

Stormwater Management Narrative for 380 Colchester Avenue

Application for City of Burlington Stormwater Permit

March 31, 2015

Prepared on Behalf of Nathaniel Hayward
By Engineering Ventures, Inc. of Burlington

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Attached Maps

HYD1: Pre-Development Drainage Area Map

HYD2: Post-Development Drainage Area Map

HYD3: Impervious Area Exhibit (For Stormwater Management Screening Form)

380 COLCHESTER AVENUE STORMWATER MANAGEMENT NARRATIVE

Project Description

The Applicant, Nathaniel Hayward, is planning on subdividing the property located at 380 Colchester Avenue in Burlington, VT. The existing property consists of 1.43 acres +/- and is located within the RL Zoning District. The lot will be divided into three (3) parcels as part of this application. In addition to subdividing the property, the Applicant will be converting the existing duplex (located on Lot 1) into a proposed triplex.

Existing Conditions

The site is located on the western side of Colchester Ave, approximately 1,000 feet south of the intersection of Colchester Ave and Riverside Avenue (US Route 2). The address is 380 Colchester Ave. A duplex and driveway currently exist on the southeastern portion of the property. The majority of the site is located on steep slopes and wooded areas. The runoff from the existing impervious areas mostly drains to an existing catch basin located on the western side of Colchester Ave. Runoff is conveyed from this catch basin via a 12" CMP to an existing 30" CMP that drains along the eastern side of Colchester Ave to an outlet at the Winooski River, approximately 1,200 ft to the north. The remainder of the site drains off the back of the property towards the northwest corner of the site. The soils located on the site are of Hydrologic Soil Group A.

Proposed Conditions

As stated in the project description, the existing duplex will be converted to a triplex, with a building addition being proposed on the north and west sides of the existing building. Parking for the proposed triplex will be provided in 3 spots at grade with the existing finished floor and 3 spots in the proposed garage, which will be set below the existing basement elevation. Access to the parking areas will be provided by two driveways, on the north and south side of the existing/proposed building. Most of the proposed impervious surfaces, as well as the existing building roof, will drain to one of three bio-retention/rain garden areas which will allow runoff to infiltrate and be treated prior to discharging to downstream areas. The proposed bio-retention areas will treat the runoff, then convey it to the existing catch basin located on the western side of Colchester Ave, where it will be conveyed to the existing system as it currently does today.

Stormwater Management Methodology

For purposes of analyzing this site, two (2) points of interests were established.

- Point of Interest #1

Point of Interest #1 (shown as P.O.I.#1) is located at the existing catch basin within Colchester Avenue. The existing area draining to this point from the site is 0.253 Ac and is comprised of existing impervious area, lawn, and wooded areas. The proposed area draining to this point from the site is 0.305 Ac. and is comprised of impervious areas and lawn areas. Three (3) bio-retention areas have been designed to treat the runoff from the post-development condition as well as reduce runoff rates and quantity for the lower intensity storms. The bio-retention areas were designed to meet the standards set forth in "The Vermont Stormwater Management Manual", with the areas containing 30" of amended soil mix, six inches of above-ground storage, and an overflow device. Due to the nature of the soils on site, assumed infiltration rates of 0.3"/hr were used to analyze all three bio-retention areas. It should be noted that infiltration testing will be performed during construction to verify the assumed rates.

Time of concentrations were calculated using the SCS Method, and runoff curve numbers were determined and input into HydroCAD (ver. 10.00) for both the pre-development and post-development conditions. Due to the large percentage of impervious area on the site, the time of concentrations to the proposed bio-retention areas were assumed to be 5 minutes. The peak rates (cubic feet per second) calculated for both pre-development and post-development conditions to P.O.I.#1 area as follows:

| | 1-YR | 2-YR | 10-YR | 25-YR | 100-YR |
|------------------------|------|------|-------|-------|--------|
| <i>Pre-Development</i> | 0.24 | 0.27 | 0.39 | 0.50 | 0.64 |
| Post-Development | 0.06 | 0.11 | 0.57 | 0.93 | 1.17 |

- Point of Interest #2

Point of Interest #2 (shown as P.O.I.#2) is located along the rear property line, northwest of the project development area. The existing area draining to this point from the site is 0.172 Ac and is comprised of mostly wooded and lawn areas. The proposed area draining to this point from the site is 0.120 Ac. The post-development drainage area is comprised of lawn area only for this project, as all the proposed impervious is being directed towards the bio-retention areas. However, future impervious areas (which are only concept designs now and are not shown on the submitted plans) will drain to this point of interest. These future areas have been accounted for in the stormwater analysis of this project. The purpose of showing the future development on THIS application is to show that even without any treatment, the increase in flow at this point of interest will be very minimal.

Time of concentrations were calculated using the SCS Method, and runoff curve numbers were determined and input into HydroCAD (ver. 10.00) for both the pre-development and post-development conditions. The peak rates (cubic feet per second) calculated for both pre-development and post-development conditions to P.O.I.#2 are as follows:

| | 1-YR | 2-YR | 10-YR | 25-YR | 100-YR |
|------------------------|-------------|-------------|--------------|--------------|---------------|
| <i>Pre-Development</i> | 0.02 | 0.02 | 0.04 | 0.05 | 0.06 |
| Post-Development | 0.13 | 0.15 | 0.22 | 0.28 | 0.36 |

Water Quality Volume (WQv) Treatment Calculation

In accordance with the Vermont Stormwater Management Manual, the project has been designed to treat the WQ storm event (or the 90% rule). Calculations have been provided within this report to show the required WQv and the volume provided in the amended soil area and 6" of above-ground storage for the three bio-retention areas. The results for the WQv calculations are as follows:

WQv required = 592 CF

Volume of Bio-Retention Area #1 = 140 CF

Volume of Bio-Retention Area #2 = 143 CF

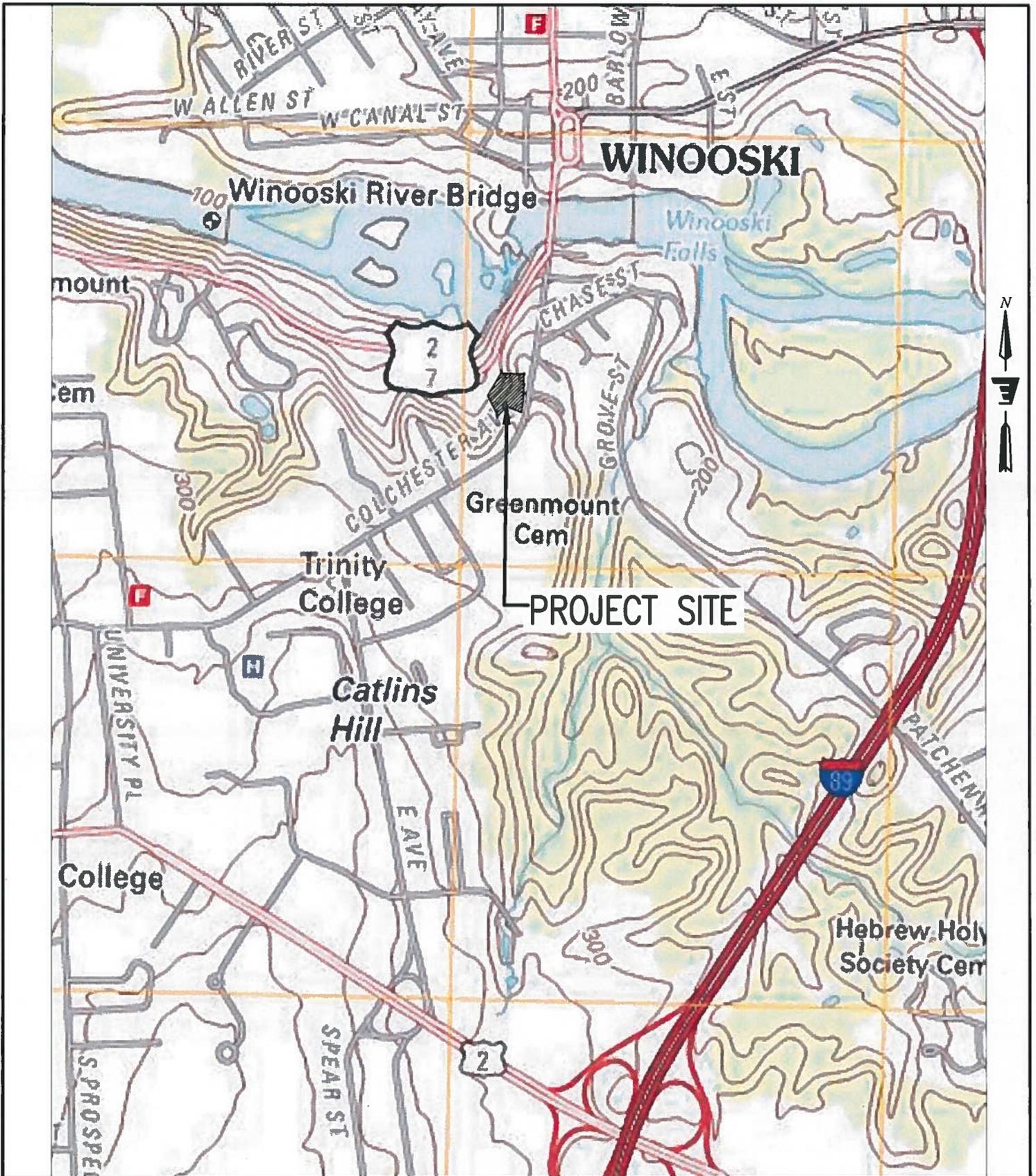
Volume of Bio-Retention Area #3 = 315 CF

TOTAL VOLUME TREATED = 598 CF

Conclusions of Stormwater Management Analysis

The development will reduce runoff peak rates and volume for the low-intensity storm events (1-YR and 2-YR) at the point where the project drains to the existing stormwater system within Colchester Avenue (P.O.I.#1). The larger storm events will result in slight increases at this point, with the greatest increase being a result of the 100-year storm event, which will increase peak rates by 0.53 CFS.

The development shows increases in runoff rate and volume at the rear property line (P.O.I.#2); however, these increases, again, are very minimal, with the largest increase being 0.30 CFS in the 100-year storm event. Runoff draining to P.O.I.#2 will flow through a large wooded area prior to reaching this point which will slow the runoff as it does in the existing conditions, which will result in unnoticeable changes in runoff at this point of interest.



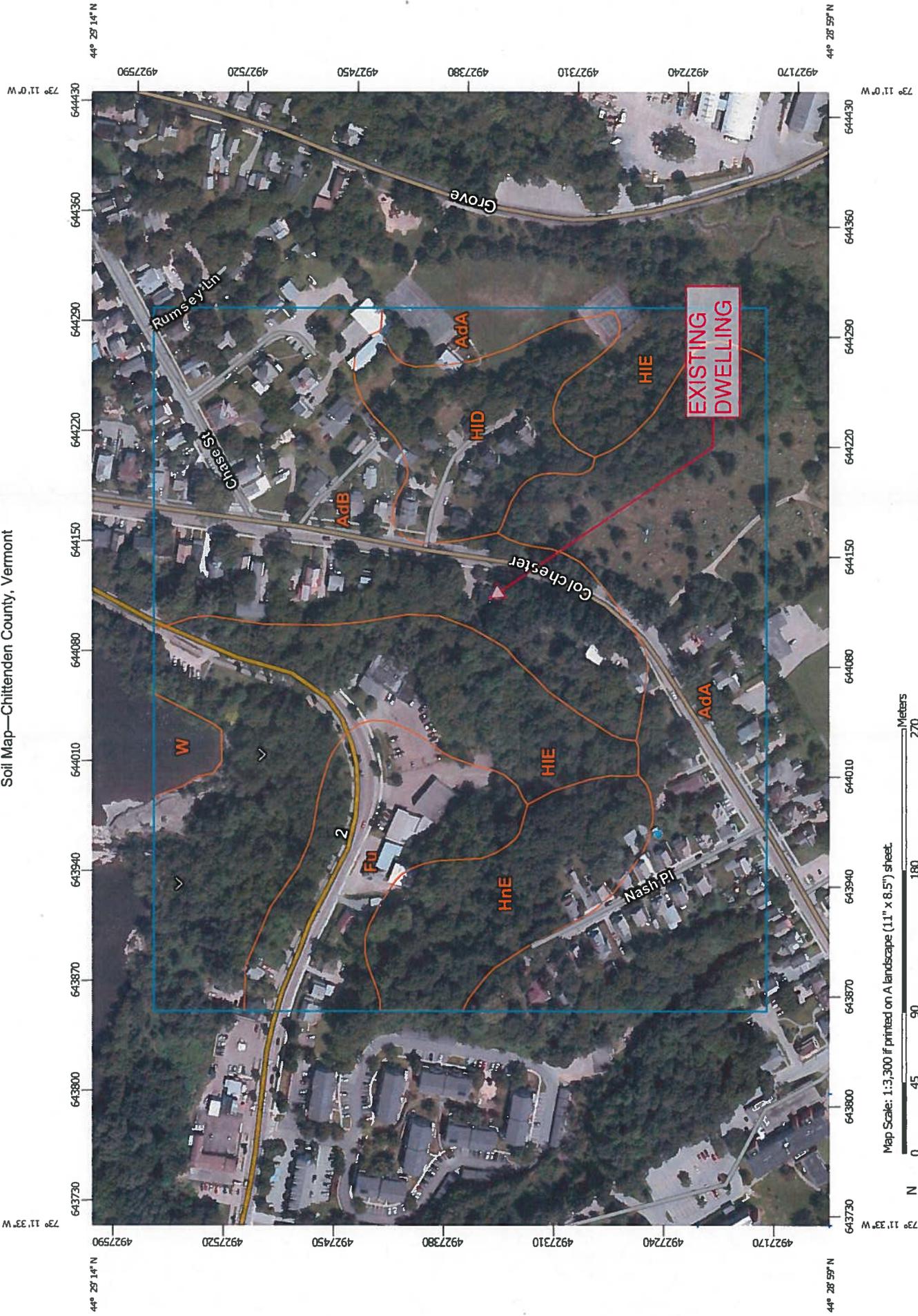
LOCATION MAP

**380 COLCHESTER AVENUE
BURLINGTON, VT 05401**

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| | |
|--------------------------|------------------------------|
| Checked By: MD | Scale: 1" = 1,000' |
| Drawn By: MD | Project No.: 14062 |
| Date: 02/26/15 | Drawing No.: LOC-1 |

Soil Map—Chittenden County, Vermont



Map Scale: 1:3,300 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84



Natural Resources Conservation Service

Web Soil Survey National Cooperative Soil Survey

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Chittenden County, Vermont

AdA—Adams and Windsor loamy sands, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 9g2p

Elevation: 90 to 1,200 feet

Mean annual precipitation: 30 to 50 inches

Mean annual air temperature: 37 to 52 degrees F

Frost-free period: 90 to 180 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Adams and similar soils: 43 percent

Windsor and similar soils: 43 percent

Minor components: 14 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor

Setting

Landform: Terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 6 inches: loamy sand

H2 - 6 to 23 inches: loamy sand

H3 - 23 to 65 inches: coarse sand

Properties and qualities

Slope: 0 to 5 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: A

Description of Adams

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy glaciofluvial deposits

Typical profile

H1 - 0 to 7 inches: loamy sand
H2 - 7 to 30 inches: loamy fine sand
H3 - 30 to 65 inches: loamy fine sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A

Minor Components

Colton

Percent of map unit: 7 percent
Landform: Terraces

Deerfield

Percent of map unit: 7 percent
Landform: Terraces, deltas

Data Source Information

Soil Survey Area: Chittenden County, Vermont
Survey Area Data: Version 17, Sep 24, 2014

Chittenden County, Vermont

HIE—Hartland very fine sandy loam, 25 to 60 percent slopes

Map Unit Setting

National map unit symbol: 9g4f
Elevation: 90 to 1,200 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 37 to 52 degrees F
Frost-free period: 90 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Hartland and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hartland

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 1 inches: very fine sandy loam
H2 - 1 to 23 inches: very fine sandy loam
H3 - 23 to 65 inches: very fine sandy loam

Properties and qualities

Slope: 25 to 60 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat):
Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B

Minor Components

Adams

Percent of map unit: 5 percent

Landform: Terraces

Agawam

Percent of map unit: 5 percent

Windsor

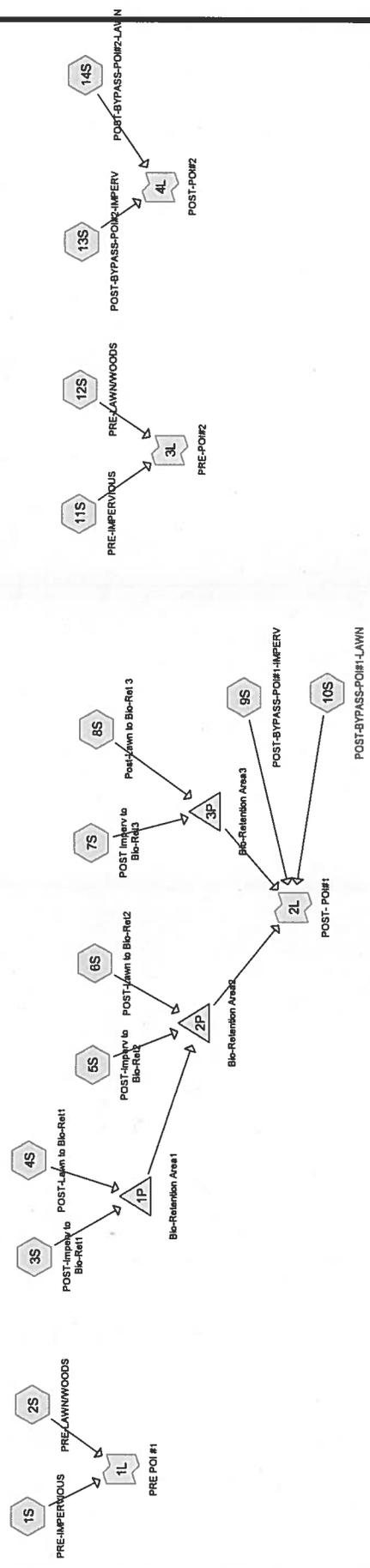
Percent of map unit: 5 percent

Landform: Terraces

Data Source Information

Soil Survey Area: Chittenden County, Vermont

Survey Area Data: Version 17, Sep 24, 2014



Legend:

- Subcat
- Reach
- Pond
- Link

Routing Diagram for 14062-SWM Model
 Prepared by Engineering Ventures, PC, Printed 2/26/2015
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14062-SWM Model

Prepared by Engineering Ventures, PC

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Type II 24-hr 1 YEAR Rainfall=1.94"

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Time span=1.00-80.00 hrs, dt=0.01 hrs, 7901 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|--|
| Subcatchment 1S: PRE-IMPERVIOUS | Runoff Area=0.086 ac 100.00% Impervious Runoff Depth=1.71" Flow Length=191' Tc=5.1 min CN=98 Runoff=0.24 cfs 0.012 af |
| Subcatchment 2S: PRE-LAWN/WOODS | Runoff Area=0.167 ac 0.00% Impervious Runoff Depth=0.00" Flow Length=191' Tc=5.1 min CN=35 Runoff=0.00 cfs 0.000 af |
| Subcatchment 3S: POST-Imperv to | Runoff Area=0.069 ac 100.00% Impervious Runoff Depth=1.71" Tc=5.0 min CN=98 Runoff=0.19 cfs 0.010 af |
| Subcatchment 4S: POST-Lawn to Bio-Ret1 | Runoff Area=0.025 ac 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 5S: POST-Imperv to | Runoff Area=0.012 ac 100.00% Impervious Runoff Depth=1.71" Tc=5.0 min CN=98 Runoff=0.03 cfs 0.002 af |
| Subcatchment 6S: POST-Lawn to Bio-Ret2 | Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 7S: POST Imperv to | Runoff Area=0.078 ac 100.00% Impervious Runoff Depth=1.71" Tc=5.0 min CN=98 Runoff=0.22 cfs 0.011 af |
| Subcatchment 8S: Post-Lawn to Bio-Ret 3 | Runoff Area=0.034 ac 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 9S: | Runoff Area=0.021 ac 100.00% Impervious Runoff Depth=1.71" Flow Length=186' Tc=5.0 min CN=98 Runoff=0.06 cfs 0.003 af |
| Subcatchment 10S: | Runoff Area=0.052 ac 0.00% Impervious Runoff Depth=0.00" Flow Length=186' Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 11S: PRE-IMPERVIOUS | Runoff Area=0.008 ac 100.00% Impervious Runoff Depth=1.71" Flow Length=284' Tc=5.8 min CN=98 Runoff=0.02 cfs 0.001 af |
| Subcatchment 12S: PRE-LAWN/WOODS | Runoff Area=0.169 ac 0.00% Impervious Runoff Depth=0.00" Flow Length=284' Tc=5.8 min CN=33 Runoff=0.00 cfs 0.000 af |
| Subcatchment 13S: | Runoff Area=0.049 ac 100.00% Impervious Runoff Depth=1.71" Tc=5.8 min CN=98 Runoff=0.13 cfs 0.007 af |
| Subcatchment 14S: | Runoff Area=0.073 ac 0.00% Impervious Runoff Depth=0.00" Tc=5.8 min CN=39 Runoff=0.00 cfs 0.000 af |
| Pond 1P: Bio-Retention Area1 | Peak Elev=500.34' Storage=157 cf Inflow=0.19 cfs 0.010 af Discarded=0.00 cfs 0.005 af Primary=0.18 cfs 0.005 af Outflow=0.18 cfs 0.010 af |
| Pond 2P: Bio-Retention Area2 | Peak Elev=494.77' Storage=147 cf Inflow=0.21 cfs 0.006 af Discarded=0.00 cfs 0.005 af Primary=0.02 cfs 0.002 af Outflow=0.02 cfs 0.006 af |

14062-SWM Model

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Type II 24-hr 1 YEAR Rainfall=1.94"

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Pond 3P: Bio-Retention Area3

Peak Elev=492.50' Storage=317 cf Inflow=0.22 cfs 0.011 af
Discarded=0.00 cfs 0.011 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.011 af

Link 1L: PRE POI #1

Inflow=0.24 cfs 0.012 af
Primary=0.24 cfs 0.012 af

Link 2L: POST- POI#1

Inflow=0.06 cfs 0.005 af
Primary=0.06 cfs 0.005 af

Link 3L: PRE-POI#2

Inflow=0.02 cfs 0.001 af
Primary=0.02 cfs 0.001 af

Link 4L: POST-POI#2

Inflow=0.13 cfs 0.007 af
Primary=0.13 cfs 0.007 af

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Type II 24-hr 1 YEAR Rainfall=1.94"

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Summary for Subcatchment 1S: PRE-IMPERVIOUS

Runoff = 0.24 cfs @ 11.96 hrs, Volume= 0.012 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| * 0.086 | 98 | Existing Impervious |
| 0.086 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 2.0 | 30 | 0.3300 | 0.24 | | Sheet Flow, AB Grass: Dense n= 0.240 P2= 2.40" |
| 2.6 | 30 | 0.1800 | 0.19 | | Sheet Flow, BC Grass: Dense n= 0.240 P2= 2.40" |
| 0.3 | 63 | 0.0550 | 3.78 | | Shallow Concentrated Flow, CD Unpaved Kv= 16.1 fps |
| 0.2 | 68 | 0.0880 | 6.02 | | Shallow Concentrated Flow, DE Paved Kv= 20.3 fps |
| 5.1 | 191 | Total | | | |

Summary for Subcatchment 2S: PRE-LAWN/WOODS

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.070 | 30 | Woods, Good, HSG A |
| 0.097 | 39 | >75% Grass cover, Good, HSG A |
| 0.167 | 35 | Weighted Average |
| 0.167 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 2.0 | 30 | 0.3300 | 0.24 | | Sheet Flow, AB Grass: Dense n= 0.240 P2= 2.40" |
| 2.6 | 30 | 0.1800 | 0.19 | | Sheet Flow, BC Grass: Dense n= 0.240 P2= 2.40" |
| 0.3 | 63 | 0.0550 | 3.78 | | Shallow Concentrated Flow, CD Unpaved Kv= 16.1 fps |
| 0.2 | 68 | 0.0880 | 6.02 | | Shallow Concentrated Flow, DE Paved Kv= 20.3 fps |
| 5.1 | 191 | Total | | | |

14062-SWM Model

Type II 24-hr 1 YEAR Rainfall=1.94"

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Summary for Subcatchment 3S: POST-Imperv to Bio-Ret1

Runoff = 0.19 cfs @ 11.96 hrs, Volume= 0.010 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|----------------------------------|
| * 0.069 | 98 | PROPOSED Impervious-Parking/Roof |
| 0.069 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 5.0 | | | | | Direct Entry, |

Summary for Subcatchment 4S: POST-Lawn to Bio-Ret1

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.025 | 39 | >75% Grass cover, Good, HSG A |
| 0.025 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 5.0 | | | | | Direct Entry, |

Summary for Subcatchment 5S: POST-Imperv to Bio-Ret2

Runoff = 0.03 cfs @ 11.96 hrs, Volume= 0.002 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|------------------------------------|
| * 0.012 | 98 | PROPOSED Impervious - Parking/Roof |
| 0.012 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 5.0 | | | | | Direct Entry, |

14062-SWM Model

Type II 24-hr 1 YEAR Rainfall=1.94"

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Summary for Subcatchment 6S: POST-Lawn to Bio-Ret2

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.017 | 39 | >75% Grass cover, Good, HSG A |
| 0.017 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 5.0 | | | | | Direct Entry, |

Summary for Subcatchment 7S: POST Imperv to Bio-Ret3

Runoff = 0.22 cfs @ 11.96 hrs, Volume= 0.011 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|------------------------------------|
| * 0.068 | 98 | PROPOSED Impervious - Parking/Roof |
| * 0.010 | 98 | FUTURE Impervious |
| 0.078 | 98 | Weighted Average |
| 0.078 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 5.0 | | | | | Direct Entry, |

Summary for Subcatchment 8S: Post-Lawn to Bio-Ret 3

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.034 | 39 | >75% Grass cover, Good, HSG A |
| 0.034 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 5.0 | | | | | Direct Entry, |

14062-SWM Model

Type II 24-hr 1 YEAR Rainfall=1.94"

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Summary for Subcatchment 9S: POST-BYPASS-POI#1-IMPERV

Runoff = 0.06 cfs @ 11.96 hrs, Volume= 0.003 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| * 0.021 | 98 | Proposed Impervious |
| 0.021 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 2.0 | 30 | 0.3300 | 0.24 | | Sheet Flow, AB Grass: Dense n= 0.240 P2= 2.40" |
| 2.6 | 20 | 0.0800 | 0.13 | | Sheet Flow, BC Grass: Dense n= 0.240 P2= 2.40" |
| 0.2 | 58 | 0.0800 | 4.55 | | Shallow Concentrated Flow, CD Unpaved Kv= 16.1 fps |
| 0.2 | 78 | 0.0760 | 5.60 | | Shallow Concentrated Flow, DE Paved Kv= 20.3 fps |
| 5.0 | 186 | Total | | | |

Summary for Subcatchment 10S: POST-BYPASS-POI#1-LAWN

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.052 | 39 | >75% Grass cover, Good, HSG A |
| 0.052 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 2.0 | 30 | 0.3300 | 0.24 | | Sheet Flow, AB Grass: Dense n= 0.240 P2= 2.40" |
| 2.6 | 20 | 0.0800 | 0.13 | | Sheet Flow, BC Grass: Dense n= 0.240 P2= 2.40" |
| 0.2 | 58 | 0.0800 | 4.55 | | Shallow Concentrated Flow, CD Unpaved Kv= 16.1 fps |
| 0.2 | 78 | 0.0760 | 5.60 | | Shallow Concentrated Flow, DE Paved Kv= 20.3 fps |
| 5.0 | 186 | Total | | | |

Summary for Subcatchment 11S: PRE-IMPERVIOUS

Runoff = 0.02 cfs @ 11.97 hrs, Volume= 0.001 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| * 0.008 | 98 | Existing Impervious |
| 0.008 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 1.8 | 26 | 0.3300 | 0.24 | | Sheet Flow, AB Grass: Dense n= 0.240 P2= 2.40" |
| 3.0 | 34 | 0.1600 | 0.19 | | Sheet Flow, BC Grass: Dense n= 0.240 P2= 2.40" |
| 0.2 | 59 | 0.1100 | 5.34 | | Shallow Concentrated Flow, CD Unpaved Kv= 16.1 fps |
| 0.8 | 165 | 0.5000 | 3.54 | | Shallow Concentrated Flow, DE Woodland Kv= 5.0 fps |
| 5.8 | 284 | Total | | | |

Summary for Subcatchment 12S: PRE-LAWN/WOODS

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.118 | 30 | Woods, Good, HSG A |
| 0.051 | 39 | >75% Grass cover, Good, HSG A |
| 0.169 | 33 | Weighted Average |
| 0.169 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 1.8 | 26 | 0.3300 | 0.24 | | Sheet Flow, AB Grass: Dense n= 0.240 P2= 2.40" |
| 3.0 | 34 | 0.1600 | 0.19 | | Sheet Flow, BC Grass: Dense n= 0.240 P2= 2.40" |
| 0.2 | 59 | 0.1100 | 5.34 | | Shallow Concentrated Flow, CD Unpaved Kv= 16.1 fps |
| 0.8 | 165 | 0.5000 | 3.54 | | Shallow Concentrated Flow, DE Woodland Kv= 5.0 fps |
| 5.8 | 284 | Total | | | |

14062-SWM Model

Type II 24-hr 1 YEAR Rainfall=1.94"

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Summary for Subcatchment 13S: POST-BYPASS-POI#2-IMPERV

Runoff = 0.13 cfs @ 11.97 hrs, Volume= 0.007 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------|
| * 0.049 | 98 | Future Impervious |
| 0.049 | | 100.00% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 5.8 | | | | | Direct Entry, |

Summary for Subcatchment 14S: POST-BYPASS-POI#2-LAWN

Runoff = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
Type II 24-hr 1 YEAR Rainfall=1.94"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| 0.073 | 39 | >75% Grass cover, Good, HSG A |
| 0.073 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|---------------|
| 5.8 | | | | | Direct Entry, |

Summary for Pond 1P: Bio-Retention Area1

Inflow Area = 0.094 ac, 73.40% Impervious, Inflow Depth = 1.26" for 1 YEAR event
 Inflow = 0.19 cfs @ 11.96 hrs, Volume= 0.010 af
 Outflow = 0.18 cfs @ 11.98 hrs, Volume= 0.010 af, Atten= 5%, Lag= 1.4 min
 Discarded = 0.00 cfs @ 11.98 hrs, Volume= 0.005 af
 Primary = 0.18 cfs @ 11.98 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
 Peak Elev= 500.34' @ 11.98 hrs Surf.Area= 224 sf Storage= 157 cf

Plug-Flow detention time= 580.4 min calculated for 0.010 af (100% of inflow)
 Center-of-Mass det. time= 580.6 min (1,344.2 - 763.7)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|---|
| #1 | 497.25' | 196 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |

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Type II 24-hr 1 YEAR Rainfall=1.94"

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| Elevation (feet) | Surf.Area (sq-ft) | Voids (%) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|------------------|-------------------|-----------|------------------------|------------------------|
| 497.25 | 128 | 0.0 | 0 | 0 |
| 499.75 | 128 | 17.0 | 54 | 54 |
| 500.00 | 170 | 100.0 | 37 | 92 |
| 500.25 | 203 | 100.0 | 47 | 138 |
| 500.50 | 262 | 100.0 | 58 | 196 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Discarded | 497.25' | 0.300 in/hr Exfiltration over Surface area |
| #2 | Primary | 496.50' | 6.0" Round Culvert L= 27.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 496.50' / 496.00' S= 0.0185 1' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf |
| #3 | Device 2 | 500.25' | 8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |

Discarded OutFlow Max=0.00 cfs @ 11.98 hrs HW=500.34' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.18 cfs @ 11.98 hrs HW=500.34' (Free Discharge)

↑2=Culvert (Passes 0.18 cfs of 1.79 cfs potential flow)

↑3=Orifice/Grate (Weir Controls 0.18 cfs @ 0.97 fps)

Summary for Pond 2P: Bio-Retention Area2

Inflow Area = 0.123 ac, 65.85% Impervious, Inflow Depth = 0.62" for 1 YEAR event
 Inflow = 0.21 cfs @ 11.98 hrs, Volume= 0.006 af
 Outflow = 0.02 cfs @ 12.37 hrs, Volume= 0.006 af, Atten= 90%, Lag= 23.9 min
 Discarded = 0.00 cfs @ 12.37 hrs, Volume= 0.005 af
 Primary = 0.02 cfs @ 12.37 hrs, Volume= 0.002 af

Routing by Stor-Ind method, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
 Peak Elev= 494.77' @ 12.37 hrs Surf.Area= 213 sf Storage= 147 cf

Plug-Flow detention time= 802.6 min calculated for 0.006 af (100% of inflow)
 Center-of-Mass det. time= 802.7 min (1,581.6 - 778.8)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|---------|---------------|--|
| #1 | 491.75' | 202 cf | Custom Stage Data (Prismatic) Listed below (Recalc) |

| Elevation (feet) | Surf.Area (sq-ft) | Voids (%) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|------------------|-------------------|-----------|------------------------|------------------------|
| 491.75 | 135 | 0.0 | 0 | 0 |
| 494.25 | 135 | 17.0 | 57 | 57 |
| 494.75 | 209 | 100.0 | 86 | 143 |
| 495.00 | 256 | 100.0 | 58 | 202 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Discarded | 491.75' | 0.300 in/hr Exfiltration over Surface area |
| #2 | Primary | 490.50' | 6.0" Round Culvert L= 34.0' CPP, square edge headwall, Ke= 0.500 |

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Type II 24-hr 1 YEAR Rainfall=1.94"

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Inlet / Outlet Invert= 490.50' / 490.30' S= 0.0059 '/' Cc= 0.900
 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf
 #3 Device 2 494.75' **8.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 12.37 hrs HW=494.77' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.02 cfs @ 12.37 hrs HW=494.77' (Free Discharge)
 ↑2=Culvert (Passes 0.02 cfs of 1.79 cfs potential flow)
 ↑3=Orifice/Grate (Weir Controls 0.02 cfs @ 0.45 fps)

Summary for Pond 3P: Bio-Retention Area3

Inflow Area = 0.112 ac, 69.64% Impervious, Inflow Depth = 1.19" for 1 YEAR event
 Inflow = 0.22 cfs @ 11.96 hrs, Volume= 0.011 af
 Outflow = 0.00 cfs @ 15.00 hrs, Volume= 0.011 af, Atten= 98%, Lag= 182.8 min
 Discarded = 0.00 cfs @ 15.00 hrs, Volume= 0.011 af
 Primary = 0.00 cfs @ 15.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs
 Peak Elev= 492.50' @ 15.00 hrs Surf.Area= 434 sf Storage= 317 cf

Plug-Flow detention time= 1,069.3 min calculated for 0.011 af (100% of inflow)
 Center-of-Mass det. time= 1,069.5 min (1,833.1 - 763.7)

| Volume | Invert | Avail.Storage | Storage Description | |
|------------------|-------------------|---------------|--|------------------------|
| #1 | 489.50' | 624 cf | Custom Stage Data (Prismatic) Listed below (Recalc) | |
| Elevation (feet) | Surf.Area (sq-ft) | Voids (%) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
| 489.50 | 307 | 0.0 | 0 | 0 |
| 492.00 | 307 | 17.0 | 130 | 130 |
| 492.50 | 432 | 100.0 | 185 | 315 |
| 493.00 | 804 | 100.0 | 309 | 624 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Discarded | 489.50' | 0.300 in/hr Exfiltration over Surface area |
| #2 | Primary | 490.30' | 12.0" Round Culvert L= 25.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 490.30' / 490.17' S= 0.0052 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.79 sf |
| #3 | Device 2 | 492.50' | 6.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |

Discarded OutFlow Max=0.00 cfs @ 15.00 hrs HW=492.50' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 15.00 hrs HW=492.50' (Free Discharge)
 ↑2=Culvert (Passes 0.00 cfs of 4.94 cfs potential flow)
 ↑3=Orifice/Grate (Weir Controls 0.00 cfs @ 0.18 fps)

Summary for Link 1L: PRE POI #1

Inflow Area = 0.253 ac, 33.99% Impervious, Inflow Depth = 0.58" for 1 YEAR event
Inflow = 0.24 cfs @ 11.96 hrs, Volume= 0.012 af
Primary = 0.24 cfs @ 11.96 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs

Summary for Link 2L: POST- POI#1

Inflow Area = 0.308 ac, 58.44% Impervious, Inflow Depth = 0.19" for 1 YEAR event
Inflow = 0.06 cfs @ 11.96 hrs, Volume= 0.005 af
Primary = 0.06 cfs @ 11.96 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs

Summary for Link 3L: PRE-POI#2

Inflow Area = 0.177 ac, 4.52% Impervious, Inflow Depth = 0.08" for 1 YEAR event
Inflow = 0.02 cfs @ 11.97 hrs, Volume= 0.001 af
Primary = 0.02 cfs @ 11.97 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs

Summary for Link 4L: POST-POI#2

Inflow Area = 0.122 ac, 40.16% Impervious, Inflow Depth = 0.69" for 1 YEAR event
Inflow = 0.13 cfs @ 11.97 hrs, Volume= 0.007 af
Primary = 0.13 cfs @ 11.97 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-80.00 hrs, dt= 0.01 hrs

14062-SWM Model

Type II 24-hr 2 YEAR Rainfall=2.20"

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Time span=1.00-80.00 hrs, dt=0.01 hrs, 7901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|--|
| Subcatchment 1S: PRE-IMPERVIOUS | Runoff Area=0.086 ac 100.00% Impervious Runoff Depth=1.97" Flow Length=191' Tc=5.1 min CN=98 Runoff=0.27 cfs 0.014 af |
| Subcatchment 2S: PRE-LAWN/WOODS | Runoff Area=0.167 ac 0.00% Impervious Runoff Depth=0.00" Flow Length=191' Tc=5.1 min CN=35 Runoff=0.00 cfs 0.000 af |
| Subcatchment 3S: POST-Imperv to | Runoff Area=0.069 ac 100.00% Impervious Runoff Depth=1.97" Tc=5.0 min CN=98 Runoff=0.22 cfs 0.011 af |
| Subcatchment 4S: POST-Lawn to Bio-Ret1 | Runoff Area=0.025 ac 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 5S: POST-Imperv to | Runoff Area=0.012 ac 100.00% Impervious Runoff Depth=1.97" Tc=5.0 min CN=98 Runoff=0.04 cfs 0.002 af |
| Subcatchment 6S: POST-Lawn to Bio-Ret2 | Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 7S: POST Imperv to | Runoff Area=0.078 ac 100.00% Impervious Runoff Depth=1.97" Tc=5.0 min CN=98 Runoff=0.25 cfs 0.013 af |
| Subcatchment 8S: Post-Lawn to Bio-Ret 3 | Runoff Area=0.034 ac 0.00% Impervious Runoff Depth=0.00" Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 9S: | Runoff Area=0.021 ac 100.00% Impervious Runoff Depth=1.97" Flow Length=186' Tc=5.0 min CN=98 Runoff=0.07 cfs 0.003 af |
| Subcatchment 10S: | Runoff Area=0.052 ac 0.00% Impervious Runoff Depth=0.00" Flow Length=186' Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 11S: PRE-IMPERVIOUS | Runoff Area=0.008 ac 100.00% Impervious Runoff Depth=1.97" Flow Length=284' Tc=5.8 min CN=98 Runoff=0.02 cfs 0.001 af |
| Subcatchment 12S: PRE-LAWN/WOODS | Runoff Area=0.169 ac 0.00% Impervious Runoff Depth=0.00" Flow Length=284' Tc=5.8 min CN=33 Runoff=0.00 cfs 0.000 af |
| Subcatchment 13S: | Runoff Area=0.049 ac 100.00% Impervious Runoff Depth=1.97" Tc=5.8 min CN=98 Runoff=0.15 cfs 0.008 af |
| Subcatchment 14S: | Runoff Area=0.073 ac 0.00% Impervious Runoff Depth=0.00" Tc=5.8 min CN=39 Runoff=0.00 cfs 0.000 af |
| Pond 1P: Bio-Retention Area1 | Peak Elev=500.35' Storage=159 cf Inflow=0.22 cfs 0.011 af Discarded=0.00 cfs 0.005 af Primary=0.21 cfs 0.006 af Outflow=0.21 cfs 0.011 af |
| Pond 2P: Bio-Retention Area2 | Peak Elev=494.81' Storage=155 cf Inflow=0.25 cfs 0.008 af Discarded=0.00 cfs 0.005 af Primary=0.09 cfs 0.003 af Outflow=0.09 cfs 0.008 af |

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Type II 24-hr 2 YEAR Rainfall=2.20"

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Pond 3P: Bio-Retention Area3

Peak Elev=492.52' Storage=322 cf Inflow=0.25 cfs 0.013 af
Discarded=0.00 cfs 0.011 af Primary=0.01 cfs 0.002 af Outflow=0.02 cfs 0.013 af

Link 1L: PRE POI #1

Inflow=0.27 cfs 0.014 af
Primary=0.27 cfs 0.014 af

Link 2L: POST- POI#1

Inflow=0.11 cfs 0.008 af
Primary=0.11 cfs 0.008 af

Link 3L: PRE-POI#2

Inflow=0.02 cfs 0.001 af
Primary=0.02 cfs 0.001 af

Link 4L: POST-POI#2

Inflow=0.15 cfs 0.008 af
Primary=0.15 cfs 0.008 af

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Type II 24-hr 10 YEAR Rainfall=3.10"

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Time span=1.00-80.00 hrs, dt=0.01 hrs, 7901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PRE-IMPERVIOUS Runoff Area=0.086 ac 100.00% Impervious Runoff Depth=2.87"
Flow Length=191' Tc=5.1 min CN=98 Runoff=0.39 cfs 0.021 af

Subcatchment 2S: PRE-LAWN/WOODS Runoff Area=0.167 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=191' Tc=5.1 min CN=35 Runoff=0.00 cfs 0.000 af

Subcatchment 3S: POST-Imperv to Runoff Area=0.069 ac 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.31 cfs 0.016 af

Subcatchment 4S: POST-Lawn to Bio-Ret1 Runoff Area=0.025 ac 0.00% Impervious Runoff Depth=0.00"
Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 5S: POST-Imperv to Runoff Area=0.012 ac 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.05 cfs 0.003 af

Subcatchment 6S: POST-Lawn to Bio-Ret2 Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=0.00"
Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 7S: POST Imperv to Runoff Area=0.078 ac 100.00% Impervious Runoff Depth=2.87"
Tc=5.0 min CN=98 Runoff=0.35 cfs 0.019 af

Subcatchment 8S: Post-Lawn to Bio-Ret 3 Runoff Area=0.034 ac 0.00% Impervious Runoff Depth=0.00"
Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 9S: Runoff Area=0.021 ac 100.00% Impervious Runoff Depth=2.87"
Flow Length=186' Tc=5.0 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 10S: Runoff Area=0.052 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=186' Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 11S: PRE-IMPERVIOUS Runoff Area=0.008 ac 100.00% Impervious Runoff Depth=2.87"
Flow Length=284' Tc=5.8 min CN=98 Runoff=0.04 cfs 0.002 af

Subcatchment 12S: PRE-LAWN/WOODS Runoff Area=0.169 ac 0.00% Impervious Runoff Depth=0.00"
Flow Length=284' Tc=5.8 min CN=33 Runoff=0.00 cfs 0.000 af

Subcatchment 13S: Runoff Area=0.049 ac 100.00% Impervious Runoff Depth=2.87"
Tc=5.8 min CN=98 Runoff=0.22 cfs 0.012 af

Subcatchment 14S: Runoff Area=0.073 ac 0.00% Impervious Runoff Depth=0.00"
Tc=5.8 min CN=39 Runoff=0.00 cfs 0.000 af

Pond 1P: Bio-Retention Area1 Peak Elev=500.37' Storage=165 cf Inflow=0.31 cfs 0.016 af
Discarded=0.00 cfs 0.005 af Primary=0.30 cfs 0.011 af Outflow=0.30 cfs 0.016 af

Pond 2P: Bio-Retention Area2 Peak Elev=494.89' Storage=173 cf Inflow=0.36 cfs 0.014 af
Discarded=0.00 cfs 0.005 af Primary=0.34 cfs 0.009 af Outflow=0.34 cfs 0.014 af

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Type II 24-hr 10 YEAR Rainfall=3.10"

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Pond 3P: Bio-Retention Area3

Peak Elev=492.62' Storage=372 cf Inflow=0.35 cfs 0.019 af
Discarded=0.00 cfs 0.012 af Primary=0.21 cfs 0.007 af Outflow=0.22 cfs 0.019 af

Link 1L: PRE POI #1

Inflow=0.39 cfs 0.021 af
Primary=0.39 cfs 0.021 af

Link 2L: POST- POI#1

Inflow=0.61 cfs 0.021 af
Primary=0.61 cfs 0.021 af

Link 3L: PRE-POI#2

Inflow=0.04 cfs 0.002 af
Primary=0.04 cfs 0.002 af

Link 4L: POST-POI#2

Inflow=0.22 cfs 0.012 af
Primary=0.22 cfs 0.012 af

14062-SWM Model

Type II 24-hr 25 YEAR Rainfall=4.00"

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Time span=1.00-80.00 hrs, dt=0.01 hrs, 7901 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

| | |
|--|--|
| Subcatchment 1S: PRE-IMPERVIOUS | Runoff Area=0.086 ac 100.00% Impervious Runoff Depth=3.77" Flow Length=191' Tc=5.1 min CN=98 Runoff=0.50 cfs 0.027 af |
| Subcatchment 2S: PRE-LAWN/WOODS | Runoff Area=0.167 ac 0.00% Impervious Runoff Depth=0.03" Flow Length=191' Tc=5.1 min CN=35 Runoff=0.00 cfs 0.000 af |
| Subcatchment 3S: POST-Imperv to | Runoff Area=0.069 ac 100.00% Impervious Runoff Depth=3.77" Tc=5.0 min CN=98 Runoff=0.40 cfs 0.022 af |
| Subcatchment 4S: POST-Lawn to Bio-Ret1 | Runoff Area=0.025 ac 0.00% Impervious Runoff Depth=0.05" Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 5S: POST-Imperv to | Runoff Area=0.012 ac 100.00% Impervious Runoff Depth=3.77" Tc=5.0 min CN=98 Runoff=0.07 cfs 0.004 af |
| Subcatchment 6S: POST-Lawn to Bio-Ret2 | Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=0.05" Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 7S: POST Imperv to | Runoff Area=0.078 ac 100.00% Impervious Runoff Depth=3.77" Tc=5.0 min CN=98 Runoff=0.46 cfs 0.024 af |
| Subcatchment 8S: Post-Lawn to Bio-Ret 3 | Runoff Area=0.034 ac 0.00% Impervious Runoff Depth=0.05" Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 9S: | Runoff Area=0.021 ac 100.00% Impervious Runoff Depth=3.77" Flow Length=186' Tc=5.0 min CN=98 Runoff=0.12 cfs 0.007 af |
| Subcatchment 10S: | Runoff Area=0.052 ac 0.00% Impervious Runoff Depth=0.05" Flow Length=186' Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af |
| Subcatchment 11S: PRE-IMPERVIOUS | Runoff Area=0.008 ac 100.00% Impervious Runoff Depth=3.77" Flow Length=284' Tc=5.8 min CN=98 Runoff=0.05 cfs 0.003 af |
| Subcatchment 12S: PRE-LAWN/WOODS | Runoff Area=0.169 ac 0.00% Impervious Runoff Depth=0.01" Flow Length=284' Tc=5.8 min CN=33 Runoff=0.00 cfs 0.000 af |
| Subcatchment 13S: | Runoff Area=0.049 ac 100.00% Impervious Runoff Depth=3.77" Tc=5.8 min CN=98 Runoff=0.28 cfs 0.015 af |
| Subcatchment 14S: | Runoff Area=0.073 ac 0.00% Impervious Runoff Depth=0.05" Tc=5.8 min CN=39 Runoff=0.00 cfs 0.000 af |
| Pond 1P: Bio-Retention Area1 | Peak Elev=500.40' Storage=171 cf Inflow=0.40 cfs 0.022 af Discarded=0.00 cfs 0.005 af Primary=0.39 cfs 0.016 af Outflow=0.40 cfs 0.022 af |
| Pond 2P: Bio-Retention Area2 | Peak Elev=494.91' Storage=180 cf Inflow=0.46 cfs 0.020 af Discarded=0.00 cfs 0.005 af Primary=0.45 cfs 0.015 af Outflow=0.45 cfs 0.020 af |

14062-SWM Model

Type II 24-hr 25 YEAR Rainfall=4.00"

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Pond 3P: Bio-Retention Area3

Peak Elev=492.68' Storage=404 cf Inflow=0.46 cfs 0.025 af
Discarded=0.00 cfs 0.012 af Primary=0.39 cfs 0.013 af Outflow=0.39 cfs 0.025 af

Link 1L: PRE POI #1

Inflow=0.50 cfs 0.027 af
Primary=0.50 cfs 0.027 af

Link 2L: POST- POI#1

Inflow=0.95 cfs 0.034 af
Primary=0.95 cfs 0.034 af

Link 3L: PRE-POI#2

Inflow=0.05 cfs 0.003 af
Primary=0.05 cfs 0.003 af

Link 4L: POST-POI#2

Inflow=0.28 cfs 0.016 af
Primary=0.28 cfs 0.016 af

14062-SWM Model

Type II 24-hr 100 YEAR Rainfall=5.06"

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Time span=1.00-80.00 hrs, dt=0.01 hrs, 7901 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PRE-IMPERVIOUS Runoff Area=0.086 ac 100.00% Impervious Runoff Depth>4.82"
Flow Length=191' Tc=5.1 min CN=98 Runoff=0.64 cfs 0.035 af

Subcatchment 2S: PRE-LAWN/WOODS Runoff Area=0.167 ac 0.00% Impervious Runoff Depth=0.13"
Flow Length=191' Tc=5.1 min CN=35 Runoff=0.00 cfs 0.002 af

Subcatchment 3S: POST-Imperv to Runoff Area=0.069 ac 100.00% Impervious Runoff Depth>4.82"
Tc=5.0 min CN=98 Runoff=0.51 cfs 0.028 af

Subcatchment 4S: POST-Lawn to Bio-Ret1 Runoff Area=0.025 ac 0.00% Impervious Runoff Depth=0.21"
Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 5S: POST-Imperv to Runoff Area=0.012 ac 100.00% Impervious Runoff Depth>4.82"
Tc=5.0 min CN=98 Runoff=0.09 cfs 0.005 af

Subcatchment 6S: POST-Lawn to Bio-Ret2 Runoff Area=0.017 ac 0.00% Impervious Runoff Depth=0.21"
Tc=5.0 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 7S: POST Imperv to Runoff Area=0.078 ac 100.00% Impervious Runoff Depth>4.82"
Tc=5.0 min CN=98 Runoff=0.58 cfs 0.031 af

Subcatchment 8S: Post-Lawn to Bio-Ret 3 Runoff Area=0.034 ac 0.00% Impervious Runoff Depth=0.21"
Tc=5.0 min CN=39 Runoff=0.00 cfs 0.001 af

Subcatchment 9S: Runoff Area=0.021 ac 100.00% Impervious Runoff Depth>4.82"
Flow Length=186' Tc=5.0 min CN=98 Runoff=0.16 cfs 0.008 af

Subcatchment 10S: Runoff Area=0.052 ac 0.00% Impervious Runoff Depth=0.21"
Flow Length=186' Tc=5.0 min CN=39 Runoff=0.00 cfs 0.001 af

Subcatchment 11S: PRE-IMPERVIOUS Runoff Area=0.008 ac 100.00% Impervious Runoff Depth>4.82"
Flow Length=284' Tc=5.8 min CN=98 Runoff=0.06 cfs 0.003 af

Subcatchment 12S: PRE-LAWN/WOODS Runoff Area=0.169 ac 0.00% Impervious Runoff Depth=0.07"
Flow Length=284' Tc=5.8 min CN=33 Runoff=0.00 cfs 0.001 af

Subcatchment 13S: Runoff Area=0.049 ac 100.00% Impervious Runoff Depth>4.82"
Tc=5.8 min CN=98 Runoff=0.36 cfs 0.020 af

Subcatchment 14S: Runoff Area=0.073 ac 0.00% Impervious Runoff Depth=0.21"
Tc=5.8 min CN=39 Runoff=0.00 cfs 0.001 af

Pond 1P: Bio-Retention Area1 Peak Elev=500.42' Storage=177 cf Inflow=0.51 cfs 0.028 af
Discarded=0.00 cfs 0.006 af Primary=0.50 cfs 0.023 af Outflow=0.50 cfs 0.028 af

Pond 2P: Bio-Retention Area2 Peak Elev=494.94' Storage=187 cf Inflow=0.59 cfs 0.028 af
Discarded=0.00 cfs 0.005 af Primary=0.58 cfs 0.022 af Outflow=0.58 cfs 0.028 af

14062-SWM Model

Type II 24-hr 100 YEAR Rainfall=5.06"

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Pond 3P: Bio-Retention Area3

Peak Elev=492.74' Storage=438 cf Inflow=0.58 cfs 0.032 af
Discarded=0.00 cfs 0.012 af Primary=0.46 cfs 0.020 af Outflow=0.46 cfs 0.032 af

Link 1L: PRE POI #1

Inflow=0.64 cfs 0.036 af
Primary=0.64 cfs 0.036 af

Link 2L: POST- POI#1

Inflow=1.18 cfs 0.051 af
Primary=1.18 cfs 0.051 af

Link 3L: PRE-POI#2

Inflow=0.06 cfs 0.004 af
Primary=0.06 cfs 0.004 af

Link 4L: POST-POI#2

Inflow=0.36 cfs 0.021 af
Primary=0.36 cfs 0.021 af

NEW IMPERVIOUS = $8,228 \text{ SF} + 100 \text{ SF ADDITIONAL} = 8,328 \text{ SF}$
* (50 PER LTS 203)

*** NOTE**
IMPERVIOUS AREA
FOR WQV CALC
INCLUDES NEW OFFSITE
AND FUTURE IMPERVIOUS

$WQV = \frac{P R_v A}{12}$ $P = 0.9"$
 $R_v = 0.05 + 0.009(1) = .95$
 $A = 8,328 \text{ SF} \times \frac{1 \text{ AC}}{43560 \text{ SF}} = 191 \text{ AC}$

$WQV = \frac{(0.9)(0.95)(0.191 \text{ AC})}{12} = 0.0136 \text{ A-FT} = \underline{592 \text{ CF}}$

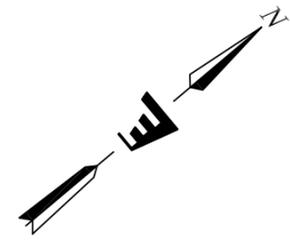
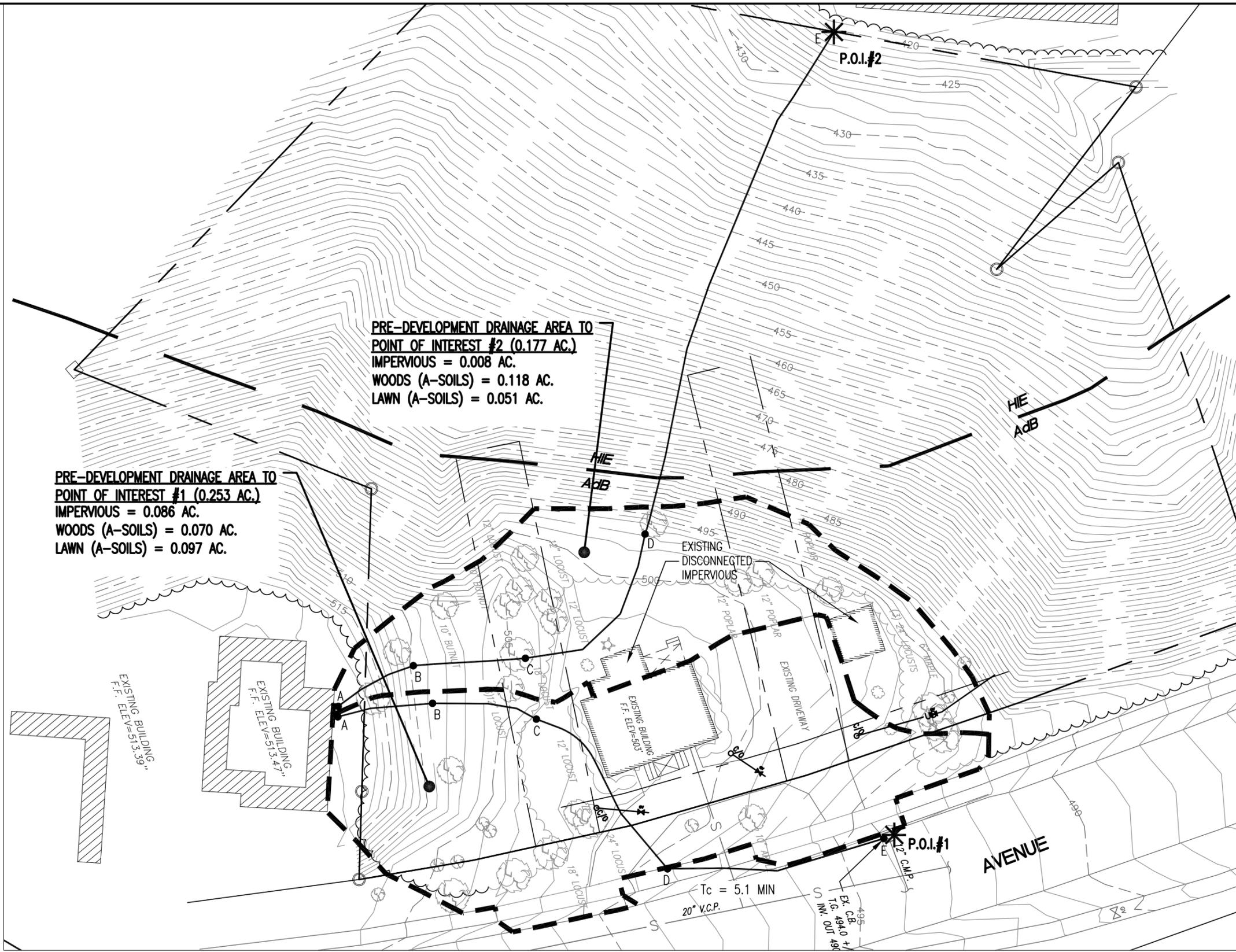
VOLUME OF RAW GARDENS:

#1: VOL OF SOIL = $128 \text{ SF} \times 2.5' \times 17\% \text{ VOIDS} = 54 \text{ CF}$ (30")
 VOL OF 6" WATER = $\frac{128 + 217}{2} \text{ SF} \times 0.5' = 86 \text{ CF}$ (30")
 TOTAL VOL = 140 CF

#2: VOL OF SOIL = $135 \text{ SF} \times 2.5' \times 17\% = 57 \text{ CF}$ (30")
 VOL OF 6" WATER = $\frac{135 + 210}{2} \text{ SF} \times 0.5' = 86 \text{ CF}$ (30")
 TOTAL VOL = 143 CF

#3: VOL SOIL = $307 \text{ SF} \times 2.5' \times 17\% \text{ VOIDS} = 130 \text{ CF}$ (30")
 VOL 6" WATER = $\frac{307 + 432}{2} \text{ SF} \times 0.5' = 185 \text{ CF}$
 TOTAL VOL = 315 CF

1598 CF TOTAL



LEGEND

- DRAINAGE BOUNDARY
- TIME OF CONCENTRATION (Tc) PATH

GRAPHIC SCALE



1 inch = 30 ft.
 for sheet size 11" x 17"

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PRE-DEVELOPMENT DRAINAGE AREA MAP

380 COLCHESTER AVENUE
 HAYWARD DESIGN BUILD

| | |
|--------------------------|------------------------------|
| Checked By: MD | Scale: 1" = 30' |
| Drawn By: MD | Project No.: 14062 |
| Date: 02/19/15 | Drawing No.: HYD1 |

NOTE:
 TIME OF CONCENTRATION FOR P.O.I.#2
 IS ASSUMED TO BE SAME AS
 PRE-DEVELOPMENT CONDITION. THIS
 TIME WILL BE UPDATED WHEN FUTURE
 (PHASE 2 DEVELOPMENT OCCURS)

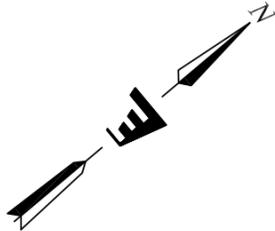
POST-DEVELOPMENT DRAINAGE AREA TO
 P.O.I.#2 (0.122 AC.)
 FUTURE IMPERVIOUS = 0.049 AC.
 LAWN (A-SOILS) = 0.073 AC.

POST-DEVELOPMENT DRAINAGE AREA TO
 BIO-RETENTION AREA #1 (0.094 AC.)
 IMPERVIOUS = 0.069 AC.
 LAWN (A-SOILS) = 0.025 AC.

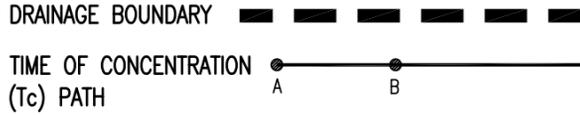
POST-DEVELOPMENT DRAINAGE AREA TO
 BIO-RETENTION AREA #3 (0.112 AC.)
 IMPERVIOUS = 0.068 AC.
 FUTURE IMPERVIOUS = 0.010 AC.
 LAWN (A-SOILS) = 0.034 AC.

POST-DEVELOPMENT DRAINAGE AREA TO
 P.O.I.#1-BYPASS AREA (0.073 AC.)
 IMPERVIOUS = 0.021 AC.
 LAWN (A-SOILS) = 0.052 AC.

POST-DEVELOPMENT DRAINAGE AREA TO
 BIO-RETENTION AREA #2 (0.029 AC.)
 IMPERVIOUS = 0.012 AC.
 LAWN (A-SOILS) = 0.017 AC.



LEGEND



GRAPHIC SCALE



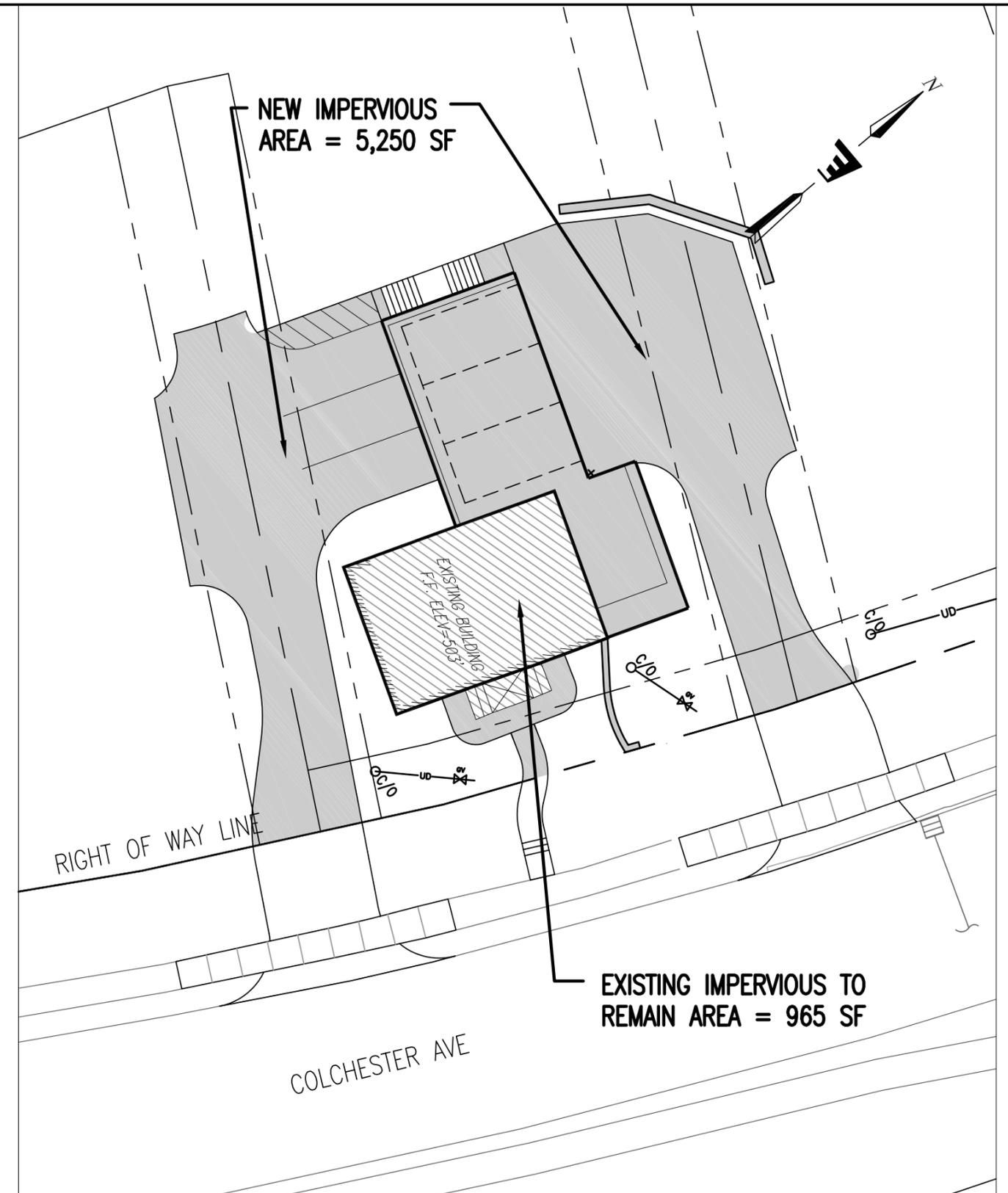
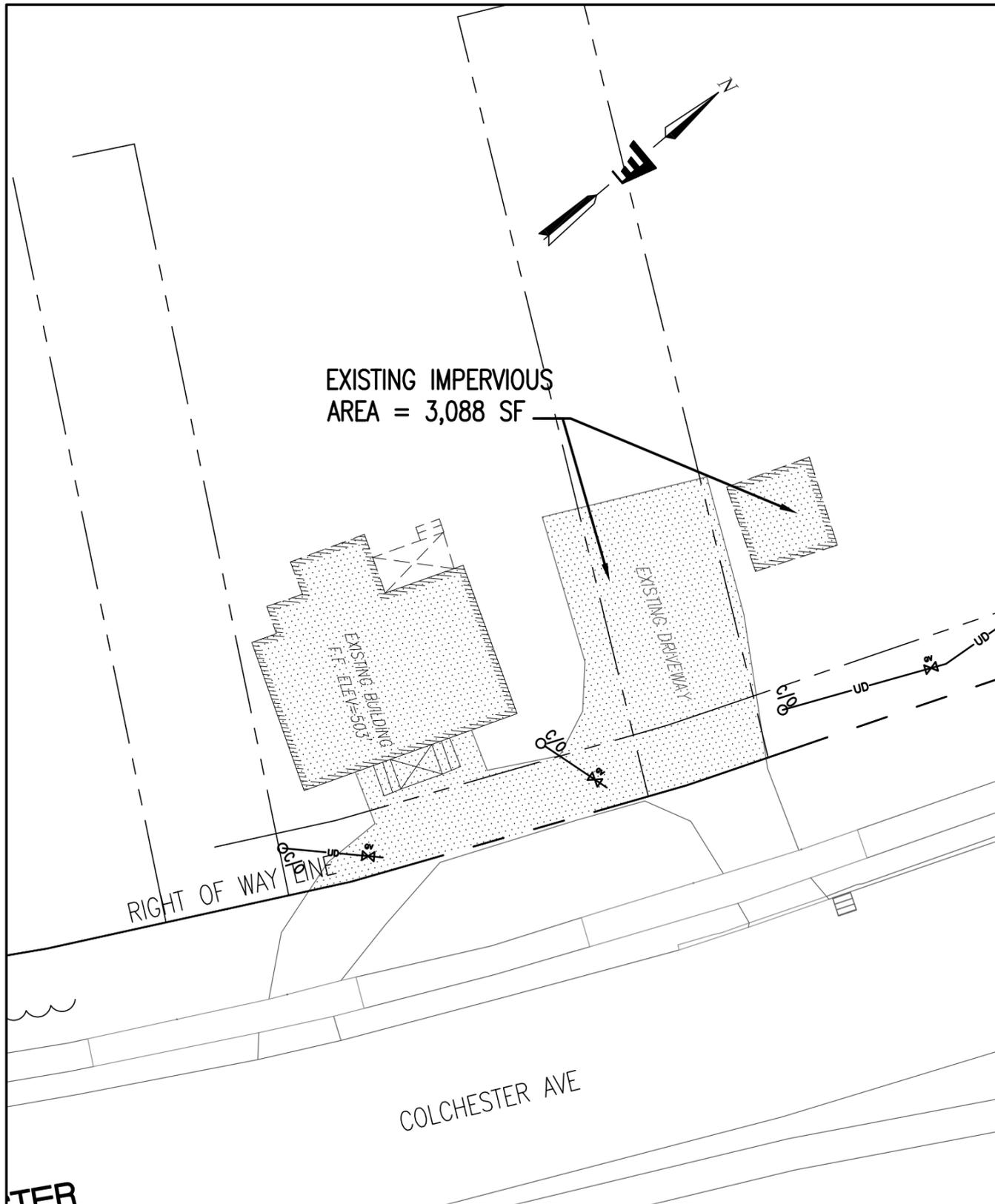
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POST-DEVELOPMENT
 DRAINAGE AREA MAP

380 COLCHESTER AVENUE
 HAYWARD DESIGN BUILD

| | |
|--------------------------|------------------------------|
| Checked By: MD | Scale: 1" = 30' |
| Drawn By: MD | Project No.: 14062 |
| Date: 02/19/15 | Drawing No.: HYD2 |



GRAPHIC SCALE



1 inch = 20 ft.
for sheet size 11" x 17"

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IMPERVIOUS AREA EXHIBIT
 (FOR STORMWATER MGMT PLAN SCREENING FORM)

380 COLCHESTER AVENUE
 HAYWARD DESIGN BUILD

| | |
|--------------------------|------------------------------|
| Checked By: MD | Scale: 1" = 20' |
| Drawn By: MD | Project No.: 14062 |
| Date: 02/19/15 | Drawing No.: HYD3 |