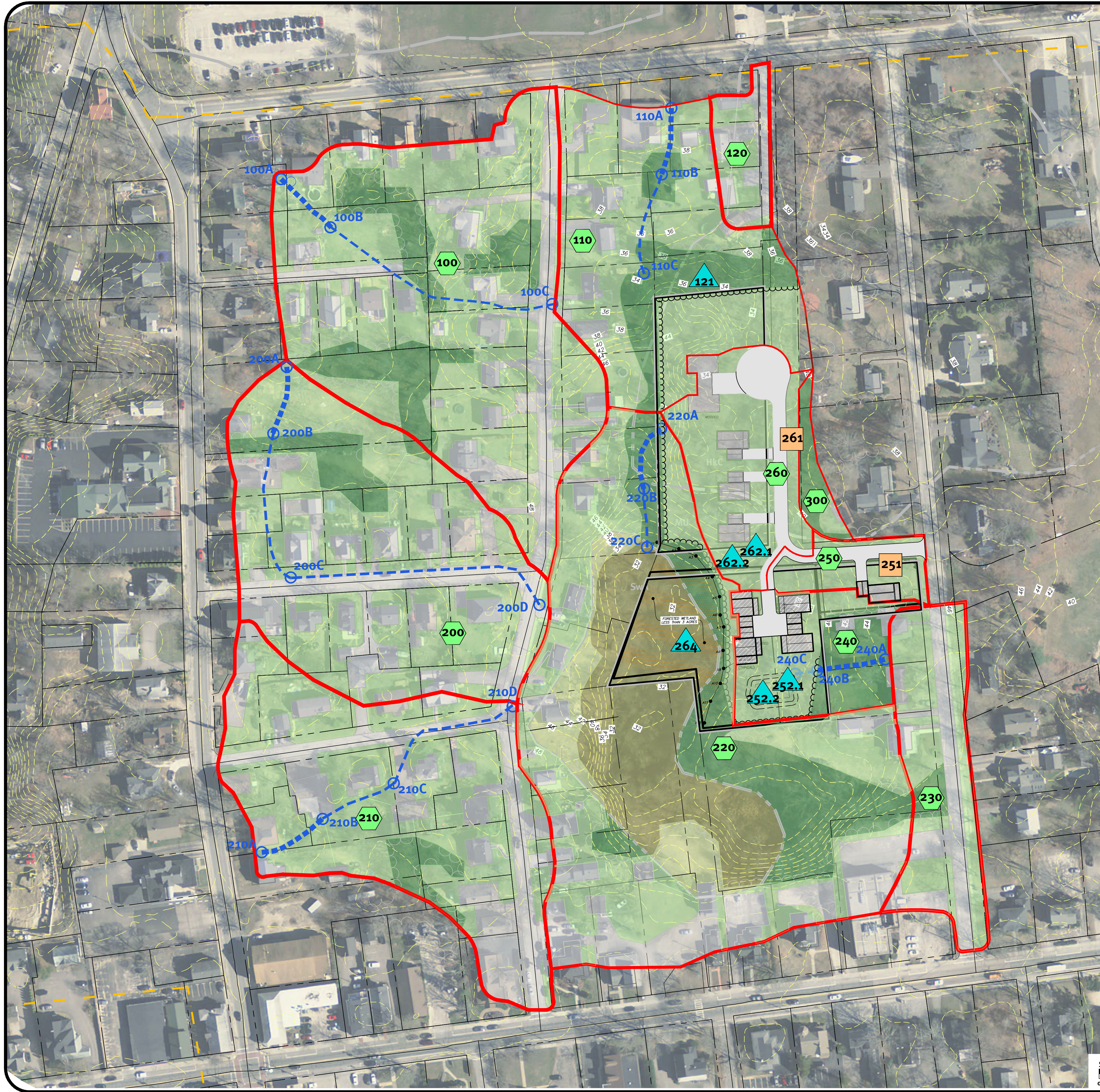
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Rev	Date	Description	By
5	11/26/2018	R187A Permit Modification Submittal to Comments	MSK
4	5/29/2018	R187A Wetlands Modification	MSK
3	9/27/2017	R187A Wetlands Modification	MSK
2	6/22/2017	R187A Wetlands Modification	MSK
1	6/22/2016	R187A Wetlands Modification	MSK
0	2/10/2016	R187A Wetland Submittal	DBR
1/0			

Drawn By: SEK  
 Designed by: RCG

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Legend

- Woods - A Soils
- Grass - A Soils
- Impervious
- Woods - D Soils
- Grass - D Soils

Legend

- Tc Line (With Elevations)
- Subcat Area
- Soil Boundary
- Subcatchment
- Drainage Area
- Swale/Design Point

**Post Watershed Map**  
**Wilson & Tarn Street Development**

Assessors: 0181 571 Lots 221, 222 & 446  
 South Kingstown, Rhode Island  
 Prepared for:  
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**Boston • Providence • Newport**

Rev	Date	Description	By	Appr
5	11/28/2018	RIPM Permit Modification Submittal Comments	MSK	
4	5/29/2018	RIPM Permit Modification Submittal	MSK	
3	9/27/2017	RIPM Permit Modification Submittal	MSK	
2	6/22/2016	RIPM Permit Modification Submittal	MSK	
1	6/22/2016	RIPM Permit Modification Submittal	MSK	
0	2/10/2016	RIPM Permit Modification Submittal	DBR	
1/0				

Drawn By: SEK  
 Designed by: RCG