Two Crown Lane, LLC

To construct a new single-family home exceeding 150,000 cubic feet in volume on a 4.54-acre parcel in the RA-4 zone.

**LOCATION:** 2 Crown Lane

**EXISTING ZONING:** RA-4 (4-acre minimum lot size)

**PARCEL SIZE:** 4.54-acres (197,762.4 sq.ft.)

**UTILITIES:** Private Septic System and Well

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<th>ALLOWABLE</th>
<th>REQUESTED</th>
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<tbody>
<tr>
<td>GROSS SQUARE FEET:</td>
<td>Previous home was demolished in spring 2021</td>
<td>12,355.5 sq.ft.</td>
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<tr>
<td>FLOOR AREA RATIO:</td>
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<td>VOLUME</td>
<td>N/A</td>
<td>Over 150,000 cu.ft. needs a Special Permit</td>
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<td>GREEN AREA:</td>
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**Dwelling**

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<td>SIZE:</td>
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**STRUCTURE SETBACKS (Min. Required/ Proposed):**

- **Front Yard Depth:** N/A 75’ >120’
- **Side Yard Width:** N/A 50’ and 62.5’ to corner >90’ and >130’ to corner
- **Rear Yard Setback:** N/A 75’ >240’

**APPLICATION SUMMARY:**

Final Site Plan and Special Permit applications are submitted by the applicant to construct a new single-family home with attached 4 car garage, pool, terrace, rain garden, septic system, and significant grading and site work with a total parcel volume of approximately 160,000 cubic feet. The site is 4.5383-acre large and located at 2 Crown Lane in the RA-4 Zone.

**ISSUES/RECOMMENDATIONS:**

1. **The Inland Wetlands Agency (IWWA)** – IWWA issued a green sheet dated 7/15/2021 indicating no action is needed with their department for the lot line revision.

2. **The Department of Health** issued comments to the applicant on 8/25/2021 and notes that they approved the submitted design proposal for a 6-bedroom septic system for this site. The existing septic system and well will be abandoned.
3. **The Zoning Enforcement Officer** issued comments dated 12/1/2021 and notes that the graded walls at the rear of the dwelling need to be limited to 4 feet in height. The applicant reached out to the ZEO on 12/2/2021 and is awaiting a response.

4. **Engineering** – DWP issued comments on 11/3/2021 and approves the design for zoning/building permit.

5. **Conservation** issued comments dated 12/1/2021 and notes many improvements to the site’s development plan with some opportunities for further advances.

6. **Planting Plan** – The Commission may ask the applicant to provide a detailed planting plan to identify specific species of proposed vegetation. The Commission may ask for the compensation of tree lost be kept to a 1:1 ratio, and all replacement plants to be native species.

7. **Invasive Plant Species** – The site has Porcelain Berry, an invasive vine that may be controlled with the help of a written management plan. The Commission may ask the applicant to submit such a management plan.

**PROPOSAL:**

Final Site Plan and Special Permit applications are submitted by the applicant to construct a new single-family home with attached 4 car garage. The project also includes a pool, terrace, rain garden, septic system, and significant grading and site work with a total parcel volume of approximately 160,000 cubic feet. The site is 4.5383-acre large and located at 2 Crown Lane in the RA-4 Zone.

The parcel was previously occupied by a single-family home and pool that was demolished in spring 2021.

A special permit is required for this application for the below two reasons:

1) Per Section 6-101(a) of the BZR, as the total volume of buildings on the property is proposed to be greater than 150,000 cubic feet.

**DEPARTMENT COMMENTS:**

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<tr>
<td>IWWA</td>
<td>see green sheet dated 7/15/2021</td>
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<tr>
<td>DPW</td>
<td>see attached memo of 11/3/2021</td>
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<tr>
<td>ZEO</td>
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<tr>
<td>CONSERVATION</td>
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<tr>
<td>HEALTH</td>
<td>see attached memo of 8/25/2021</td>
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**EXISTING CONDITIONS:** The parcel is a corner lot in the southeast quadrant of the Crown Lane and Stanwich Road intersection. Stanwich Road abuts the property on the west and south sides, and Crown Lane on the north side.

The site has many mature specimen trees and naturally vegetated areas along the edges which are habitat for local wildlife.
**DRAINAGE:** DWP issued comments on 11/3/2021 and approved the application for zoning / building permit.

The applicant notes in the Drainage Summary Report that the proposed development strategy utilizes Low Impact Development (LID) design principles and techniques as well as Best Management Practices (BMPs). A Bioretention Rain Garden (LID strategy) is planned along with a Cultec system (traditional BMP strategy).

The Commission may ask the applicant to investigate creating a detailed planting plan for the proposed rain garden as this will help insure the longevity and efficiently of the proposed LID method.

**HEALTH:** The Health Department issued comments to the applicant on 8/25/2021 and notes that they approved the submitted design proposal for a 6-bedroom septic system for this site. The existing septic system and well will be abandoned.

**ZONING:** The proposed development looks to conforms to FAR, Green Area, and setback requirements for the RA-4 zone per Section 6-205 of the BZR.

The ZEO issued comments on 12/1/2021 and asks the applicant to resubmit prior to site plan approval to review the graded walls at the rear of the dwelling. The ZEO states that these walls need to be limited to 4-feet in height. The applicant reached out to the ZEO to find a resolution on 12/2/2021 and is awaiting a response.

**PROPOSED VEGETATION AND INVASIVE PLANTS:** The applicant submitted a planting plan that shows some very good ideas, however it is very general and does not specify specific plants. The Commission may ask for a more detailed planting plan to be submitted and reviewed by staff. The final planting plan may maintain the commitment to the southern side of the septic system to be planted with native groundcover and the eastern side of the driveway turned into a native lawn alternative, as shown on the current planting plan by Eckerson Design Associates, dated 11/16/202. The recommended compensation for tree loss is 1:1, and the replacement trees should be native species.

The invasive vine Porcelain Berry can be found on the site. This vine may be controlled with the help of a written management plan. The Commission may ask the applicant to provide such a document for staff to review.

**BACKGROUND:** This is the first application to Planning & Zoning for this parcel.

**APPLICABLE ZONING REGULATIONS:**
- Section 6-5 – Definitions
- Section 6-10 – Zoning Permit Applications; Plans; Contents; Survey
- Section 6-13 – Site Plan Approval Required by Planning and Zoning Commission
- Section 6-14 – [Site Plan] Procedure
Section 6-15 – [Site Plan] Standards
Section 6-17 – Special Permit Standards and Procedures
Section 6-95 – Permitted Accessory Uses
Section 6-101(a) – Special Permit for Residential Zones
Section 6-205 – Schedule of Required Open Spaces, Limiting Heights and Bulk of Bdgs.
MEMORANDUM

To: Jacalyn Pruitt, Planner II

From: Aleksandra Moch, Environmental Analyst (Wetland and Soil Scientist)

Date: December 1, 2021

Re: Two Crown Lane, LLC; 2 Crown Lane; PLPZ 202100334
  Site plan by Rocco V. D’Andrea, dated July 15, 2021, response to CC comments and
  landscape plan by Eckerson Design Associates Landscape Architecture dated November
  16, 2021

The Conservation Commission staff had reviewed this project on September 20, 2021. The main
concerns raised at that time were related to the intensity of the proposed site disturbance, impact
to mature trees, encroachment into the naturally vegetated areas, and lack of a mitigation
planting plan and proper soil erosion and sediment control plan. The aforementioned revised
plans address most of the above concerns.

1. The proposed site redevelopment will still result in significant site modifications and
disturbance. No changes were made to the location or size of the proposed site improvements.
The increase in impervious surface was mitigated with areas restored with vegetated
alternative to lawn, which greatly exceed the 6,373 s.f. increase in hardscape.

2. In response to previous comments, the revised plan shows all the large trees growing along
Crown Lane to be preserved and properly protected during the construction activities. The 26”
Western pine and 36” Eastern cottonwood (marked as an oak on the site plan) are located
where the swimming pool is still proposed. The applicant argues preserving them is not
possible due to owner preference pertaining to the layout.

3. The newly mapped edge-of-the lawn shows encroachments projecting into naturally vegetated
area, including unnecessary grading. More work should be done to preserve the existing
vegetation to leave in place the more productive green space.

4. The concern pertaining to soil erodibility was properly addressed with more robust plan for
soil erosion and sediment control measured used during the construction activities.
5. The newly submitted landscape plan provides support to the existing naturalized areas and limits the area of lawn. The plant material has not been specified, therefore a more detailed plan should be submitted prior to the site stabilization. The final plan should maintain the commitment to the southern side of the septic system being planted with native cover and the eastern side of the driveway turned into the native lawn alternative. The compensation of the lost trees should be kept in ration 1:1 and the replacement should consist of native trees which are of greater value to the existing wildlife habitat. The plan should also include a management plan for the highly invasive porcelain berry on-site.

cc: Conservation Commission
DEPARTMENT OF PUBLIC WORKS – ENGINEERING DIVISION
SITE DEVELOPMENT REVIEW

Engineering Project No. 21-5(49)  Department Project No. PLPZ202100334  Submittal Received Date: 11/1/2021

Submittal Reviewed For: Planning and Zoning  Traffic Review Requested: No  Review Type: Final Site Plan

PLAN SET INFORMATION

Plan Title: Final Site Plan Review Set  Project Address: 2 Crown Lane

Engineering Firm: Rocco V. D'Andrea, Inc.  Original Plan Date: 7/15/2021  Latest Plan Revision Date: 10/18/2021

DRAINAGE SUMMARY REPORT INFORMATION

Engineering Firm: Rocco V. D'Andrea, Inc.  Original Report Date: 7/15/2021  Latest Report Revision Date: 10/18/2021

Reviews provided by the Engineering Division are for compliance with the Town’s “Roadway Design Manual and Standard Construction Details” and “Drainage Manual” as amended. Reviews are based upon the information and plans provided. Comments pertaining to the Town’s manuals are not all encompassing. Other reviewing entities may provide additional comments regarding consistency with these manuals in accordance with their jurisdictions. Review of sanitary sewer and septic systems are not reviewed by the Engineering Division.

All New Submittals for Commission Meetings must be received by the Engineering Division four weeks before scheduled Commission Meeting.

All Revised Submittals for Commission Meetings must be received by the Engineering Division three weeks before scheduled Commission Meeting.

Reviewed and Approved by: Juan Paredes, P.E. - Civil Engineer II  Date: 11/03/2021

COMMENTS AND CONDITIONS OF APPROVAL: Approved for Zoning/Building Permit

1. The Drainage Summary Report is acceptable.
2. The Operations and Maintenance Plan Report must include the following for the Certificate of Occupancy:
   b. The final completed Exhibit A, and B
   c. The Maintenance Declaration needs to be filed on the Town of Greenwich Land Records prior to a Certificate of Occupancy. A review of the documents above must be completed before filing on the Town of Greenwich Land Records.
3. The Town of Greenwich – Standard Construction Notes for Site and Subdivision Plans are conditions that must be met.
4. All requests for a Temporary Certificate of Occupancy (T.C.O.) or a Certificate of Occupancy (C.O.) shall be submitted one month before the T.C.O. or C.O. is required.
5. The submittal for a Temporary or Final Certificate of Occupancy must include the following:

c. Field Inspection Record (All required photos) – Form SC-106 – Sealed and Signed by a Connecticut Licensed Professional Engineer.

d. Bioretention Soil Testing Certification Sign-Off (as applicable with the bioretention soil gradation test and the phosphorous test for the mixed soil) – Form SC-104 – Sealed and Signed by a Connecticut Licensed Professional Engineer.


h. A Letter discussing all the work that remains to be completed (Only for a Temporary Certificate of Occupancy Submittal).
The Health Department has approved a new 6 bedroom septic system for this site, the existing septic system and well will be abandoned. The Health Department will recommend approval of this proposal.

Michael Long
Greenwich Health Department

Hello All,

Please find attached routing sheet and link to new Final Site Plan and Special Permit at 2 Crown Lane for a welling in excess of 150,000 cubic feet in volume.

https://greenwichct-my.sharepoint.com/:f:/g/personal/katie_deluca_greenwichct_org/Ev6FlHuW4CxAhkxXfMRKulBO6dTMHhDXD3Gwzb13XAomA?e=bAT32P

This is tentatively on the 9/14 meeting.

Thanks,

Bianca Dygert
Planner II

Town of Greenwich
Land Use - Planning & Zoning
101 Field Point Road
Greenwich, CT 06830-6463
Ph. (203) 622-7894
Office Fax. (203) 622-3795
Direct Fax. (203) 861-6113
Bianca.Dygert@greenwichct.org

www.greenwichct.gov
ZONING ENFORCEMENT

Project No.  PLPZ202100334  Preliminary  Final  X

Reviewed for Planning and Zoning Commission.

TITLE OF PLAN REVIEWED:  Two Crown Lane

LOCATION:  2 Crown Lane

PLAN DATE:  

ZONE:  RA-4

☐  Ok for Zoning Permit Sign-off with the following revisions:

☐  Resubmit the following prior to Site Plan/ Subdivision approval:
   The grade walls at the rear of the dwelling need to be limited to 4 feet in height.

☐  The subject site plan/subdivision meets the requirements of the Building Zone Regulations, excluding sections 6-15 and 6-17, and is Ok for Zoning Permit Sign-off.

Reviewed by:  Jodi Couture  Date:  12/1/2021

Note:  These comments do not represent Building Inspection Division approval. Plans subject to review by ZEO at time of building permit application.
Hi Jodie,

See the attached markup. We are following up on comments made to Planning and Zoning.

The walls higher than 4’, they are basement walkout walls that we understand that you typically allow to be greater than 4 as they are in a cut.

Can you please comment?

Thx rich

Richard Regan PE
Rocco V. D'Andrea Inc
D'Andrea Surveying & Engineering PC
6 Neil Lane
Riverside CT 06878
203.637.1779
November 16th, 2021

Aleksandra Moch, Environmental Analyst (Wetland and Soil Scientist)
Town of Greenwich Conservation Commission
Town Hall – 101 Field Point Road - Greenwich, CT 06830
Phone 203-622-6461    Fax 203-622-3795

Dear Aleksandra,

Please see below for responses to your comments.

1. The proposed site redevelopment will result in a significantly greater site modifications and disturbance. The paved areas will increase by approximately 6,373 sf. These impacts are of concern because the site supports mature specimen trees and naturally vegetated areas along the edges which assist in stormwater management, pollution attenuation, and are critical habitat for local wildlife.
   - EDA Response/comment: The revised plan still maintains a vegetated edge. Tree removals due to construction are noted on the plan with replacements as indicated. We have also removed a significant amount of lawn at the front of the property where it would not provide recreational use.

2. The proposed site design uses the rough outline of the existing driveway and places the residence over the already disturbed area of the old foundation. The new footprint however is significantly greater so the established landscape supporting large trees is being encroached upon. A few significant trees which include the 26” Western pine and 36” Eastern cottonwood (marked as an oak on the site plan) are of special concern. Both trees are located on the eastern edge of the old swimming pool and are marked to be removed. The applicant should make an effort to preserve them.
   - EDA Response/comment: Due to the location of the new pool the 26” western pine will need to be removed. The 36” Eastern Cottonwood is leaning towards the pool area and with a shallow root system is of concern from a safety perspective and should be removed prior to construction.

Trees are important assets to all community members and their benefits are not limited to the property boundaries. Mature trees provide large canopy which is not replaceable with smaller species. Mature canopy trees provide shade and moderate summer heat, sequester carbon, protect and enhance soils, filter noise and air pollution, absorb and filter storm water and supply food, shelter and protection to the wildlife.
The applicant should consider rotating the residence to align it more parallel to Crown Lane and bring it a bit closer to the road. This will avoid the tree clearing, cut down on unnecessary grading and shorten the driveway resulting in decreased amount of storm water runoff. Another option for the tree preservation is to rotate the pool 90 degrees or relocating the pool towards the west. In addition, decreasing the area of the pool terrace could be helpful not only in preserving the trees, but also in reducing storm water volume.

- EDA Response/comment: Owner preference is for the current site plan as provided by RVDI.

3. There are three other notable trees at the site which should be preserved. They are located along Crown Lane (30” oak, 36” copper beech, and 36” (M) believed to be another purple copper beech). These trees should be properly protected during the construction activities. A revised soil erosion and sediment control plan should provide proper tree protections.

- EDA Response/comment: These existing trees will be protected and will remain. A revised drawing by RVDI will show protection measures.

4. There is more room for environmental improvements and preservation of the environmentally beneficial vegetated edges.
   a. If feasible, the rain garden placed in the rear of the residence should be relocated to the front of the residence and placed within the driveway island. A beautifully vegetated rain garden would not only enhance site’s aesthetics, but will provide important storm water management services, while preserving the existing vegetated area in the back.

- EDA Response/comment: The location is based on the drainage design per the plans by RVDI.

b. The proposed septic location could be moved a few feet towards the residence to preserve the 20” maple.

- EDA Response/comment: Due to soil issues on site this is the only location for the septic system. The 20” maple will need to be removed as a part of the septic system construction.

c. It is strongly encouraged that the new driveway be permeable and the grading in the back of the residence be limited to the necessary minimum. Less disturbance and site filling will allow preservation of native soils which are way superior to fill and performs important environmental functions such as moisture and nutrient retention, support for wildlife and plant growth, storm water absorption and filtration, support to microbial communities processing organic matter and site stability.

- EDA Response/comment: A portion of the driveway is permeable.

5. The site is underlaid by Paxton soil. This soil type is characterized as being highly erodible. Once the topsoil is stripped, the underlying soil horizon is difficult to keep stable during the rain events. Past experience with adjacent properties had demonstrated several lines of silt fence are needed to properly
segment the slope and a sediment basin is necessary to deal with storm water runoff during the site development phase. It is recommended the plan be revised to address this soil condition.

- EDA Response/comment: RVDI to submit revised plan with additional silt fencing.

6. A revised plan should depict the edge of the existing lawn to ensure the existing vegetated/wooded edges are preserved. The area is invaded by porcelain berry, an invasive vine which should be controlled with the help of a written management plan.

- EDA Response/comment: A Landscape plan has been provided to show existing and proposed edge of lawn. The existing vegetation/wooded edges have been preserved.

7. The submission fails to offer a landscape plan which will properly mitigate for the increased impervious surface and tree loss. The approach to this plan should start with preserving trees and existing vegetation, followed by implementation of the above recommendations. If changes are not possible, more meaningful compensation should be provided including the replacement of the existing lawn with native plants covering an area equal to the area of increased of impervious surface, each lost tree should be replaced with one native canopy tree or two smaller native trees for every 6 inches dbh lost. Encroachments into the vegetated edges should be restored with native shrubs at a 1:1 ratio.

- EDA Response/comment: A Landscape plan has been provided to show tree removals and proposed new trees (plan and in a chart to quantify) as well as native planting areas and areas to receive ornamental (no lawn) plantings. Tree replacements have been made with a 3:1 ratio using a combination of shade and understory/ornamental trees.

Sincerely,

Michael J. Mitchell, ASLA
Associate
Site Plan Application

Property Address: 2 Crown Lane  Tax ID: 11-2609
Property Owner: Two Crown Lane LLC  Address: 1301 River Place Blvd Suite 2400 Jacksonville FL 32207
Email: rachelle.pompa@construction.com  Cell Phone: 561.275.8102  Other Phone: 203-552-5236
Applicant: Same  Address: 
Email:  Cell Phone:  Other Phone: 
Authorized Agent: Rocco V. O’Andrea Inc  Address: 6 Neil Lane Riverside CT
Email: rich.regan@cvidi.com  Cell Phone: 203.437.1779  Other Phone: 

Select One: □ Pre-Application  √ Final
Zone(s): 2A-4  Lot Area: 4.54 +/- acres

Please select all relevant items below:

☑ Special Permit – Complete special permit application form
☐ Coastal Overlay Zone
☐ Property is within 500 feet of a Municipal Boundary of ___________________ (for notification)
☐ Amendment to Building Zone Regulations – Section(s) ___________________
☐ Amendment to Building Zone Map – Zone(s) affected ___________________
☐ Health Department review needed
☐ Sewer Department review needed
☐ Architectural Review Committee Application attached or Review needed
☐ Planning & Zoning Board of Appeals review needed
☐ Inland Wetlands and Watercourses Agency Review / Approval Required
☐ Scenic Road Designation

To be completed by P&Z staff only:
Check # __________________  Check Amount: $ __________
Application # __________________________

pzSitePlanApp 2020
Special Permit Application

Property Address: 2 Crown Lane

Property Owner: Two Crown Lane, LLC
Address: 1301 River Place Blvd, Suite 2400

Email: racile.pomp@constrco.com
Cell Phone: 561-275-8102
Other Phone: 203-552-5236

Applicant: Same
Address:

Email: 
Cell Phone: 
Other Phone:

Authorized Agent: Rocco V. DiAndrea, Inc
Address: 6 Neil Lane, Riverside CT

Email: rich.regan@rdv.com
Cell Phone: 203.637.1779
Other Phone:

Zone(s): RA-4
Lot Area: 4.547 acres

PLEASE SELECT ALL RELEVANT ITEMS BELOW:

☐ Section 6-17 — Special Permit standards and procedure
☐ Section 6-30 — Conservation Zone special provisions
☐ Section 6-94(b) — Non-residential Uses and Group Living Facilities permitted in Residential Zones including Resident Medical Professional Office
☐ Section 6-98 — RMF Zone
☐ Section 6-100 — Use Groups for Business Zones
☒ Section 6-101, 107 — Buildings over 40,000 c.f. in Central Greenwich Impact Overlay Zone, Post Road Impact Overlay Zone, WB, LB or LBR Zones; and over 150,000 c.f. in all other zones
☐ Section 6-103.1 — Parking deficient uses in CGBR
☐ Section 6-104 — Parking Structures incl. underground in LB Zone and Height exceptions
☐ Section 6-105, 106 — Front Yard Parking in GB or GBO Zone
☐ Section 6-109 — HO & HRO Zones
☐ Section 6-110 — Dwellings under special requirements for Business Zones
☐ Section 6-112 — IND-RE Zone applications
☐ Section 6-113 — In Hospital Zones: certain accessory uses, expansions exceeding 4,000 s.f. or interior alterations or changes of use exceeding 20,000 s.f. (cumulative within 2 years)
☐ Section 6-114 — CCRC (Continuing Care Retirement Community)
☐ Section 6-118.1 — Uses within railroad rights of way
☐ Section 6-123 — Setbacks from Connecticut Turnpike in Business Zones
☐ Section 6-140.1 — Satellite Earth Stations that emit microwaves
☐ Section 6-141 — Changes in non-conforming uses, buildings
☐ Section 6-205 — Historic structures in CBG Zone exceeding FAR And Notes 7, 8 & 9

To be completed by P&Z staff only:
Check # ____________________  Check Amount: $ __________

Application # ____________________

pzSpecialPermitApp 2020
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TOWN OF GREENWICH
Town Hall ~ 101 Field Point Road ~ Greenwich, CT 06830
Planning & Zoning Department ~ 203-622-7894 ~ Fax.203-622-3795

Application Signature Page

Property Address: 2 CROWN LANE

Property Owner 1: TWO CROWN LANE LLC
Email: frank@ponjacrruction.com
Signature: [Signature]
Address: 130 River Place Blvd #2400 Jacksonville, Fl. 32207
Cell Phone: 203.667.8341
Other Phone: [Other Phone]
Date: 4/18/21

Property Owner 2:
Email: [Email]
Signature: [Signature]
Address:
Cell Phone: [Cell Phone]
Other Phone: [Other Phone]
Date: [Date]

Property Owner 3:
Email: [Email]
Signature: [Signature]
Address:
Cell Phone: [Cell Phone]
Other Phone: [Other Phone]
Date: [Date]

Property Owner 4:
Email: [Email]
Signature: [Signature]
Address:
Cell Phone: [Cell Phone]
Other Phone: [Other Phone]
Date: [Date]

Applicant:
Email: [Email]
Signature: [Signature]
Address:
Cell Phone: [Cell Phone]
Other Phone: [Other Phone]
Date: [Date]

Authorized Agent: Rocco V. O’Andrea Inc
Email: rich.regan@nd1.com
Signature: [Signature]
Address: 6 NCL LANE RIVERSIDE CT 06870
Cell Phone: 203.637.1774
Other Phone: [Other Phone]
Date: 7-15-21
TWO CROWN LANE LLC

ADMINISTRATIVE INFORMATION

PARCEL NUMBER
11-2609

Parent Parcel Number

Property Address
CROWN LANE 0002
1301 RIVERPLACE BLVD SUITE 2400
JACKSONVILLE, FL 32207
LOT NO 4 34 CROWN LANE

TWO CROWN LANE LLC

OWNSHIP

CROWN LANE 0002

Tax ID 298/016

TRANSFER OF OWNERSHIP

Card No. 1

Date

02/25/2021

CHUANG DANIEL C & PAUSHOU W/S

Bk/Pg: 7033, 19

$1700000

06/01/1995

CHUANG DANIEL C & PAUSHOU

Bk/Pg: 2660, 53

$1480000

06/13/1991

GOLDMAN LOUIS H & DOROTHY W/S

Bk/Pg: 2133, 281

$0

07/01/1971

NA

Bk/Pg: 817, 490

$0

RESIDENTIAL

VALUATION RECORD

Assessment Year

10/01/2015

10/01/2015

10/01/2016

10/01/2017

10/01/2018

10/01/2019

10/01/2020

Reason for Change

2015 Prelim

2015 Final

2016 List

2017 List

2018 List

2019 List

2020 List

VALUATION

Market

846400

846400

846400

846400

846400

846400

846400

846400

846400

T

694100

694100

694100

694100

694100

694100

694100

694100

694100

70% Assessed

592480

592480

592480

592480

592480

592480

592480

592480

592480

T

485870

485870

485870

485870

485870

485870

485870

485870

485870

LAND DATA AND CALCULATIONS

Land Type

Residential Land

Residential Excess

Rating

4.0000

0.5600

Measured

1.00

1.00

Table

220000.00

176000.00

Prod. Factor

220000.00

176000.00

Effective Depth

Base Rate

Adjusted Rate

Extended Value

800000.00

950000

A

-5%

Value

836000

95000

Supplemental Cards

TRUE TAX VALUE

931000

Supplemental Cards

TOTAL LAND VALUE

931000

CEMP: 4109, 4508

TRDS: V7833 P19
TOWN OF GREENWICH
Town Hall ~ 101 Field Point Road ~ Greenwich, CT 06830
Planning & Zoning Department ~ 203-622-7894 ~ Fax 203-622-3795

Site Plan Review Checklist

Property Address: 2 Crown Lane  Tax ID: 11-2609
Anticipated Type of Application: Special Permit Section 6-101, 107
150,000 sf

All applications for preliminary and final site plan approval shall be made on the appropriate forms as provided by the Planning Staff. The following items must also be provided with the application. If any of the following items are not filed at the time of application, the application may be returned to the applicant in order that it may be filed in the entirety at an appropriate future date. Required Items: (Sec. 6-14)

Please check the items submitted below:

☑ Fifteen copies of a survey, folded to 9" x 12", showing existing conditions, including:
   a. Locations and dimensions of all existing buildings, structures, fences, retaining walls, utility facilities, trees of six (6) inches or more in diameter at breast height, and other similar features.
   b. Existing contours at no more than a two-foot vertical interval, unless waived by the commission Staff in circumstances where such contours may not be necessarily pertinent. The survey shall indicate topographic conditions of property immediately adjoining the subject parcel.
   c. The location of all existing watercourses, intermittent streams wetlands as required by IMWA, Flood Hazard Lines as determined by FEMA, springs and rock outcrops or a note indicating that none exist, with the sources of information listed.
   d. The zone in which the land to be developed falls and the location of any town and zone boundary lines within or adjoining the tract, and yard dimensions to existing buildings. Lot area, by zone, shall be indicated.
   e. The title of the development, date, revision date if any and nature of revision, north arrow, scale, and the name and address of owner and names of owners of adjacent land.
   f. Street and property lines, curbs, edges of pavement, sidewalks, easements, right-of-way, covenants, and deed restrictions.
   g. Traffic lights and controls, public trees, catch basins, hydrants, and power and telephone lines in adjacent streets.
   h. Certification with the signature and seal or registration number of a registered land surveyor licensed in the State of Connecticut that the drawing is substantially correct to A-2 Standards, and that the property is in a designated zone under the zoning regulations.

☑ Fifteen sets of a detailed Site development plan, at a readable scale, folded to 9" x 12", prepared in accordance with all applicable Town standards including the Roadway Design and Drainage Design Manuals, and signed by a professional architect, land surveyor, or engineer licensed in the State of Connecticut, showing:
   a. Location, dimension, and elevation of all proposed buildings, structures, walls, fences.
   b. Location dimensions and surface treatment of all existing and proposed parking and loading spaces, traffic access and circulation drives, and pedestrian walks. Sidewalks are to be provided as required by the Building Zone Regulations.
   c. Approximate location of proposed utility lines, including water, gas, electricity, sewer and the location of any transformers.
   d. Note specifying source of water supply and method of sewage disposal.
   e. Existing and proposed contours at units of no more than a two-foot interval unless waived by the Commission’s staff. Cuts and fills and estimates of blasting to be submitted at time of final site plan.
   f. Location, size and type of proposed landscaping and buffer planting and the designation of those areas of natural vegetation not to be disturbed.
   g. Any other similar information determined by the Commission staff to provide for the proper enforcement of the Building Zone Regulations.
   h. Zoning statistics including: Gross Floor Area, Floor Area Ratio, Usable Floor Area, Required Parking, Actual Parking

pzSitePlanChecklist 2020
Provided, Building Height, Building Footprint, and Area Devoted to Surface parking, Building and Drives.

- i. Provisions for compliance with Americans with Disabilities Act (Handicap Access) and State Building Code.
- j. Coastal Area Management Application for projects within the Coastal Overlay Zone.

- 3. Eight sets of architectural plans, signed and sealed by an architect registered in the State of Connecticut, of all floors, all exterior elevations showing existing and proposed grade conditions. Elevations are to detail architectural elements by labeling materials, color and dimensions. Each architectural elevation shall show the absolute building height as well as building height for zoning purposes. All HVAC facilities are to be shown on architectural elevations.

- 4. Three copies of Floor Plan Work Sheets with the dimensions and calculated floor areas for each floor prepared in accordance with Sec. 6-5(22). Consult Commission Staff for required format.

- 5. Three copies of "building coverage" computation sheets.

- 6. Three copies of "area devoted to surface parking, building, and drives" worksheets.

- 7. Five copies of sight distance certification reports when required by a preliminary site plan review or when advised by the commission staff pursuant to item 2(g) of this checklist.

- 8. Three copies of Volume calculations per 6-101.

- 9. Completed Traffic Impact Evaluation Form if applicable. Submission requirements are defined on the form, available at the Commission office. A traffic report may be required.

- 10. Ten copies of completed application form signed by applicant or authorized agent, owners and contract purchasers, as applicable.

- 11. Ten copies of completed Special Permit form, if required by Building Zone Regulations.

- 12. Fifteen copies of detailed, inclusive narrative description of the proposed project. For those projects involving amendments to the Building Zone Regulations and/or amendments to the Building Zone Regulation Map, the narrative description must provide the section number and text for the proposed amendment(s) to the BZR and an explanation providing justification for the proposal. For map changes, a scaled drawing at 1" to 400' needs to be provided for affected areas(s).

- 13. Eight copies of reductions in, 11 x 17 size, or other appropriate size, providing a readable, clear plan of proposed site development and architectural plans.

- 14. A showing that an adequate source of potable water is available to satisfy the needs of the proposed development as per Sec. 6-15(a)(5), signed by C.A.W.C.

- 15. An affidavit certifying that all abutting property owners have been notified, as evidenced by the submission of a certificate of mailing or certified or registered mail receipts about said application. A schedule of names, addresses, shown on a GIS map with lot lines indicating the location of the notified property owners. Owners of lots, or portions of lots, which are across a public or private street shall be deemed to be abutting property owners. For projects which require the preliminary review by the Conservation Commission, the notice shall be sent by the applicant to abutting owners two weeks prior to any scheduled hearing date of the Conservation Commission.

- 16. Authorization for the agent and contract purchasers to act on behalf of the certified property owner(s).

- 17. A separate schematic plan at a scale no larger than 1" - 100" indicating buildings, parking and drives on the site and all adjoining properties, including those across the street, and the nearest cross street.

- 18. Five copies of a Drainage Summary Report as per Department of Public Works and the Town Drainage Design Manual. The summary report must be prepared in accordance with the following formats: PRELIMINARY: Existing and proposed storm water distribution, existing and proposed runoff rates, capability of off-site drainage facilities to accommodate proposed runoff, capability of off-site soils to accommodate percolation or detention if proposed, and identification of proposed drainage structures. FINAL: Final structure design details, prior approval from IWWA, Engineering Division and Conservation Commission as appropriate, and all information required by the preliminary report or two copies of drainage exemption forms.

- 19. In accordance with Sec. 6-183.1 to 6-183.10 of the Building Zone regulations, tree protection and sedimentation and erosion control plans shall be submitted with all site plan applications.

- 20. All applications for final site plans shall be in the form of a survey prepared by a registered Connecticut land surveyor having metes and bounds, dimensions of all buildings, parking and drives, setbacks of all structures from property lines, setbacks between buildings, and certification that building dimensions shown thereon are the same as the approved architectural plans. Architectural and drainage plans are to be referenced by title, date(s) and sheet numbers.

- 21. Required fee submitted at time of application (see fee schedule).

- 22. "It is the belief of the PZC staff that this application is incomplete because of the failure of the applicant to provide the materials...
referred to above. This application will be reviewed by the PZC and a decision made as to whether it is complete or incomplete at its public meeting to be held in the PZC office."

All applicants must make an appointment to submit this application with the Applications Coordinator, Peter Mangs, who can be reached by (email) Peter.Mangs@greenwichct.org or (phone) 203-622-7894.

NOTE: Any new documentation presented at Planning and Zoning Meetings shall be submitted to staff so that they can be made part of the record. Please ensure all documents can easily be removed from presentation boards.
2 Crown Lane, LLC
2 Crown Lane
Greenwich, CT 06831
July 15, 2021
Site Plan & Special Permit -Application Planning and Zoning Commission

The owners are proposing to build a 6 bedroom home with approximately 10,882 sf of FAR with an attached 4 car garage on a 4.5383 acre (197,688sf) parcel in an RA-4 zone. This parcel allows up to 12,355.5 sf of FAR. We are following all zoning setbacks and heights. The volume of the proposed home is approximately 160,000 cubic feet.

The home is proposed as a 2 ½ story home with a basement below grade. The attic will be minimal and used for mechanical equipment. The main volume of the house will be built of brick veneer painted with a pitched cedar roof and painted trim details. The wings of the home will be clapboard siding with pitched cedar roof. The connectors will be mostly glass and wood panels with flat roofs. Overhang bracketed roofs at the side door and the middle two garage doors will be made of standing seam zinc coated copper. Gutters will be half round with leaders in zinc coated copper. Bluestone terraces will be built off of the first floor living room, study and guest suite. A lower bluestone terrace will be built off of the basement recreation room. This terrace will lead to the pool and pool terrace in the back yard.

Concerning the site, the existing home has already been removed along with the existing pool. The new home will be sited in essentially the same location as the dwelling that has been removed. The existing driveway entrance off Crown lane will be maintained. The property is a corner lot in the southeast quadrant of the Stanwich Road, Crown Lane intersection. Stanwich Road abuts the property on the west and south sides and Crown Lane on the north side. Septic soil testing has been done with the Greenwich Health Dept. and a suitable area has been identified for a 6 bedroom septic system which is depicted on the site plan. The property will be served by a new individual well. A drainage system complying with the Town of Greenwich Drainage Manual is depicted on the site plan. There are no wetlands on the property.
July 19, 2021

Re: Greenwich Planning & Zoning Commission
2 Crown Lane- (Parcel ID 11-2609)

Dear Adjacent Property Owner:

Our office is representing Two Crown Lane, LLC, in the presentation of applications to the Greenwich Planning & Zoning Commission seeking permission to construct a new home and pool at the above-cited address.

If you have any questions concerning the above matter, please contact our office, or the office of the Greenwich Planning & Zoning Commission at 203.622.7894.

Sincerely,

ROCCO V. D'ANDREA, INC.

RAR:adm
21AU P&ZNotice

cc: Two Crown Lane, LLC

Richard Regan PE
CERTIFICATE OF MAILING
2 Crown Lane
Tax ID #11-2609
June 17, 2021

Tax ID #11-2091
Class V 1911 LLC
540 Stanwich Road
Greenwich CT 06830

Tax ID #11-1835
Katherine Goldberg
548 Stanwich Road
Greenwich CT 06830

Tax ID #11-1920
Sheila Trabish
556 Stanwich Road
Greenwich CT 06830

Tax ID #11-2610
Alexander Denner
565 Stanwich Road
Greenwich CT 06830

Tax ID #11-2603
Lawrence Portnoy
18 Crown Lane
Greenwich CT 06830

Tax ID #11-2608
Oliver Engert
543 Stanwich Road
Greenwich CT 06830

Tax ID #11-1921
Aphrodite Skeadas
564 Stanwich Road
Greenwich CT 06830
AFFIDAVIT

STATE OF CONNECTICUT    }  
COUNTY OF FAIRFIELD    )  :

GREENWICH  )

I, Richard A. Regan, being first duly sworn, do hereby certify that on July 19, 2021, I caused to be mailed, postage prepaid, to those persons whose names are set forth, attached hereto, a copy of the notice attached hereto. Said persons were the record owners, as of June 17, 2021, of property abutting (as said term is defined in Sec. 6-14(a)(14) of the Greenwich Building Zone Regulations) the property belonging to Two Crown Lane, LLC for whom an application for construction of a new home and pool has been filed with the Greenwich Planning & Zoning Commission.

Richard A. Regan, PE

Subscribed and sworn to
before me on
July 19, 2021

Alicia D. Melillo
Notary Public
My Commission Expires 4/30/2026
July 7, 2021

Town of Greenwich
Planning & Zoning Commission
101 Field Point Road
Greenwich CT 06830

2 Crown Lane

To Whom It May Concern:

As owner(s) of the referenced property located at, 2 Crown Lane, I/we hereby authorize Rocco V. D’Andrea, Inc. to represent my/our interests in presenting an application(s) to the Greenwich Planning and Zoning Commission.

Sincerely,

[Signature]
PROJECT: Street Address [ ] Crown Lane [ ] "Crown Lane LLC"

PARCEL ID: [ ] 2609 [ ] Has there ever been an IWWA application for this site? [ ] YES [ ] NO

ACTIVITY: (Circle) [ ] Addition [ ] Demolition [ ] Deck [ ] Garage [ ] Interior renovations [ ] New residence [ ] Pool [ ] Tennis court

Will this activity require an addition to the septic system or B100a? [ ] YES [ ] NO

FEES: $65 for reviews requiring a site visit or further in the office analysis.

Owner’s full name [please print] 2 Crown Lane LLC [ ] Phone (203) 552-5236

Mailing address 12 Crown Street [ ] Town Greenwich CT Zip 06830

Authorized Agent’s name [please print] Rocco V. D’Andrea Inc [ ] Phone (203) 633-7178

Mailing address 6 Neil Lane Riverside [ ] Town Greenwich Zip 06830

A PLOT PLAN IS REQUIRED SHOWING THE PROPOSED ACTIVITY IN RED.
Staff cannot review your proposal without a plan.

IWAA staff will review this questionnaire to determine if regulated activities are associated with the proposal and whether an IWWA permit is required. Do not apply for a Building Permit until this review is complete.

If your project does not require an IWWA permit, we will sign off on this questionnaire, which you will need if you are obtaining permits from other departments.

If an IWWA permit is required, we will supply you with a permit application packet. You must obtain an IWWA permit prior to the commencement of your project. No work may begin until you receive an IWWA permit. The issuance of a building permit alone does not constitute an authorization to proceed.

If you do not receive notice regarding your questionnaire within two weeks of submission, please contact the IWWA office.

As the property owner [ ] or, authorized agent [ ] I believe that the information I have submitted is correct.

Signature [ ] Date 7/15/21

If mailing, return completed form.

If a site visit is required, you will be notified and asked to remit a $65 fee (payable to "Town of Greenwich") to the Greenwich Inland Wetlands & Watercourses Agency.

The site visit will not take place until this fee is received.

STAFF NOTES

Office Rev Date 7/19/21 Field Visit Date [ ] WET/WC? [ ] YES [ ] NO TIDAL [ ]

Action Required? [ ] YES [ ] NO if yes, DR AA AR SIA Staff [ ]

Soils Report Date [ ] Author [ ] Soils [ ]

Comments: Work is more than 100' from offshore wells [ ]

Fee Received: [ ] YES [ ] NO Comment: N/A

IWWA Questionnaire Revised 9/21/17
DRAINAGE SUMMARY REPORT

For

2 Crown Lane
Greenwich, Connecticut

Prepared For

Two Crown Lane, LLC

July 15, 2021
Revised October 18, 2021

Richard Regan, PE
CT License No. 13247
DEPARTMENT OF PUBLIC WORKS – ENGINEERING DIVISION
SITE DEVELOPMENT REVIEW

Engineering Project No. 21-5(49)  Department Project No. PLPZ202100334  Submittal Received Date: 7/28/2021

Submittal Reviewed For: Planning and Zoning

Traffic Review Requested: No  Review Type: Final Site Plan

PLAN SET INFORMATION

Plan Title: Final Site Plan Review Set  Project Address: 2 Crown Lane

Engineering Firm: Rocco V. D'Andrea, Inc.  Original Plan Date: 7/15/2021  Latest Plan Revision Date: ___

DRAINAGE SUMMARY REPORT INFORMATION

Engineering Firm: Rocco V. D'Andrea, Inc.  Original Report Date: 7/15/2021  Latest Report Revision Date: ___

Reviews provided by the Engineering Division are for compliance with the Town’s “Roadway Design Manual and Standard Construction Details” and “Drainage Manual” as amended. Reviews are based upon the information and plans provided. Comments pertaining to the Town’s manuals are not all encompassing. Other reviewing entities may provide additional comments regarding consistency with these manuals in accordance with their jurisdictions. Review of sanitary sewer and septic systems are not reviewed by the Engineering Division.

All New Submittals for Commission Meetings must be received by the Engineering Division four weeks before scheduled Commission Meeting.

All Revised Submittals for Commission Meetings must be received by the Engineering Division three weeks before scheduled Commission Meeting.

Reviewed and Approved by: Juan Paredes, P.E. - Civil Engineer II  Date: 09/22/2021

COMMENTS AND CONDITIONS OF APPROVAL: Resubmit Prior to Final Site Plan Approval

The Engineering Division recommends the Commission/P&Z Staff discuss the following with the applicant:

a) Minimizing the clearing of wooded areas by creating pre and post construction tree line delineation map.

b) Minimizing the area of land disturbance by installing constructing fencing only in the areas where work will be performed, shifting level spreader closer to rain garden. Commission may further discuss construction fencing placement and geometry.

c) Creating a staging area for both materials and construction vehicles as part of the e&s plan.

d) Creating a detailed planting plan for the proposed rain garden.

The following are comments for the site development review:

1. A revised Form SC-107 needs to be submitted.

2. The Drainage Summary Report must be revised as follows:

   a. Watershed A-1b: revise delineation to include all areas upgradient of pool and pool patio and all the rain garden.

   b. Watershed A-1f: it appears this watershed is directed to the permeable pavers BMP.

   c. Watershed A-1c: it appears this watershed is directed in part to proposed CULTECs and permeable pavers BMPs.
d. Revise grading in between rain garden and pool patio to direct runoff as intended per watershed delineation.

e. Revise routing model for permeable pavers outlet structure to show one primary discharge device (6" pipe).

f. Soil profile in test hole data DW#8 appears to show mottling at elevation 413.5; bottom of stone in proposed CULTECs is proposed at 412.0. Revise this BMP to remain above the mottled layer; if a two-foot vertical separation cannot be achieved, BMP may not provide RRV storage.

g. Bottom of rain garden is proposed 1.5’ above the restrictive layer. A minimum two-foot separation is required for an infiltration practice (thus providing RRV credit); otherwise, BMP must be designed as a filtering rain garden.

h. Provide EVQ tables from routing model for all proposed BMPs.

i. Revisited all other computations.

j. Additional comments may be issued upon submission.

3. The construction plan set needs to be revised as follows:

   a. Site Plan Sheets
      i. Show excavation and fill quantities in a table.
      ii. Show notes for construction phasing.
      iii. Show all bioretention (rain gardens) with contours (1/2 foot if needed) and include the following in the callout:
           1. Top of mulch/sod elevation and surface area.
      iv. Show all infiltrators (culverts, concrete dry wells, rainstores, etc.) with the following in the callout:
           1. Top of stone elevation above infiltrators.

   b. Construction Details Sheets
      i. Remove filter fabric from bottom of CULTEC detail.

   c. Building/House Section or Elevation Sheet
      i. Show all elevations to the deepest footings on section/elevation.
      ii. Show existing mottling elevation on section/elevation.
      iii. Show existing groundwater elevation on section/elevation.
      iv. Sheet shall be sealed and signed by a State of Connecticut Professional Engineer or Architect.


**Standard Conditions for Each Submittal**

1. The Engineering Division will no longer keep any records for the submittals. All records for the submittal shall be obtained from the Town of Greenwich Department/Division that has taken in applications and/or submittals. These documents are maintained within each office (e.g., P&Z, IWWA, and DPW Building and Highway Divisions).

2. All revisions to the reports and plans must follow the requirements in the Town of Greenwich Drainage Manual February 2014 as amended.

3. All revisions must be accompanied by a point-by-point written response to the Engineering Division’s comments.

**Standard Conditions of Approval**

1. The Operations and Maintenance Plan Report must include the following for the Certificate of Occupancy:
   b. The final completed Exhibit A, and B
   c. The Maintenance Declaration needs to be filed on the Town of Greenwich Land Records prior to a Certificate of Occupancy. A review of the documents above must be completed before filing on the Town of Greenwich Land Records.

2. The Town of Greenwich – Standard Construction Notes for Site and Subdivision Plans are conditions that must be met.

3. All requests for a Temporary Certificate of Occupancy (T.C.O.) or a Certificate of Occupancy (C.O.) shall be submitted one month before the T.C.O. or C.O. is required.

4. The submittal for a Temporary or Final Certificate of Occupancy must include the following:
c. Field Inspection Record (All required photos) – Form SC-106 – Sealed and Signed by a Connecticut Licensed Professional Engineer.

d. Bioretention Soil Testing Certification Sign-Off (as applicable with the bioretention soil gradation test and the phosphorous test for the mixed soil) – Form SC-104 – Sealed and Signed by a Connecticut Licensed Professional Engineer.


h. A Letter discussing all the work that remains to be completed (Only for a Temporary Certificate of Occupancy Submittal).
**DIRECTLY CONNECTED IMPERVIOUS AREA (DCIA) CERTIFICATION**

**PRE-CONSTRUCTION**

<table>
<thead>
<tr>
<th>Property Address:</th>
<th>2 Crown Lane, Greenwich</th>
<th>Tax Account No.:</th>
<th>11-2809</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Permit No.:</td>
<td>_______________________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PLANS & DRAINAGE SUMMARY REPORT INFORMATION**

<table>
<thead>
<tr>
<th>Engineering Firm:</th>
<th>Rocco V. D'Andrea, Inc.</th>
<th>Drainage Report Date:</th>
<th>10/18/2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Plans Date:</td>
<td>10/18/2021</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PROPERTY INFORMATION FOR DIRECTLY CONNECTED IMPERVIOUS AREA (DCIA)**

<table>
<thead>
<tr>
<th>Total Impervious Area Under Existing Conditions (SF)¹</th>
<th>Total Impervious Area Under Proposed Conditions (SF)¹</th>
<th>Total Disconnected Impervious Area Under Proposed Conditions (SF)²</th>
<th>Total Directly Connected Impervious Area Under Proposed Conditions (SF)³</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,530.00</td>
<td>18,803.00</td>
<td>18,803.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

¹ Impervious surfaces include but are not limited to roofs (including green roofs), buildings, houses, walks, patios, walls, tennis/sport courts (all surface types must be counted), landscape ponds, pools, paved streets/drives/parking areas constructed with concrete, asphalt, compacted dirt, gravel, or permeable pavements.

² All impervious surfaces that are directed to stormwater BMPs that meet the water quality volume (WQV) standard will be considered disconnected impervious cover. Acceptable stormwater BMPs are Bioretention (infiltrating/filtering), Constructed Stormwater Wetlands, Extended Dry Detention Basins (infiltration required), Gravel Wetlands, Constructed Wet Stormwater Ponds, Sand/Organic Filters (sand filters, tree filters, stormwater planters, etc.), Infiltration Systems (drywells, Culverts, etc.), Permeable Pavement Areas (infiltrating/filtering), Green Roofs, and Disconnected Impervious Area (must meet all the standards under Simple Disconnection on page 44 and 45 of the Drainage Manual).

³ Subtract the Total Disconnected Impervious Area Under Proposed Conditions (SF) from the Total Impervious Area Under Proposed Conditions (SF).

---

**Engineer’s Signature**

[Signature]

**Date**

10/18/2021

**Engineer’s Seal**

[Seal]
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   USDA Soil Delineation Map Exhibit C

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   Credits for LID BMPs Appendix B
   Runoff Volume & Retention System Design Calculations Appendix C
   HydroCAD Analysis – Existing Conditions Appendix D
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   Pipe Conveyance Calculations Appendix F
   Soil Results Forms & Hydraulic Conductivity Tests Appendix G
Introduction & LID Techniques

1.1. Project Narrative

The applicant is proposing improvements to the subject property. The property is bordered to the north by Crown Lane and the west and south by Stanwich Road. The owners are proposing to build a 6-bedroom home with approximately 10,900 sf of floor area with an attached 4-car garage on a 4.5383 acre (197,688 s.f.) parcel in an RA-4 Zone. The proposed improvements will include the construction of the home, new driveway and motor court. Improvements also include the installation of a new pool, storm drainage systems, septic system, site grading, and associated landscaping.

For a depiction of existing conditions and the proposed development refer to a development plan set entitled “Final Site Plan Review Set, Single Family Dwelling, Location 2 Crown Lane, Greenwich, Connecticut, prepared for Two Crown Lane, LLC” as prepared by Rocco V. D’Andrea, Inc.

The proposed redevelopment of the parcel will increase the impervious coverage by approximately 6,273 square feet. Refer to Appendix “C” for a depiction of the proposed stormwater BMPs and drainage calculations.

This proposed project will conform to all applicable Town stormwater management standards to the maximum extent practicable. Refer to Appendix “A” for a narrative detailing the projects compliance with each stormwater management standard.

1.2. Land Use Regulations

The subject parcel is located in the “R-4” zone. All applicable zoning setbacks and regulations will be adhered to. There are no inland wetlands or watercourses located on the property.

1.3. Site Inventory & Evaluation

The existing site consisted of an existing asphalt driveway, a dwelling, and a pool. Note that the pool and dwelling were removed this spring. The topography of the site slopes from north (Crown Lane) to south Stanwich Road. Runoff flows onto Stanwich Road and into the town drainage system. Existing drainage patterns will generally be maintained under post-construction conditions. A substantial portion of the northerly portion of the property off Crown Lane was improved with, driveway, home, pool and landscaped lawn areas. The southerly portion of the property is wooded.

Refer to Exhibit “C” for the USDA soil delineation map and hydraulic soil group ratings for the site. Refer to the Development Plan for the test pit locations and Appendix “G” for the soil test results forms and Hydraulic Conductivity Tests results.
1.4. Development Envelope

The approximate development/disturbance envelope will encompass approximately 45% of the site when proposed grading area is included. Sediment and erosion controls will be installed around the proposed development envelope prior to the start of construction to minimize the impact to the surrounding areas. The intent is to leave the vast majority of the wooded portion in its current condition to function as a buffer. The septic area is specified to be seeded with meadow grass so that it will not be a manicured lawn and thereby have less runoff.

1.5. LID Control Strategies

In the watershed analysis of existing and proposed conditions, the site has been divided into various sub-drainage areas discharging to various POCs, “Points of Concern.” The analysis is limited to the subject parcel. Refer to Exhibits “A” and “B” for a depiction of the existing and proposed conditions drainage areas and flow paths. Refer to Appendices “D” and “E” for the existing and proposed HydroCAD Analysis. Refer to Tables 1 & 2 at the end of this section for a comparison of existing and proposed peak flows and volume runoffs for Points of Concern A and B under every storm event. Point of Concern C was unmodified and therefore, peak flows and volume runoffs are the same under existing and proposed conditions.

Conformance to the standards for water quality, TSS removal, and runoff volume reduction will be achieved through the construction of the proposed BMPs. The runoff peak flow reduction standard has been met for all storms up to the at least the 25-year storm to all points of concern. Refer to the HydroCAD Summary Table at the end of this introduction for a comparison of existing and proposed condition stormwater runoff volumes and flow rates to all points of concern.

2. Structural BMPs

2.1. Water Quality Volume and TSS Removal

Refer to Appendix “C” for Water Quality Volume calculations. The proposed BMPs will provide adequate storage to retain and infiltrate the water quality volume of the contributing runoff from the proposed impervious improvements.

Retention of the Water Quality Volume from newly constructed impervious areas will provide the minimum 80% removal of total suspended solids (TSS), which exceeds Town standards. Refer to Appendix “C” for TSS removal calculations.

This volume will be retained and infiltrated by the proposed stormwater systems. Refer to Appendix “C” for 72-Hour Drawdown Calculations.
2.2. **Runoff Reduction Volume**

The proposed development will not result in an increase in runoff volume from the site for the 1-year storm event towards all points of concern, as compared to existing conditions. Refer to Appendix “C” for Runoff Reduction Volume Calculations.

2.3. **Groundwater Recharge Volume**

The groundwater recharge standard has been satisfied through the stormwater infiltration capabilities of the proposed systems. Refer to Appendix “C” for Groundwater Recharge Volume Calculations.

2.4. **Peak Runoff Attenuation**

The proposed development will decrease peak runoff flow rates to less than pre-construction conditions to all points of concern. Refer to Appendices “D” and “E”. The decrease in peak runoff flow rates meets the standard of reduction for all storms up to at least the 25-year storm.

3. **Conclusion**

The proposed improvements to the subject parcel will increase the impervious coverage on the site and thus increase the volume and peak rate of runoff generated during a storm event. However, with the use of the proposed BMPs and site grading there will be a reduction in stormwater runoff volume and flow rates to all points of concern.

The proposed development will meet the water quality volume, TSS removal, runoff reduction volume, and groundwater recharge volume standards of the Town of Greenwich Drainage Manual to the maximum extent practicable. The proposed development incorporates pretreatment and attenuation of runoff to the maximum extent practicable. If the development is constructed as depicted on the proposed plans, there will be no adverse impacts to adjoining properties, the subject parcel, or the town drainage system, due to the proposed improvements.
### Tables 1 & 2

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>POC</th>
<th>Flow/Volume</th>
<th>Existing</th>
<th>Proposed</th>
<th>Δ</th>
<th>Δ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Year Storm</td>
<td>A</td>
<td>q (ft³/s)</td>
<td>2.28</td>
<td>1.53</td>
<td>-0.75</td>
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<tr>
<td></td>
<td></td>
<td>v (ft³)</td>
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<td>-20.0</td>
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<td>A</td>
<td>q (ft³/s)</td>
<td>3.27</td>
<td>2.66</td>
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<td>-18.7</td>
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<td></td>
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<td>v (ft³)</td>
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<td>100 Year Storm</td>
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<td>q (ft³/s)</td>
<td>17.31</td>
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<td>v (ft³)</td>
<td>76,378</td>
<td>73,630</td>
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</table>

*Table 1: Comparison of Existing and Proposed Peak Flow Rates and Volumes for Point of Concern "A"*

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>POC</th>
<th>Flow/Volume</th>
<th>Existing</th>
<th>Proposed</th>
<th>Δ</th>
<th>Δ (%)</th>
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<tr>
<td>1 Year Storm</td>
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<td>q (ft³/s)</td>
<td>0.47</td>
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<td>v (ft³)</td>
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<td>q (ft³/s)</td>
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<td>-0.01</td>
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<td>-1.2</td>
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<td>q (ft³/s)</td>
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<td>v (ft³)</td>
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<td>1.64</td>
<td>-0.02</td>
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<td></td>
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<td>v (ft³)</td>
<td>7,457</td>
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<td>25 Year Storm</td>
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<td>q (ft³/s)</td>
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<td>2.44</td>
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<td>v (ft³)</td>
<td>10,967</td>
<td>10,840</td>
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<td>50 Year Storm</td>
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<td>q (ft³/s)</td>
<td>4.26</td>
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<td></td>
<td>v (ft³)</td>
<td>18,869</td>
<td>18,651</td>
<td>-218</td>
<td>-1.2</td>
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</tbody>
</table>

*Table 2: Comparison of Existing and Proposed Peak Flow Rates and Volumes for Point of Concern "B"*

Point of Concern "C" was unmodified when comparing existing and proposed conditions.
Exhibits “A & B”

Watershed Maps -
Existing and Proposed Conditions
"RA-4" ZONE
AREA = 4.5383 ACRES

ROCCO V. D'ANDREA INC.
- LAND PLANNERS
- ENGINEERS
- SURVEYORS
P.O. BOX 546
POTTSVILLE, PA 17901
T. 610-682-3278
F. 610-682-3279
EXHIBIT "B"
PROPOSED CONDITIONS
Exhibit "C"

NRCS Web Soil Survey
MAP LEGEND

Area of Interest (AOI)

Soils

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

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)
Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: State of Connecticut
Survey Area Date: Version 20, Jun 9, 2020
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Oct 5, 2016

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

<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>45A</td>
<td>Woodbridge fine sandy loam, 0 to 3 percent slopes</td>
<td>C/D</td>
<td>2.0</td>
<td>38.7%</td>
</tr>
<tr>
<td>45B</td>
<td>Woodbridge fine sandy loam, 3 to 8 percent slopes</td>
<td>C/D</td>
<td>0.5</td>
<td>9.4%</td>
</tr>
<tr>
<td>48C</td>
<td>Georgia and Amenia silt loams, 8 to 15 percent slopes</td>
<td>C</td>
<td>0.7</td>
<td>14.3%</td>
</tr>
<tr>
<td>73C</td>
<td>Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky</td>
<td>B</td>
<td>0.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>84B</td>
<td>Paxton and Montauk fine sandy loams, 3 to 8 percent slopes</td>
<td>C</td>
<td>1.9</td>
<td>37.6%</td>
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<tr>
<td><strong>Totals for Area of Interest</strong></td>
<td></td>
<td></td>
<td><strong>5.1</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Appendix “A”

Stormwater Management Standards Narrative
1. **Standard 1: Low Impact Development**

Low Impact Development site planning and design techniques are used to the maximum extent practicable in the development of the subject parcel. Infiltration practices will be sited on the most permeable soils on the site. Over 60% of the proposed impervious coverage is to be treated by the proposed LID BMPs. Refer to Appendix “C” for a depiction of each proposed LID and non-LID BMP.

2. **Standard 2: Protection of Natural Hydrology**

   A. **Site Disturbance**
   Site disturbance shall be minimized. The project disturbance area shall include only the area necessary to reasonably accommodate construction activities.

   B. **Soil Compaction**
   Soil compaction is to be minimized for this site using only the lightest equipment possible and minimizing all travel over lawn and bioretention areas.

   C. **Time of Concentration**
   Post-development times of concentration values are similar to those of pre-development for the portions of the parcel remaining lawn. The collection and infiltration of stormwater runoff from the proposed impervious coverage will help slow down the time of concentration of the runoff to all POC’s to more match that of existing conditions.

   D. **Grading Plan**
   Development shall follow the natural contours of the landscape to the maximum extent practicable. Points of concern will remain consistent from pre-existing to proposed conditions despite proposed grading changes.

   E. **Compost Amended Soils**
   This sub-standard is not applicable to this project.

   F. **Ground Disturbance**
   Per the site design, no disturbed ground is to be left as exposed bare soil at project completion. All disturbed areas are to be covered with topsoil and planted with grass or landscaped with vegetation.
G. Surface Water Systems
Existing surface waters and systems shall be maintained to the maximum extent practicable.

H. Roadway and Driveway Crossings (Surface Waters)
This sub-standard is not applicable to this project.

I. Roadway and Driveway Crossings (Streams)
This sub-standard is not applicable to this project.


Several BMPs will be utilized to meet the stormwater management requirements. Refer to Appendix “C” for an in depth analysis of the proposed systems.

A. Hydrologic and Geologic Conditions
Refer to Exhibit “C” for the USDA soil delineation map and hydraulic soil group ratings for the site. Refer to Appendix G for the soil test results forms.

B. Design Calculations
Refer to Appendix “C” for runoff reduction, groundwater recharge, and pollutant reduction calculations. Refer to the HydroCAD Summary Table of the “Introduction” for a summary and comparison of peak flow rates.

C. Shutdown & Containment
Shutdown and containment of the retention system infiltration systems is not feasible without the use of pumps.

D. Pumping of Stormwater
This sub-standard is not applicable to this project.

E. Pumping of Uncontaminated Groundwater
This sub-standard is not applicable to this project.

4. Standard 4: Runoff Volume Reduction and Groundwater Recharge

A. Runoff Volume Reduction
Refer to Appendix “C” for Runoff Reduction Volume Calculations.

B. Groundwater Recharge
Refer to Appendix “C” for Groundwater Recharge Volume Calculations.

C. Runoff Capture
As the Runoff Volume Reduction standard is met to all points of concern and the water quality volume will be infiltrated and treated, the proposed drainage design for the site is also compliant with the runoff capture standard.
5. **Standard 5: Peak Flow Control**

   A. **Stream Channel Protection**
   This sub-standard is not applicable to this project.

   B. **Conveyance Protection**
   Refer to Appendix “F” for Pipe Conveyance Computations.

   C. **Peak Runoff Attenuation**
   Refer to the HydroCAD Summary Table of the “Introduction” for a summary and comparison of peak flow rates as well as Appendices “D” and “E” for the results of the Hydrologic Analyses for existing and proposed conditions, respectively.

   D. **Emergency Outlet Sizing**
   This sub-standard is not applicable to this project.

6. **Standard 6: Pollutant Reduction**

   A. **TSS Removal**
   Refer to Appendix “C” for TSS Removal Calculations.

7. **Standard 7: High Load Areas**
   The proposed development does not classify this site as a High Load Area. Therefore standard 7 is not applicable to this project.

8. **Standard 8: Critical Areas**
   The Critical Area sub-standard is not applicable to this project.

   A. **Source Control, Pollution Prevention Measures, Structural Stormwater BMPs**
   The proposed BMPs have been designed to meet the pollutant reduction standard and the water quality volume infiltration standard.

   B. **Higher Potential Pollutant Loads**
   The proposed development does not classify this site as a High Load Area. Therefore this standard is not applicable to this project.

9. **Standard 9: Re-development**

   A. **Re-development Definition**
   This project will include alterations that disturb the ground surface or increase the impervious area on site. This project is considered a re-development.

   B. **Meet the Standards**
   The proposed project meets the standards to the maximum extent possible, including the evaluation of LID site planning and the inclusion of stormwater LID BMPs.
C. Undeveloped Portions of the Property
Any development on previously undeveloped portions of a site shall fully comply with all of the other Stormwater Management Standards.

D. Stormwater Controls
Refer to Appendix “C” for a depiction of the proposed stormwater controls.

E. Infiltration through Hazardous Substances
There are no known hazardous substances or areas with soil or groundwater contamination on the site. Therefore, this standard is not applicable to this project.

10. Standard 10: Construct Erosion and Sediment Control

A. Sedimentation and Erosion Control Plan
Refer to the Sedimentation and Erosion Control Plan, for a depiction of the proposed sedimentation and erosion control measures including but not limited to construction fencing and silt fencing.

B. Sedimentation and Erosion Control Measures Installation and Removal
The proposed site design instructs the contractor to install all sedimentation and erosion control measures prior to commencing construction and appropriately remove these measures at the completion of construction.

11. Standard 11: Construction Inspections

A. Surety
If requested by the approving authority, the proponent will post a bond, cash, or other acceptable surety in an amount deemed sufficient to ensure the work will be completed in accordance with the approved plans.

B. Notification of Work
The proponent will be instructed to notify the approving authority before starting land-disturbing activity and before construction of the key components of the stormwater management system.

C. Stormwater Management System Inspections
The project engineer will complete periodic inspections of the stormwater management system.

D. Site Inspections
The project engineer will complete site inspections in accordance with this sub-standard and the Field Inspection Record form (SC-106). The project engineer will inspect the stormwater management system during a storm event if possible.
E. Failing Stormwater Management System
The approving authority will be notified if the system is found to be inadequate due to operational failure, regardless of its compliance with the approved plans. The design of the system shall then be corrected before final approval is granted by the approving authority.

F. Project Completion
Upon project completion, the project’s compliance with the approved plans will be certified and all required inspection certifications will be provided to the approving authority.

12. Standard 12: Operation and Maintenance

A. Operation and Maintenance Plan
Refer to the Operations and Maintenance Plan Report prepared for the project outlining maintenance measures to ensure functionality of the proposed stormwater management system.

B. O&M Plan Components
The Operations and Maintenance Plan will identify all applicable items in Section 5 and Section 7 of the Town of Greenwich Drainage Manual.

C. O&M Plan Implementation
The Operation and Maintenance Plan Report will identify the parties legally responsible for implementing the O&M Plan.

D. O&M Plan Records
The appropriate parties will be instructed to complete and retain documents relating to installation, maintenance and repairs to the stormwater management system.

E. Proof of O&M Plan Records
The appropriate parties will be instructed to provide records of maintenance and repairs to the approving authority during inspections and/or upon request.

F. Failure to Implement O&M Plan
The appropriate parties will be informed that failure to implement the O&M Plan can result in the municipality assuming responsibility for their implementation and securing reimbursement for associated expenses.

The drainage design depicted on the Development Plans for the site is congruent with the stormwater management plan outlined in this report.

14. Standard 14: Illicit Discharges
Illicit discharges do not currently exist on the site. The proposed site design does not depict any illicit discharges to be installed.
Appendix “B”

Credits for LID BMPs
## Credits for Low Impact Development (LID) Best Management Practices (BMPs)

<table>
<thead>
<tr>
<th>LID Technique</th>
<th>Compliance Requirements</th>
<th>Credit</th>
<th>LID Used</th>
<th>Credit Taken</th>
</tr>
</thead>
</table>
| Minimizing Soil Compaction (Section 4.4.1)        | - The "no disturbance" areas are protected by having the limits of disturbance and access clearly shown on the Stormwater Management Plan, all construction drawings, and delineated/flagged/fenced in the field.  
  - "No disturbance" areas are not to be stripped of existing topsoil.  
  - "No disturbance" areas are not to be stripped of existing vegetation.  
  - Vehicle movement, storage, or equipment/material lay-down is not to be permitted in "no disturbance" areas.  
  - Use of soil amendments and additional topsoil is permitted in other areas being disturbed. Grading may be performed using low ground pressure equipment (less than 3 pounds per square inch) to reduce the potential for soil compaction.  
  - Lawn and turf grass are acceptable uses. Planted meadow is an encouraged use. | Areas that comply (i.e., "no disturbance areas") can use the forested cover and open space site cover runoff coefficient (R) when calculating the required Water Quality Volume. See Section 5.6.3 and Table 5-5, Site Cover Runoff Coefficients. | \( v_0 \) | \( n_0 \) |
| Minimizing Site Disturbance (Section 4.4.2)       | Site disturbance including earthwork and clearing of vegetation should be limited to 40 feet beyond the building perimeter, 10 feet beyond the primary roadway curbs, walkways, and main utility branch trenches, and 25 feet beyond areas of proposed infiltration in order to limit compaction in the proposed infiltration area. This guidance is not intended to limit lawn areas. | Areas that comply can use the forested cover and open space site cover runoff coefficient (R) when calculating the required Water Quality Volume. See Section 5.6.3 and Table 5-5, Site Cover Runoff Coefficients. | \( v_0 \) | \( n_0 \) |
| Protecting Sensitive Natural Areas (Section 4.4.3) | Sensitive natural areas should be conserved at development sites, thereby preserving predevelopment hydrologic and water quality characteristics. The area must be permanently protected under a conservation easement. | The project proponent can subtract the conservation area from the total area in the Water Quality Volume calculation. | \( n_0 \) | \( n_0 \) |
| Protecting Riparian Buffers (Section 4.4.4)       | Effective treatment of stormwater runoff is achieved when pervious and impervious area runoff is discharged to a grass or forested buffer via overland flow. The use of a filter strip is recommended to treat overland flow in the green space of a development site.  
  - The minimum stream buffer width (i.e., perpendicular to the stream flow path) shall be 50 feet as measured from the top bank elevation of a stream or the boundary of a wetland.  
  - The maximum contributing path shall be 150 feet for pervious surfaces and 75 feet for impervious surfaces.  
  - The average contributing overland slope to and across the buffer shall be less than or equal to 5%.  
  - Runoff shall enter the buffer as sheet flow. A level spreader shall be utilized where local site conditions prevent sheet flow from being maintained.  
  - The stream buffer remains unmanaged other than routine debris removal.  
  - The buffer is protected by an acceptable conservation easement or other enforceable instrument that provides perpetual protection of the area. The easement must clearly specify how the natural area vegetation shall be | The area draining by sheet flow to a buffer can be subtracted from the total area in the Water Quality Volume calculation, and the impervious area draining to the buffer by sheet flow can be subtracted from the impervious area in the Groundwater Recharge Volume calculation and post-development impervious area in the Runoff Reduction Volume calculation. | \( n_0 \) | \( n_0 \) |
## Credits for Low Impact Development (LID) Best Management Practices (BMPs)

<table>
<thead>
<tr>
<th>LID Technique</th>
<th>Compliance Requirements</th>
<th>Credit</th>
<th>LID Used</th>
<th>Credit Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoiding Disturbance of Steep Slopes (Section 4.4.5)</td>
<td>Development on steep slope areas shall be avoided. Unnecessary grading should be avoided on all slopes, as should the flattening of hills and ridges. Development shall follow the natural contours of the landscape.</td>
<td>Undisturbed steep slope areas can use the forested cover and open space site cover runoff coefficient (R) when calculating the required Water Quality Volume. See Section 5.6.3 and Table 5-5, Site Cover Runoff Coefficients.</td>
<td>( N_0 )</td>
<td>( N_0 )</td>
</tr>
<tr>
<td>Siting on Permeable and Erodible Soils (Section 4.4.6)</td>
<td>Whenever possible, highly erodible soils should be left undisturbed and protected from disturbance during site construction. Gravel soils tend to be the least erodible. Also as clay and organic matter increase erodibility tends to decrease. Infiltration practices should be located on those portions of the site with the most permeable soils.</td>
<td>( N_0 )</td>
<td>( N_0 )</td>
<td></td>
</tr>
<tr>
<td>Protecting Natural Flow Pathways (Section 4.4.7)</td>
<td>Site designs should use and/or improve natural drainage pathways whenever possible to reduce or eliminate the need for stormwater pipe networks. Natural drainage pathways should be protected from significantly increased runoff volumes and rates due to development. The design should prevent the erosion and degradation of natural drainage pathways through the use of upstream volume and rate control BMPs, if necessary. Level spreaders, erosion control matting, revegetation, outlet stabilization, and check dams can also be used to protect natural drainage features.</td>
<td>( N_0 )</td>
<td>( N_0 )</td>
<td></td>
</tr>
<tr>
<td>Reducing Impervious Surfaces (Section 4.4.8)</td>
<td>By reducing the amount of paved surfaces, stormwater runoff is decreased while infiltration and evapotranspiration opportunities are increased.</td>
<td>Reducing impervious surfaces reduces the Water Quality Volume, Runoff Reduction Volume, Groundwater Recharge Volume, and Peak Flow/Runoff Attenuation requirements.</td>
<td>( N_0 )</td>
<td>( N_0 )</td>
</tr>
<tr>
<td>Stormwater Disconnection (Section 4.4.9)</td>
<td>Disconnecting roof leaders and routing road and driveway runoff from conventional stormwater conveyance systems allows runoff to be collected and managed onsite. Runoff can be directed to vegetated areas designed for onsite storage, treatment, and volume control.</td>
<td>Methods to compute the resultant runoff volumes and peak runoff rates from disconnected impervious areas are discussed in Section 4.6 of this manual and the design references cited therein. For simple disconnection, subtract 100% of the disconnected area from the total area in the Water Quality Volume calculation if the receiving pervious area is HSG A or B soils or 50% of the ( N_0 )</td>
<td>( N_0 )</td>
<td>( N_0 )</td>
</tr>
<tr>
<td>LID Technique</td>
<td>Compliance Requirements</td>
<td>Credit</td>
<td>LID Used</td>
<td>Credit Taken</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<td>--------------</td>
</tr>
</tbody>
</table>
| Compost-Amended Soils      | Restore the original properties and porosity of the soil by deep till and amendment with compost to reduce the generation of runoff and enhance the runoff reduction performance of infiltration BMPs.  
  - Soil must be tilled to 12 to 16 inches and amended with small amounts of organic material.  
  - For mechanical aeration of lawns/turf to be effective:  
    - Utilize a soil aerator that has a mechanical action that not only penetrates the soil surface but also shatters the soil matrix, causing the soil to de Compact and crack, thus creating void space and increasing infiltration. (Passive-type aerators which simply poke a hole into the soil, whether it removes a plug or simply spikes a hole, can create a hardpan effect at the depth of penetration.)  
    - Shatter-type aerators include vertidrain, soil reliever, agrivator, and groundbreaker. Shatter-type aerators should penetrate the soil at depths of 8 to 18 inches.  
    - The depth to water table or bedrock must be greater than 18 inches.  
    - Existing soils may not be saturated or seasonal wet.  
    - Slopes may not exceed 10%.  
    - Existing tree root systems shall be avoided, no deep till or amendment under the tree drip lines. | Subtract 50% of any restored areas (100% of any restored and reforested areas) from the total post development site area and re-calculate the Runoff Reduction Volume. | N₀       | N₀           |
| Rainwater Harvesting        | Rain barrels should hold a minimum of 50 gallons. Rain barrels can be connected in series to provide larger storage volumes.  
  Equip rain barrels with a drain spigot near the bottom of the barrel with garden hose threading to allow easy hook up and use for watering.  
  Provide an overflow pipe or hose near the top of the rain barrel.  
  Provide removable, child-resistant covers.  
  Provide mosquito screening on water entry holes to prevent mosquito breeding in standing water. | Subtract 25% of the contributing drainage area from the total area in the Water Quality Volume calculation. | N₀       | N₀           |
## Credits for Low Impact Development (LID) Best Management Practices (BMPs)

<table>
<thead>
<tr>
<th>LID Technique</th>
<th>Compliance Requirements</th>
<th>Credit</th>
<th>LID Used</th>
<th>Credit Taken</th>
</tr>
</thead>
</table>
| Rainwater Harvesting (Cisterns) | The rooftop runoff must be captured and either (1) used on site for irrigation of lawns and gardens, wash water and other non-potable uses, or (2) treated and released, or (3) infiltrated.  
  The cistern must be sized to treat the design rainfall from the roof area directed to the water harvesting system. If all of the design volume captured cannot be used, then a scaled reduction in credit will be given. The remaining volume must be treated by a properly designed BMP.  
  A minimum factor of safety equal to 1.2 must be applied to the calculated cistern volume required.  
  All stormwater collected must have a dedicated, year-round, use to assure no overflow of the system during a design rainfall. A water balance calculation must be used to establish the dedicated use volumes and rates. The water balance calculation must demonstrate that the design volume can: (1) be drawn down (used) within 3 days to allow for available volume in the system for the next rain event to be captured and stored, or (2) have an overflow of no more than 14 percent of the annual average historic rainfall, or (3) be drawn down within 3 days and discharged to a properly designed BMP. On a case-by-case basis, reduced credit may be given if the design volume cannot be reliably drawn down within 3 days, or if a year-round reuse is not available. The dedicated water use system must be automated to ensure that the water will be used at the rate and volume designed.  
  The overflow shall discharge flows in excess of the design volume to a vegetated or natural area, or to another properly designed BMP (e.g., rain garden). This discharge shall be non-erosive flow for the 10-yr rainfall event. It shall not discharge directly to impervious surfaces. The elevation of the overflow pipe from the cistern shall be at or above the design volume elevation. If a first flush diverter is used, the bypassed water must discharge to a properly designed BMP. The first flush can be directed to a relatively small BMP next to the water harvesting system, or it can be directed to and accounted for in other BMPs on the site.  
  At a minimum, a 1 mm or smaller screen at the entrance to the cistern from the gutter system shall be provided to filter out debris and to keep mosquitoes out of the cistern.  
  If the water reuse system is designed to accommodate basement sump/foundation drain water and roof runoff, the design must allow for adequate storage for the full volume of roof runoff for the next design storm and basement sump/foundation drain water. | Subtract 100% of the contributing drainage area from the total area in the Water Quality Volume calculation. | ☐        | ☐            |
## Credits for Low Impact Development (LID) Best Management Practices (BMPs)

<table>
<thead>
<tr>
<th>LID Technique</th>
<th>Compliance Requirements</th>
<th>Credit</th>
<th>LID Used</th>
<th>Credit Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A properly designed footing for the cistern must be designed if the load of the cistern at full capacity is greater than the soils will support. If it is buried, buoyancy calculations must be provided to show the cistern will not float when empty. Buoyancy calculations and flotation constraints must be provided if any part of the buried cistern is below the seasonal high water table, or if the area is subject to flooding. An appropriate pump shall be selected to provide adequate pressure for its designated uses. Above ground cisterns shall be made of a material or color that prevents light from entering the cistern, which helps prevent algae growth within the cistern. Irrigation water from a cistern shall be applied so that the water infiltrates into the ground. If for any reason the designed dedicated end use becomes unavailable because of some change, it will be required that an approved alternative end use or a properly designed BMP treatment system be installed on site to manage the roof runoff. The harvesting system shall be labeled and identified as non-potable water. The harvesting system shall meet all local and state building and plumbing codes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LID Technique</td>
<td>Can Credit be Used? Groundwater Recharge Volume GRV</td>
<td>Can Credit be Used? Run-off Reduction Volume RRV</td>
<td>Can Credit be Used? Water Quality Volume WQV</td>
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<td>---------------------------------------------------</td>
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<td>-------------------------------------------------</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Minimizing Soil Compaction (Section 4.4.1)</td>
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<td>NO</td>
<td>YES</td>
<td></td>
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<tr>
<td>Minimizing Site Disturbance (Section 4.4.2)</td>
<td>NO</td>
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<tr>
<td>Protecting Sensitive Natural Areas (Section 4.4.3)</td>
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<tr>
<td>Protecting Riparian Buffers (Section 4.4.4)</td>
<td>YES</td>
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<tr>
<td>Avoiding Disturbance of Steep Slopes (Section 4.4.5)</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
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<tr>
<td>Siting on Permeable and Erodible Soils (Section 4.4.6)</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Protecting Natural Flow Pathways (Section 4.4.7)</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Reducing Impervious Surfaces (Section 4.4.8)</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Stormwater Disconnection (Section 4.4.9)</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Compost-Amended Soils</td>
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<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Rainwater Harvesting (Rain Barrels)</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Rainwater Harvesting (Cisterns)</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>
Appendix “C”

Runoff Volume & Retention
System Design Calculations
**Water Quality Volume: Drain Area A-1a > POC A**

Watershed Data

Watershed Area = 115,841 ft²

Pervious Cover (Soil C) = 115,841 ft² (100%)

\[ WQV = \frac{1}{12} \text{ in} \frac{in}{ft} \]

Where:

\[ WQV = \text{Water quality volume} \]

\[ R = \text{Site cover runoff coefficient} = R_{T}(%T) \]

\[ R_{T} = \text{Runoff coefficient for lawn} = 0.22 \text{ (HSG C)} \]

\[ %T = \text{Percent of site in lawn (Soil C)} = 1.00 \text{ (decimal)} \]

\[ A = \text{Watershed area} = 115,841 \text{ ft}^2 \]

\[ R = \text{Site cover runoff coefficient} = 0.22 \]

\[ WQV = \frac{1}{12} (0.22)(115,841) = 2,123.8 \text{ ft}^3 \]

\[ WQV = 2,123.8 \text{ ft}^3 \]

**Water Quality Volume: Drain Area A-1b > Rain Garden > POC A**

Watershed Data

Watershed Area = 19,799 ft²

Impervious Cover = 9,703 ft² (49.0%)

Pervious Cover (Soil C) = 10,096 ft² (51.0%)

\[ WQV = \frac{1}{12} \text{ in} \frac{in}{ft} \]

Where:

\[ WQV = \text{Water quality volume} \]

\[ R = \text{Site cover runoff coefficient} = R_{I}(%) + R_{T}(%T) \]

\[ R_{I} = \text{Runoff coefficient for impervious} = 0.95 \]

\[ R_{T} = \text{Runoff coefficient for lawn} = 0.22 \text{ (HSG C)} \]

\[ %I = \text{Percent of site as impervious cover} = 0.49 \text{ (decimal)} \]

\[ %T = \text{Percent of site in lawn (Soil C)} = 0.51 \text{ (decimal)} \]

\[ A = \text{Watershed area} = 19,799 \text{ ft}^2 \]

\[ R = \text{Site cover runoff coefficient} = 0.592 \]

\[ WQV = \frac{1}{12} (0.592)(19,799) = 976.8 \text{ ft}^3 \]

\[ WQV = 976.8 \text{ ft}^3 \]
• **Water Quality Volume: Drain Area A-1c > Permeable Pavers > POC A**

  Watershed Data
  - **Watershed Area** = 10,726 ft²
  - Impervious Cover = 7,730 ft² (72.1%)
  - Pervious Cover (Soil C) = 2,996 ft² (27.9%)

  \[ WQV = \frac{1}{12} \frac{in}{ft} RA \]

  Where:
  - WQV = Water quality volume
  - R = Site cover runoff coefficient = R,I(%I) + R,T(%T)
  - R,I = Runoff coefficient for impervious = 0.95
  - R,T = Runoff coefficient for lawn = 0.22 (HSG C)
  - %I = Percent of site as impervious cover = 0.721 (decimal)
  - %T = Percent of site in lawn (Soil C) = 0.279 (decimal)
  - A = Watershed area = 10,726 ft²
  - R = Site cover runoff coefficient
  - (0.95)(0.721) + (0.22)(0.279) = 0.75

  \[ WQV = \frac{1}{12} (0.75)(10,726) = 670.40 ft³ \]
  \[ WQV = 670.4 ft³ \]

• **Water Quality Volume: Drain Area A-1d > Cultec System > POC A**

  Watershed Data
  - Watershed Area = 1,209 ft²
  - Impervious Cover = 1,209 ft² (100%)

  \[ WQV = \frac{1}{12} \frac{in}{ft} RA \]

  Where:
  - WQV = Water quality volume
  - R = Site cover runoff coefficient = R,I(%I)
  - %I = Percent of site as impervious cover = 1.00 (decimal)
  - A = Watershed area = 1,209 ft²
  - R = Site cover runoff coefficient
  - (0.95)(1.00) = 0.95

  \[ WQV = \frac{1}{12} (0.95)(1,209) = 95.7 ft³ \]
  \[ WQV = 95.7 ft³ \]

• **Water Quality Volume: Drain Area A-1e > POC A**

  Watershed Data
  - Watershed Area = 3,883 ft²
  - Pervious Cover (Soil C) = 3,883 ft² (100%)
\[ WQV = \frac{1}{12} \frac{\text{in}}{\text{ft}} RA \]

Where:
- \( WQV \) = Water quality volume
- \( R \) = Site cover runoff coefficient
- \( R, T \) = Runoff coefficient for lawn
- \( \%T \) = Percent of site in lawn (Soil C)
- \( A \) = Watershed area

\( R = \frac{1}{12} (0.22)(3,883) = 71.2 \text{ ft}^3 \)

\( WQV = 71.2 \text{ ft}^3 \)

**Water Quality Volume: Drain Area A-1f > POC A**

Watershed Data
- Watershed Area = 4,181 ft²
- Pervious Cover (Soil C) = 4,181 ft² (100.0%)

\[ WQV = \frac{1}{12} \frac{\text{in}}{\text{ft}} RA \]

Where:
- \( WQV \) = Water quality volume
- \( R \) = Site cover runoff coefficient
- \( R, T \) = Runoff coefficient for lawn
- \( \%T \) = Percent of site in lawn (Soil C)
- \( A \) = Watershed area

\( R = \frac{1}{12} (0.22)(1.00) = 0.22 \)

\[ WQV = \frac{1}{12} (0.22)(4,181) = 76.7 \text{ ft}^3 \]

\( WQV = 76.7 \text{ ft}^3 \)

**Water Quality Volume: Drain Basin B-1 > POC B**

Watershed Data
- Watershed Area = 40,344 ft²
- Pervious Cover (Soil C) = 40,344 ft² (100%)

\[ WQV = \frac{1}{12} \frac{\text{in}}{\text{ft}} RA \]

Where:
- \( WQV \) = Water quality volume
- \( R \) = Site cover runoff coefficient
- \( R, T \) = Runoff coefficient for lawn
- \( \%T \) = Percent of site in lawn
- \( A \) = Watershed area

\( WQV = 40,344 \text{ ft}^2 \)
\[ R = \text{Site cover runoff coefficient} = 0.22(1.00) = 0.22 \]

\[ WQV = \frac{1}{12} (0.22)(40,344) = 739.6 \text{ ft}^3 \]

\[ WQV = 739.6 \text{ ft}^3 \]

---

**Water Quality Volume: Drain Basin C-1 > POC C**

Watershed Data
- Watershed Area = 1,705 ft²
- Pervious Cover (Soil C) = 1,705 ft² (100%)

\[ WQV = \frac{\text{in}}{12} \frac{\text{in}}{\text{ft}} RA \]

Where:
- WQV = Water quality volume
- R = Site cover runoff coefficient = \( R_T \times \% T \)
- \( R_T \) = Runoff coefficient for lawn = 0.22 (HSG C)
- \( \% T \) = Percent of site in lawn = 1.00 (decimal)
- A = Watershed area = 1,705 ft²

\[ R = \text{Site cover runoff coefficient} = 0.220 \]

\[ WQV = \frac{1}{12} (0.220)(1,705) = 31.3 \text{ ft}^3 \]

\[ WQV = 31.3 \text{ ft}^3 \]

---

**Groundwater Recharge Volume**

Site Information
- Existing Impervious Cover = 12,530 ft²
- Proposed Impervious Cover = 18,803 ft²
- Net Increase = 6,273 ft²

\[ GRV = F \times I \]

Where:
- GRV = Required groundwater recharge volume
- F = Target depth factor = 0.25 in (HSG C)
- I = Net increase in impervious area = 6,273 ft²

\[ GRV = \frac{(0.25)}{12} (6,273) = 130.7 \text{ ft}^3 \]

\[ GRV = 130.7 \text{ ft}^3 \]

---

**Runoff Reduction Volume at POC “A”**

1-Year Storm Runoff Data at POC A
- Pre-development runoff volume = 10,867 ft³
- Post-development runoff volume (No BMPs) = 12,079 ft³

\[ RRV = V_{post} - V_{pre} \]

Where:
- RRV = Runoff reduction volume

---

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\[ V_{\text{pre}} = \text{1-year pre-development runoff volume} \]
\[ V_{\text{post}} = \text{1-year post-development runoff volume (No BMPs)} \]
\[ RRV = 12,079 - 10,867 = 1,212 \text{ ft}^3 \]

**Runoff Reduction Volume at POC “B”**

1-Year Storm Runoff Data at POC B

Pre-development runoff volume = 2,393 ft³
Post-development runoff volume (No BMPs) = 2,365 ft³

\[ RRV = V_{\text{post}} - V_{\text{pre}} \]

Where:
- RRV = Runoff reduction volume
- \( V_{\text{pre}} \) = 1-year pre-development runoff volume
- \( V_{\text{post}} \) = 1-year post-development runoff volume (No BMPs)

\[ RRV = 2,365 - 2,393 = -28 \text{ ft}^3 \]

**Runoff Reduction Volume at POC “C”**

1-Year Storm Runoff Data at POC C

Pre-development runoff volume = 100 ft³
Post-development runoff volume (No BMPs) = 100 ft³

\[ RRV = V_{\text{post}} - V_{\text{pre}} \]

Where:
- RRV = Runoff reduction volume
- \( V_{\text{pre}} \) = 1-year pre-development runoff volume
- \( V_{\text{post}} \) = 1-year post-development runoff volume (No BMPs)

\[ RRV = 100 - 100 = 0 \text{ ft}^3 \]

**Proposed BMPs**

To meet the requirements of Stormwater Management Standards 4 (Runoff Volume Reduction and Groundwater Recharge), 5 (Peak Flow Control), and 6 (Pollutant Reduction) of Section 3 of the Town of Greenwich Drainage Manual, we are proposing one rain garden, one permeable paver area (driveway courtyard) with gravel storage reservoir below; and one standard drywell system.

**Pond RG: Rain Garden**

The proposed rain garden was designed to aid in the retention of the WQV from Area A-1b. A summary structure rating table for the proposed rain garden is below.

<table>
<thead>
<tr>
<th>EL (ft)</th>
<th>h (ft)</th>
<th>( A_{\text{contour}} ) (ft²)</th>
<th>% Voids</th>
<th>( V_{\text{inc}} ) (ft³)</th>
<th>( V_{\text{cunt}} ) (ft³)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>396.50</td>
<td>0.00</td>
<td>1,000</td>
<td>30</td>
<td>0.0</td>
<td>0.0</td>
<td>Bottom of sub-soils</td>
</tr>
<tr>
<td>398.00</td>
<td>1.50</td>
<td>1,000</td>
<td>30</td>
<td>450</td>
<td>450</td>
<td>Top of sub-soils</td>
</tr>
<tr>
<td>398.25</td>
<td>1.75</td>
<td>1,000</td>
<td>100</td>
<td>32</td>
<td>482</td>
<td>Bottom of surface ponding</td>
</tr>
<tr>
<td>398.75</td>
<td>2.25</td>
<td>1,100</td>
<td>100</td>
<td>615</td>
<td>1,097</td>
<td>Overflow CB</td>
</tr>
</tbody>
</table>

**Total Storage Volume @ Overflow CB**

\[ = 1,097 \text{ ft}^3 \]

Pond RG is considered LID.

**Total Storage Volume**

\[ = 1,097 \text{ ft}^3 \]

**Water Quality Volume (Area A-1b)**

\[ = 976.8 \text{ ft}^3 \ (100\% \text{ conforms}) \]
**Pond PP D: Permeable Pavers (Driveway)**

Drywell PP D is designed to retain runoff from the revised watershed area A-1c (drainage area A-1c includes the drainage area A-1f from the original Drainage Summary Report). Refer to the end of this section for a structure-rating table for pond PP D.

- Permeable Pavers will accommodate the watershed collected from the entire driveway (except for a portion routed to a different drywell system described below). The total watershed area routed through the permeable pavers is 8,000 s.f. The minimum surface area of the permeable paver surface must be 20% of the total serving watershed; therefore minimum permeable paver area = 1,600 s.f. Actual permeable pavers surface area = 1,600 s.f. therefore compliant. Drainage area A-1f from the original Drainage Summary Report, now included in drainage area A-1c will also be routed to the driveway permeable pavers, adding 2,996 square feet of lawn.
- Overflow water from the stone reservoir below the permeable pavers will be routed to a level spreader near the southern corner of the property. Permeable Pavers will also treat to overall infiltration of RRV and GRV volumes.

Pond PP D is considered LID.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Total Storage Volume</td>
<td>2,432 ft³</td>
</tr>
<tr>
<td>Runoff Reduction Volume</td>
<td>1,212 ft³ (100% conforms)</td>
</tr>
<tr>
<td>Water Quality Volume (Area A-1c)</td>
<td>670.4 ft³ (100% conforms)</td>
</tr>
<tr>
<td>Groundwater Recharge Volume</td>
<td>130.7 ft³ (100% conforms)</td>
</tr>
</tbody>
</table>

**Pond RS: 4 Units R-330XLHD**

Pond RS is designed to infiltrate additional driveway surface area that was not treated by the permeable pavers. Refer to the end of this section for a structure-rating table for Permeable Pavers

- Pond RS is designed to assist in additional stormwater volume infiltration and peak flow rate attenuation.

Pond RS is considered LID.

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Storage Volume</td>
<td>412.0 ft³</td>
</tr>
<tr>
<td>Water Quality Volume (A-1d)</td>
<td>95.7 ft³ (100% conforms)</td>
</tr>
</tbody>
</table>

**TSS Removal Rates**

Rain Garden

\[ R = A + B - \frac{(AxB)}{100} \]

- R = Total TSS Removal Rate
- A = TSS Removal Rate for Permeable Pavement = 90%
- B = TSS Removal Rate for Deep Sump Basin = 25%

\[ R = 90 + 25 - \frac{(90x25)}{100} = 92.5\% \]

Total Removal Rate (R) = 92.5%

Drywell System: 4-R-330XLHD

\[ R = A + B - \frac{(AxB)}{100} \]

- R = Total TSS Removal Rate
- A = TSS Removal Rate for Drywell = 80%
- B = TSS Removal Rate for Deep Sump Basin = 25%
\[ R = 80 + 25 - \left[ \frac{(80 \times 25)}{100} \right] = 85\% \]
Total Removal Rate (R) = 85\%

**Permeable Pavers (Driveway)**

\[ R = A + B - \left[ \frac{(AxB)}{100} \right] \]
\[ R = \text{Total TSS Removal Rate} \]
\[ A = \text{TSS Removal Rate for Permeable Pavement} = 90\% \]
\[ B = \text{TSS Removal Rate for Deep Sump Basin} = 25\% \]

\[ R = 90 + 25 - \left[ \frac{(90 \times 25)}{100} \right] = 92.5\% \]
Total Removal Rate (R) = 92.5\%

**BMP Draw Down Calculations**

A Rawls Infiltration Rate of 0.27 inches/hour – Loam HSG-C is used:

**Rain Garden:**

\[ t_{\text{drawdown}} = \frac{DV}{kA} \]

Where:
\[ DV = \text{Design Volume (up to Overflow CB)} = 1,097 \text{ ft}^3 \]
\[ k = \text{Infiltration Rate} = 0.27 \text{ in/hr (L HSG-C)} \]
\[ A = \text{Bottom Area} = 1,000 \text{ ft}^2 \]

\[ t_{\text{drawdown}} = \frac{1,097}{(0.27)\left(\frac{1}{12}\right)(1,000)} = 48.8 \text{ hr} \]

Rain Garden will draw down in **48.8 hrs**.

**Permeable Pavers (Driveway)**

\[ t_{\text{drawdown}} = \frac{DV}{kA} \]

Where:
\[ DV = \text{Design Volume} = 2,432 \text{ ft}^3 \]
\[ k = \text{Infiltration Rate} = 0.27 \text{ in/hr (L HSG-C)} \]
\[ A = \text{Bottom Area} = 1,600 \text{ ft}^2 \]

\[ t_{\text{drawdown}} = \frac{2,432}{(0.27)\left(\frac{1}{12}\right)(1,600)} = 67.6 \text{ hr} \]

Driveway Permeable Pavers will draw down in 67.6hrs.

**Drywell System:** 4-R-330XI.HD

\[ t_{\text{drawdown}} = \frac{DV}{kA} \]
### Stage-Discharge for Pond RG: Rain Garden

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→ Discharge volume up to overflow catch basin (el.: 398.75')
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Storage volume up to overflow catch basin (el. = 398.75')
## Stage-Discharge for Pond PP D: Permeable Pavers (Driveway)

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* Discharge up to overflow pipe invert (el. = 414.00')
### Stage-Area-Storage for Pond RS: Cultec System

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> Storage Volume up to overflow pipe invert. (el. = 414.00')
Appendix “D”

HydroCAD Analysis –
Existing Conditions
### Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

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<th>Impervious</th>
<th>Runoff Depth</th>
<th>Tc</th>
<th>CN</th>
<th>Runoff Flow</th>
<th>Flow Length</th>
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<tr>
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<td>150,985 sf</td>
<td>8.30%</td>
<td>0.85&quot;</td>
<td>17.6 min</td>
<td>74</td>
<td>2.24 cfs</td>
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<td>1,181 sf</td>
<td>0.00%</td>
<td>0.88&quot;</td>
<td>5.0 min</td>
<td>70</td>
<td>0.07 cfs</td>
<td>230 cf</td>
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<tr>
<td>B-1</td>
<td>40,817 sf</td>
<td>0.00%</td>
<td>0.70&quot;</td>
<td>18.3 min</td>
<td>71</td>
<td>0.47 cfs</td>
<td>2,393 cf</td>
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<tr>
<td>C-1</td>
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<td>0.0 min</td>
<td>71</td>
<td>0.03 cfs</td>
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### Link POC A: POC A
- Inflow: 2.28 cfs 10.867 cf
- Primary: 2.28 cfs 10.867 cf

### Link POC B: POC B
- Inflow: 0.47 cfs 2.393 cf
- Primary: 0.47 cfs 2.393 cf

### Link POC C: POC C
- Inflow: 0.03 cfs 100 cf
- Primary: 0.03 cfs 100 cf
### Type III 24-hr 5-Year Rainfall=4.30"  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

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<th>Depth</th>
<th>Length</th>
<th>Tc</th>
<th>CN</th>
<th>Runoff</th>
<th>Primary</th>
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<tbody>
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<td>A-1</td>
<td>Runoff</td>
<td>150,985 sf</td>
<td>83.0%</td>
<td>1.82'</td>
<td>691'</td>
<td>17.6</td>
<td>74</td>
<td>22,897 cf</td>
<td>150,985 sf</td>
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<tr>
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<td>0.00%</td>
<td>1.53'</td>
<td>70</td>
<td>9.0</td>
<td>534 cf</td>
<td>4,181 sf</td>
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<tr>
<td>B-1</td>
<td>Runoff</td>
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<td>0.00%</td>
<td>1.60'</td>
<td>517'</td>
<td>18.3</td>
<td>71</td>
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### Type III 24-hr 10-Year Rainfall=5.10"  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

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<th>Primary</th>
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Type III 24-hr Rainfall=4.30"  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

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<td>83.0%</td>
<td>1.82'</td>
<td>691'</td>
<td>17.6</td>
<td>74</td>
<td>22,897 cf</td>
<td>150,985 sf</td>
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<td>Runoff</td>
<td>40,817 sf</td>
<td>0.00%</td>
<td>1.60'</td>
<td>517'</td>
<td>18.3</td>
<td>71</td>
<td>5,453 cf</td>
<td>40,817 sf</td>
</tr>
<tr>
<td>C-1</td>
<td>Runoff</td>
<td>1,705 sf</td>
<td>0.00%</td>
<td>1.60'</td>
<td>71</td>
<td>0.0</td>
<td>228 cf</td>
<td>1,705 sf</td>
<td></td>
</tr>
</tbody>
</table>

### Type III 24-hr Rainfall=5.10"  
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<table>
<thead>
<tr>
<th>Subcatchment</th>
<th>Type</th>
<th>Area</th>
<th>Impervious</th>
<th>Depth</th>
<th>Length</th>
<th>Tc</th>
<th>CN</th>
<th>Runoff</th>
<th>Primary</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>Runoff</td>
<td>150,985 sf</td>
<td>83.0%</td>
<td>2.44'</td>
<td>691'</td>
<td>17.6</td>
<td>74</td>
<td>30,764 cf</td>
<td>150,985 sf</td>
</tr>
<tr>
<td>A-2</td>
<td>Runoff</td>
<td>4,181 sf</td>
<td>0.00%</td>
<td>2.11'</td>
<td>70</td>
<td>9.0</td>
<td>735 cf</td>
<td>4,181 sf</td>
<td></td>
</tr>
<tr>
<td>B-1</td>
<td>Runoff</td>
<td>40,817 sf</td>
<td>0.00%</td>
<td>2.19'</td>
<td>517'</td>
<td>18.3</td>
<td>71</td>
<td>7,457 cf</td>
<td>40,817 sf</td>
</tr>
<tr>
<td>C-1</td>
<td>Runoff</td>
<td>1,705 sf</td>
<td>0.00%</td>
<td>2.19'</td>
<td>71</td>
<td>0.0</td>
<td>312 cf</td>
<td>1,705 sf</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Link POC A</th>
<th>Type</th>
<th>Inflow</th>
<th>Primary</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Runoff</td>
<td>23,432 cf</td>
<td>23,432 cf</td>
</tr>
<tr>
<td>B</td>
<td>Runoff</td>
<td>5,453 cf</td>
<td>5,453 cf</td>
</tr>
<tr>
<td>C</td>
<td>Runoff</td>
<td>228 cf</td>
<td>228 cf</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Link POC B</th>
<th>Type</th>
<th>Inflow</th>
<th>Primary</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Runoff</td>
<td>1,19 cf</td>
<td>1,19 cf</td>
</tr>
<tr>
<td>B</td>
<td>Runoff</td>
<td>5,453 cf</td>
<td>5,453 cf</td>
</tr>
<tr>
<td>C</td>
<td>Runoff</td>
<td>228 cf</td>
<td>228 cf</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Link POC C</th>
<th>Type</th>
<th>Inflow</th>
<th>Primary</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Runoff</td>
<td>0.99 cf</td>
<td>0.99 cf</td>
</tr>
<tr>
<td>B</td>
<td>Runoff</td>
<td>5,453 cf</td>
<td>5,453 cf</td>
</tr>
<tr>
<td>C</td>
<td>Runoff</td>
<td>228 cf</td>
<td>228 cf</td>
</tr>
</tbody>
</table>
### Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 A-1: DA A-1
- Runoff Area=150,985 sf
- 8.30% Impervious
- Runoff Depth=3.52"  
  - Flow Length=691’  
  - Tc=17.6 min  
  - CN=74  
  - Runoff=10.17 cfs

#### Subcatchment A-2: DA A-2
- Runoff Area=4,181 sf
- 0.00% Impervious
- Runoff Depth=3.13"  
  - Tc=5.0 min  
  - CN=73  
  - Runoff=0.36 cfs

#### Subcatchment B-1: DA B-1
- Runoff Area=40,617 sf
- 0.00% Impervious
- Runoff Depth=3.22"  
  - Flow Length=613’  
  - Tc=18.3 min  
  - CN=71  
  - Runoff=2.47 cfs

#### Subcatchment C-1: DA C-1
- Runoff Area=1,705 sf
- 0.00% Impervious
- Runoff Depth=3.22"  
  - Tc=0.0 min  
  - CN=71  
  - Runoff=0.16 cfs

#### Link POC A: POC A
- Inflow=10.34 cfs
- Primary=10.34 cfs

#### Link POC B: POC B
- Inflow=2.47 cfs
- Primary=2.47 cfs

#### Link POC C: POC C
- Inflow=0.16 cfs
- Primary=0.16 cfs

---

### Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 A-1: DA A-1
- Runoff Area=150,985 sf
- 8.30% Impervious
- Runoff Depth=4.57"  
  - Flow Length=691’  
  - Tc=17.6 min  
  - CN=74  
  - Runoff=13.18 cfs

#### Subcatchment A-2: DA A-2
- Runoff Area=4,181 sf
- 0.00% Impervious
- Runoff Depth=4.12"  
  - Tc=5.0 min  
  - CN=70  
  - Runoff=0.48 cfs

#### Subcatchment B-1: DA B-1
- Runoff Area=40,617 sf
- 0.00% Impervious
- Runoff Depth=4.23"  
  - Flow Length=613’  
  - Tc=18.3 min  
  - CN=71  
  - Runoff=3.26 cfs

#### Subcatchment C-1: DA C-1
- Runoff Area=1,705 sf
- 0.00% Impervious
- Runoff Depth=4.23"  
  - Tc=0.0 min  
  - CN=71  
  - Runoff=0.24 cfs

#### Link POC A: POC A
- Inflow=13.41 cfs
- Primary=13.41 cfs

#### Link POC B: POC B
- Inflow=3.26 cfs
- Primary=3.26 cfs

#### Link POC C: POC C
- Inflow=0.24 cfs
- Primary=0.24 cfs
<table>
<thead>
<tr>
<th>Subcatchment</th>
<th>Area (sf)</th>
<th>Impervious (%)</th>
<th>Runoff Depth (in)</th>
<th>Flow Length (ft)</th>
<th>Tc (min)</th>
<th>CN</th>
<th>Runoff (cfs)</th>
<th>Qc (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcatchment A-1: DA A-1</td>
<td>150,985</td>
<td>8.30</td>
<td>5.92</td>
<td>891</td>
<td>17.6</td>
<td>74</td>
<td>74,489</td>
<td>74,489</td>
</tr>
<tr>
<td>Subcatchment A-2: DA A-2</td>
<td>4,181</td>
<td>0.00</td>
<td>5.42</td>
<td>70</td>
<td>5.0</td>
<td>70</td>
<td>1,650</td>
<td>1,650</td>
</tr>
<tr>
<td>Subcatchment B-1: DA B-1</td>
<td>40,617</td>
<td>0.00</td>
<td>5.55</td>
<td>517</td>
<td>18.3</td>
<td>71</td>
<td>18,869</td>
<td>18,869</td>
</tr>
<tr>
<td>Subcatchment C-1: DA C-1</td>
<td>1,705</td>
<td>0.00</td>
<td>5.55</td>
<td>71</td>
<td>0.0</td>
<td>71</td>
<td>788</td>
<td>788</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Link POC A: POC A</th>
<th>Inflow (cfs)</th>
<th>Primary (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.31</td>
<td>76,378</td>
</tr>
<tr>
<td>Link POC B: POC B</td>
<td>Inflow (cfs)</td>
<td>Primary (cfs)</td>
</tr>
<tr>
<td></td>
<td>4.26</td>
<td>18,869</td>
</tr>
<tr>
<td>Link POC C: POC C</td>
<td>Inflow (cfs)</td>
<td>Primary (cfs)</td>
</tr>
<tr>
<td></td>
<td>0.31</td>
<td>788</td>
</tr>
</tbody>
</table>
21AU_Ex_Conditions
Prepared by rvd
HydroCAD® 10.00-15 s/n 09164 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

<table>
<thead>
<tr>
<th>Area</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>54,943</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C (A-1, B-1, C-1)</td>
</tr>
<tr>
<td>723</td>
<td>98</td>
<td>Patio, HSG C (A-1)</td>
</tr>
<tr>
<td>6,866</td>
<td>98</td>
<td>Paved parking, HSG C (A-1)</td>
</tr>
<tr>
<td>1,813</td>
<td>98</td>
<td>Pool Patio, HSG C (A-1)</td>
</tr>
<tr>
<td>633</td>
<td>98</td>
<td>Pool, HSG C (A-1)</td>
</tr>
<tr>
<td>2,238</td>
<td>98</td>
<td>Roofs, HSG C (A-1)</td>
</tr>
<tr>
<td>92</td>
<td>98</td>
<td>Shed, HSG C (A-1)</td>
</tr>
<tr>
<td>65</td>
<td>98</td>
<td>Walk, HSG C (A-1)</td>
</tr>
<tr>
<td>124,802</td>
<td>70</td>
<td>Woods, Good, HSG C (A-1, B-1)</td>
</tr>
<tr>
<td>5,413</td>
<td>70</td>
<td>Woods, HSG C (A-2, C-1)</td>
</tr>
<tr>
<td>197,688</td>
<td>73</td>
<td>TOTAL AREA</td>
</tr>
</tbody>
</table>
Summary for Subcatchment A-1: DA A-1

Runoff = 10.17 cfs @ 12.24 hrs, Volume= 44,340 cf, Depth= 3.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (ft²)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>92,756</td>
<td>70</td>
<td>Woods, Good, HSG C</td>
</tr>
<tr>
<td>45,699</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>6,966</td>
<td>98</td>
<td>Paved parking, HSG C</td>
</tr>
<tr>
<td>2,238</td>
<td>98</td>
<td>Roofs, HSG C</td>
</tr>
<tr>
<td>*</td>
<td>98</td>
<td>Pool, HSG C</td>
</tr>
<tr>
<td>1,813</td>
<td>98</td>
<td>Pool Patio, HSG C</td>
</tr>
<tr>
<td>*</td>
<td>98</td>
<td>Patio, HSG C</td>
</tr>
<tr>
<td>633</td>
<td>98</td>
<td>Pool, HSG C</td>
</tr>
<tr>
<td>92</td>
<td>98</td>
<td>Shed, HSG C</td>
</tr>
<tr>
<td>*</td>
<td>98</td>
<td>Walk, HSG C</td>
</tr>
<tr>
<td>150,985</td>
<td>74</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>138,455</td>
<td>91.70%</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>12,530</td>
<td>8.30%</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc</th>
<th>Length</th>
<th>Slope</th>
<th>Velocity</th>
<th>Capacity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(min)</td>
<td>(ft)</td>
<td>(ft/sec)</td>
<td>(cfs)</td>
<td></td>
</tr>
<tr>
<td>15.3</td>
<td>100</td>
<td>0.0430</td>
<td>0.11</td>
<td></td>
<td>Sheet Flow, First 100&quot;</td>
</tr>
<tr>
<td>2.3</td>
<td>591</td>
<td>0.0720</td>
<td>4.32</td>
<td></td>
<td>Shallow Concentrated Flow, Up to POC A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Unpaved ( K_v = 16.1 ) fps</td>
</tr>
</tbody>
</table>

Subcatchment A-1: DA A-1

Hydrograph

Type III 24-hr 25-Year Rainfall=6.40"
Runoff Area=150,985 sq ft
Runoff Volume=44,340 cf
Runoff Depth=3.52"
Flow Length=691'
Tc=17.6 min
CN=74
Summary for Subcatchment A-2: DA A-2

Runoff = 0.36 cfs @ 12.08 hrs, Volume= 1,089 cf, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,181</td>
<td>70</td>
<td>Woods, HSG C</td>
</tr>
<tr>
<td>4,181</td>
<td>100.00% Porous Area</td>
<td></td>
</tr>
</tbody>
</table>

Tc | Length | Slope | Velocity | Capacity |
---|--------|-------|----------|----------|
5.0 | (min)  | (feet) | (ft/ft) | (ft/sec) |

Direct Entry, 5 Minutes Minimum Required Time

Subcatchment A-2: DA A-2

![Hydrograph]

Type III 24-hr 25-Year Rainfall=6.40"
Runoff Area=4,181 sf
Runoff Volume=1,089 cf
Runoff Depth=3.13"
Tc=5.0 min
CN=70

Summary for Subcatchment B-1: DA B-1

Runoff = 2.47 cfs @ 12.26 hrs, Volume= 10,967 cf, Depth= 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>32,046</td>
<td>70</td>
<td>Woods, Good, HSG C</td>
</tr>
<tr>
<td>8,771</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>40,617</td>
<td>71</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>40,617</td>
<td>100.00% Porous Area</td>
<td></td>
</tr>
</tbody>
</table>

Tc | Length | Slope | Velocity | Capacity |
---|--------|-------|----------|----------|
16.5 | (min)  | (feet) | (ft/ft) | (ft/sec) |
1.8  | 417    | 0.0600 | 3.94     |          |
18.3  | 517    | Total  |          |          |

Sheet Flow, First 100'
Woods: Light underbrush, n= 0.400, P2= 3.40"
Shallow Concentrated Flow, Up to POC B
Unpaved, Kn= 16.1 fps
Subcatchment B-1: DA B-1

Type III 24-hr 25-Year Rainfall=6.40"
Runoff Area=40,817 sf
Runoff Volume=10,967 cf
Runoff Depth=3.22"
Flow Length=517'
Tc=18.3 min
CN=71

Summary for Subcatchment C-1: DA C-1

Runoff = 0.18 cfs @ 12.00 hrs, Volume= 458 cf, Depth= 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,232</td>
<td>70</td>
<td>Woods, HSG C</td>
</tr>
<tr>
<td>473</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>1,705</td>
<td>71</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>1,705</td>
<td>71</td>
<td>100.00% Pervious Area</td>
</tr>
</tbody>
</table>

Subcatchment C-1: DA C-1

Type III 24-hr 25-Year Rainfall=6.40"
Runoff Area=1,705 sf
Runoff Volume=458 cf
Runoff Depth=3.22"
Tc=0.0 min
CN=71
Summary for Link POC A: POC A

Inflow Area = 155,166 ft², 8.08% Impervious, Inflow Depth = 3.51" for 25-Year event
Inflow = 10.34 cfs @ 12.24 hrs, Volume = 45,429 cf
Primary = 10.34 cfs @ 12.24 hrs, Volume = 45,429 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Inflow Area=155,166 sf

Summary for Link POC B: POC B

Inflow Area = 40,817 ft², 0.00% Impervious, Inflow Depth = 3.22" for 25-Year event
Inflow = 2.47 cfs @ 12.26 hrs, Volume = 10,967 cf
Primary = 2.47 cfs @ 12.26 hrs, Volume = 10,967 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Inflow Area=40,817 sf
Summary for Link POC C: POC C

Inflow Area = 1,705 sf, 0.00% Impervious, Inflow Depth = 3.22" for 25-Year event
Inflow = 0.18 cfs @ 12.00 hrs, Volume = 458 cf
Primary = 0.18 cfs @ 12.00 hrs, Volume = 458 cf, Attenuation = 0%, Lag = 0.0 min

Primary outflow = Inflow, Time Span = 0.00-36.00 hrs, dt = 0.01 hrs

Inflow Area = 1,705 sf
Appendix “E”

HydroCAD Analysis – Proposed Conditions
Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 A-1a: Area A-1a
Runoff Area=115,841 sf 0.00% Impervious Runoff Depth=0.70"
Flow Length=691' Tc=17.6 min CN=71 Runoff=1.35 cfs 6,792 cf

Subcatchment A-1b: Area A-1b
Runoff Area=19,799 sf 49.01% Impervious Runoff Depth=1.50"
Tc=5.0 min CN=85 Runoff=0.83 cfs 2,482 cf

Subcatchment A-1c: Area A-1c
Runoff Area=10,726 sf 72.07% Impervious Runoff Depth=1.98"
Tc=5.0 min CN=91 Runoff=0.59 cfs 1,768 cf

Subcatchment A-1d: Area A-1d
Runoff Area=1,209 sf 100.00% Impervious Runoff Depth=2.67"
Tc=5.0 min CN=98 Runoff=0.08 cfs 269 cf

Subcatchment A-1e: Area A-1e
Runoff Area=3,883 sf 0.00% Impervious Runoff Depth=0.85"
Tc=5.0 min CN=74 Runoff=0.08 cfs 274 cf

Subcatchment A-1f: Area A-1f
Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=0.66"
Tc=5.0 min CN=70 Runoff=0.07 cfs 230 cf

Subcatchment B-1: Area B-1
Runoff Area=40,344 sf 0.00% Impervious Runoff Depth=0.70"
Flow Length=517' Tc=18.3 min CN=71 Runoff=0.46 cfs 2,365 cf

Subcatchment C-1: DA C-1
Runoff Area=1,705 sf 0.00% Impervious Runoff Depth=0.70"
Tc=0.0 min CN=71 Runoff=0.03 cfs 100 cf

Pond PP D: Permeable Pavers (Driveway)
Peak Elev=412.76' Storage=1,768 cf Inflow=0.59 cfs 1,768 cf
6.0" Round Culvert n=0.011 L=188.0' S=0.0848 '/' Outflow=0.00 cfs 0 cf

Pond RG: Rain Garden
Peak Elev=398.80' Storage=1,167 cf Inflow=0.83 cfs 2,482 cf
Outflow=0.25 cfs 1,386 cf

Pond RS: Cultec System
Peak Elev=414.02' Storage=261 cf Inflow=0.08 cfs 269 cf
6.0" Round Culvert n=0.011 L=426.0' S=0.0480 '/' Outflow=0.00 cfs 10 cf

Link POC A: POC A
Inflow=1.53 cfs 8,691 cf
Primary=1.53 cfs 8,691 cf

Link POC B: POC B
Inflow=0.46 cfs 2,365 cf
Primary=0.46 cfs 2,365 cf

Link POC C: POC C
Inflow=0.03 cfs 100 cf
Primary=0.03 cfs 100 cf

Total Runoff Area = 197,688 sf  Runoff Volume = 14,280 cf  Average Runoff Depth = 0.87"
90.57% Pervious = 179,046 sf  9.43% Impervious = 18,642 sf
Subcatchment A-1a: Area A-1a  
Runoff Area=115,841 sf  0.00% Impervious  Runoff Depth=1.00"  
Flow Length=691'  Tc=17.6 min  CN=71  Runoff=2.04 cfs  9,660 cf

Subcatchment A-1b: Area A-1b  
Runoff Area=19,799 sf  49.01% Impervious  Runoff Depth=1.93"  
Tc=5.0 min  CN=85  Runoff=1.07 cfs  3,184 cf

Subcatchment A-1c: Area A-1c  
Runoff Area=10,726 sf  72.07% Impervious  Runoff Depth=2.45"  
Tc=5.0 min  CN=91  Runoff=0.72 cfs  2,187 cf

Subcatchment A-1d: Area A-1d  
Runoff Area=1,209 sf  100.00% Impervious  Runoff Depth=3.17"  
Tc=5.0 min  CN=98  Runoff=0.10 cfs  319 cf

Subcatchment A-1e: Area A-1e  
Runoff Area=3,883 sf  0.00% Impervious  Runoff Depth=1.17"  
Tc=5.0 min  CN=74  Runoff=0.12 cfs  379 cf

Subcatchment A-1f: Area-1f  
Runoff Area=4,181 sf  0.00% Impervious  Runoff Depth=0.95"  
Tc=5.0 min  CN=70  Runoff=0.10 cfs  330 cf

Subcatchment B-1: Area B-1  
Runoff Area=40,344 sf  0.00% Impervious  Runoff Depth=1.00"  
Flow Length=517'  Tc=18.3 min  CN=71  Runoff=0.70 cfs  3,364 cf

Subcatchment C-1: DA C-1  
Runoff Area=1,705 sf  0.00% Impervious  Runoff Depth=1.00"  
Tc=0.0 min  CN=71  Runoff=0.05 cfs  142 cf

Pond PP D: Permeable Pavers (Driveway)  
Peak Elev=413.42'  Storage=2,187 cf  Inflow=0.72 cfs  2,187 cf  
6.0" Round Culvert  n=0.011  L=188.0'  S=0.0848 '/'  Outflow=0.00 cfs  0 cf

Pond RG: Rain Garden  
Peak Elev=398.84'  Storage=1,217 cf  Inflow=1.07 cfs  3,184 cf  
Outflow=0.55 cfs  2,087 cf

Pond RS: Cultec System  
Peak Elev=414.03'  Storage=263 cf  Inflow=0.10 cfs  319 cf  
6.0" Round Culvert  n=0.011  L=426.0'  S=0.0480 '/'  Outflow=0.00 cfs  60 cf

Link POC A: POC A  
Inflow=2.66 cfs  12,516 cf  
Primary=2.66 cfs  12,516 cf

Link POC B: POC B  
Inflow=0.70 cfs  3,364 cf  
Primary=0.70 cfs  3,364 cf

Link POC C: POC C  
Inflow=0.05 cfs  142 cf  
Primary=0.05 cfs  142 cf

Total Runoff Area = 197,688 sf  Runoff Volume = 19,565 cf  Average Runoff Depth = 1.19"  
90.57% Pervious = 179,046 sf  9.43% Impervious = 18,642 sf
Subcatchment A-1a: Area A-1a  
Runoff Area=115,841 sf  0.00% Impervious  Runoff Depth=1.60"  
Flow Length=691'  Tc=17.6 min  CN=71  Runoff=3.43 cfs  15,476 cf

Subcatchment A-1b: Area A-1b  
Runoff Area=19,799 sf  49.01% Impervious  Runoff Depth=2.73"  
Tc=5.0 min  CN=85  Runoff=1.50 cfs  4,500 cf

Subcatchment A-1c: Area A-1c  
Runoff Area=10,726 sf  72.07% Impervious  Runoff Depth=3.31"  
Tc=5.0 min  CN=91  Runoff=0.96 cfs  2,954 cf

Subcatchment A-1d: Area A-1d  
Runoff Area=1,209 sf  100.00% Impervious  Runoff Depth=4.06"  
Tc=5.0 min  CN=98  Runoff=0.12 cfs  409 cf

Subcatchment A-1e: Area A-1e  
Runoff Area=3,883 sf  0.00% Impervious  Runoff Depth=1.82"  
Tc=5.0 min  CN=74  Runoff=0.19 cfs  589 cf

Subcatchment A-1f: Area A-1f  
Runoff Area=4,181 sf  0.00% Impervious  Runoff Depth=1.53"  
Tc=5.0 min  CN=70  Runoff=0.17 cfs  534 cf

Subcatchment B-1: Area B-1  
Runoff Area=40,344 sf  0.00% Impervious  Runoff Depth=1.60"  
Flow Length=517'  Tc=18.3 min  CN=71  Runoff=1.18 cfs  5,390 cf

Subcatchment C-1: DA C-1  
Runoff Area=1,705 sf  0.00% Impervious  Runoff Depth=1.60"  
Tc=0.0 min  CN=71  Runoff=0.09 cfs  228 cf

Pond PP D: Permeable Pavers (Driveway)  
Peak Elev=413.89'  Storage=2,490 cf  Inflow=0.96 cfs  2,954 cf  
6.0" Round Culvert  n=0.011  L=188.0'  S=0.0848 '/'  Outflow=0.03 cfs  520 cf

Pond RG: Rain Garden  
Peak Elev=398.91'  Storage=1,319 cf  Inflow=1.50 cfs  4,500 cf  
Outflow=1.36 cfs  3,403 cf

Pond RS: Cultec System  
Peak Elev=414.08'  Storage=270 cf  Inflow=0.12 cfs  409 cf  
6.0" Round Culvert  n=0.011  L=426.0'  S=0.0480 '/'  Outflow=0.02 cfs  151 cf

Link POC A: POC A  
Inflow=4.40 cfs  20,673 cf  
Primary=4.40 cfs  20,673 cf

Link POC B: POC B  
Inflow=1.18 cfs  5,390 cf  
Primary=1.18 cfs  5,390 cf

Link POC C: POC C  
Inflow=0.09 cfs  228 cf  
Primary=0.09 cfs  228 cf

Total Runoff Area = 197,688 sf  Runoff Volume = 30,081 cf  Average Runoff Depth = 1.83"  
90.57% Pervious = 179,046 sf  9.43% Impervious = 18,642 sf
Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 A-1a: Area A-1a
Runoff Area=115,841 sf 0.00% Impervious Runoff Depth=2.19"
Flow Length=691' Tc=17.6 min CN=71 Runoff=4.78 cfs 21,164 cf

Subcatchment A-1b: Area A-1b
Runoff Area=19,799 sf 49.01% Impervious Runoff Depth=3.46"
Tc=5.0 min CN=85 Runoff=1.89 cfs 5,710 cf

Subcatchment A-1c: Area A-1c
Runoff Area=10,726 sf 72.07% Impervious Runoff Depth=4.08"
Tc=5.0 min CN=91 Runoff=1.17 cfs 3,646 cf

Subcatchment A-1d: Area A-1d
Runoff Area=1,209 sf 100.00% Impervious Runoff Depth=4.86"
Tc=5.0 min CN=98 Runoff=0.14 cfs 490 cf

Subcatchment A-1e: Area A-1e
Runoff Area=3,883 sf 0.00% Impervious Runoff Depth=2.44"
Tc=5.0 min CN=74 Runoff=0.26 cfs 791 cf

Subcatchment A-1f: Area A-1f
Runoff Area=4,181 sf 0.00% Impervious Runoff Depth=2.11"
Tc=5.0 min CN=70 Runoff=0.24 cfs 735 cf

Subcatchment B-1: Area B-1
Runoff Area=40,344 sf 0.00% Impervious Runoff Depth=2.19"
Flow Length=517' Tc=18.3 min CN=71 Runoff=1.64 cfs 7,371 cf

Subcatchment C-1: DA C-1
Runoff Area=1,705 sf 0.00% Impervious Runoff Depth=2.19"
Tc=0.0 min CN=71 Runoff=0.12 cfs 312 cf

Pond PP D: Permeable Pavers (Driveway)
Peak Elev=413.96' Storage=2,537 cf Inflow=1.17 cfs 3,646 cf
6.0" Round Culvert n=0.011 L=188.0' S=0.0848 '/' Outflow=0.08 cfs 1,211 cf

Pond RG: Rain Garden
Peak Elev=398.95' Storage=1,375 cf Inflow=1.89 cfs 5,710 cf
Outflow=1.67 cfs 4,613 cf

Pond RS: Cultec System
Peak Elev=414.14' Storage=278 cf Inflow=0.14 cfs 490 cf
6.0" Round Culvert n=0.011 L=426.0' S=0.0480 '/' Outflow=0.06 cfs 231 cf

Link POC A: POC A
Inflow=6.08 cfs 28,746 cf Primary=6.08 cfs 28,746 cf

Link POC B: POC B
Inflow=1.64 cfs 7,371 cf Primary=1.64 cfs 7,371 cf

Link POC C: POC C
Inflow=0.12 cfs 312 cf Primary=0.12 cfs 312 cf

Total Runoff Area = 197,688 sf Runoff Volume = 40,218 cf Average Runoff Depth = 2.44"
90.57% Pervious = 179,046 sf 9.43% Impervious = 18,642 sf
Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 A-1a: Area A-1a**
Runoff Area=115,841 sf  0.00% Impervious  Runoff Depth=3.22"
Flow Length=691'  Tc=17.6 min  CN=71  Runoff=7.11 cfs  31,125 cf

**Subcatchment A-1b: Area A-1b**
Runoff Area=19,799 sf  49.01% Impervious  Runoff Depth=4.68"
Tc=5.0 min  CN=85  Runoff=2.53 cfs  7,723 cf

**Subcatchment A-1c: Area A-1c**
Runoff Area=10,726 sf  72.07% Impervious  Runoff Depth=5.35"
Tc=5.0 min  CN=91  Runoff=1.51 cfs  4,781 cf

**Subcatchment A-1d: Area A-1d**
Runoff Area=1,209 sf  100.00% Impervious  Runoff Depth=6.16"
Tc=5.0 min  CN=98  Runoff=0.18 cfs  621 cf

**Subcatchment A-1e: Area A-1e**
Runoff Area=3,883 sf  0.00% Impervious  Runoff Depth=3.52"
Tc=5.0 min  CN=74  Runoff=0.38 cfs  1,140 cf

**Subcatchment A-1f: Area A-1f**
Runoff Area=4,181 sf  0.00% Impervious  Runoff Depth=3.13"
Tc=5.0 min  CN=70  Runoff=0.36 cfs  1,089 cf

**Subcatchment B-1: Area B-1**
Runoff Area=40,344 sf  0.00% Impervious  Runoff Depth=3.22"
Flow Length=517'  Tc=18.3 min  CN=71  Runoff=2.44 cfs  10,840 cf

**Subcatchment C-1: DA C-1**
Runoff Area=1,705 sf  0.00% Impervious  Runoff Depth=3.22"
Tc=0.0 min  CN=71  Runoff=0.18 cfs  458 cf

**Pond PP D: Permeable Pavers (Driveway)**
Peak Elev=414.24'  Storage=2,711 cf  Inflow=1.51 cfs  4,781 cf
6.0" Round Culvert  n=0.011  L=188.0'  S=0.0848 '/'  Outflow=0.41 cfs  2,347 cf

**Pond RG: Rain Garden**
Peak Elev=399.12'  Storage=1,608 cf  Inflow=2.53 cfs  7,723 cf
Outflow=1.71 cfs  6,626 cf

**Pond RS: Cuitce System**
Peak Elev=414.24'  Storage=290 cf  Inflow=0.18 cfs  621 cf
6.0" Round Culvert  n=0.011  L=426.0'  S=0.0480 '/'  Outflow=0.15 cfs  362 cf

**Link POC A: POC A**
Inflow=9.44 cfs  42,689 cf
Primary=9.44 cfs  42,689 cf

**Link POC B: POC B**
Inflow=2.44 cfs  10,840 cf
Primary=2.44 cfs  10,840 cf

**Link POC C: POC C**
Inflow=0.18 cfs  458 cf
Primary=0.18 cfs  458 cf

Total Runoff Area = 197,688 sf  Runoff Volume = 57,778 cf  Average Runoff Depth = 3.51"
90.57% Pervious = 179,046 sf  9.43% Impervious = 18,642 sf
Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 A-1a: Area A-1a
Runoff Area=115,841 sf  0.00% Impervious  Runoff Depth=4.23"
Flow Length=691'  Tc=17.6 min  CN=71  Runoff=9.37 cfs  40,870 cf

Subcatchment A-1b: Area A-1b
Runoff Area=19,799 sf  49.01% Impervious  Runoff Depth=5.83"
Tc=5.0 min  CN=85  Runoff=3.11 cfs  9,616 cf

Subcatchment A-1c: Area A-1c
Runoff Area=10,726 sf  72.07% Impervious  Runoff Depth=6.53"
Tc=5.0 min  CN=91  Runoff=1.82 cfs  5,837 cf

Subcatchment A-1d: Area A-1d
Runoff Area=1,209 sf  100.00% Impervious  Runoff Depth=7.36"
Tc=5.0 min  CN=98  Runoff=0.21 cfs  742 cf

Subcatchment A-1e: Area A-1e
Runoff Area=3,883 sf  0.00% Impervious  Runoff Depth=4.57"
Tc=5.0 min  CN=74  Runoff=0.49 cfs  1,479 cf

Subcatchment A-1f: Area A-1f
Runoff Area=4,181 sf  0.00% Impervious  Runoff Depth=4.12"
Tc=5.0 min  CN=70  Runoff=0.48 cfs  1,436 cf

Subcatchment B-1: Area B-1
Runoff Area=40,344 sf  0.00% Impervious  Runoff Depth=4.23"
Flow Length=517'  Tc=18.3 min  CN=71  Runoff=3.22 cfs  14,234 cf

Subcatchment C-1: DA C-1
Runoff Area=1,705 sf  0.00% Impervious  Runoff Depth=4.23"
Tc=0.0 min  CN=71  Runoff=0.24 cfs  602 cf

Pond PP D: Permeable Pavers (Driveway)
Peak Elev=414.59'  Storage=2,940 cf  Inflow=1.82 cfs  5,837 cf
6.0" Round Culvert  n=0.011  L=188.0'  S=-0.0848 '/'  Outflow=0.70 cfs  3,402 cf

Pond RG: Rain Garden
Peak Elev=399.31'  Storage=1,903 cf  Inflow=3.11 cfs  9,616 cf
Outflow=1.76 cfs  8,519 cf

Pond RS: Cultec System
Peak Elev=414.28'  Storage=296 cf  Inflow=0.21 cfs  742 cf
6.0" Round Culvert  n=0.011  L=426.0'  S=-0.0480 '/'  Outflow=0.20 cfs  483 cf

Link POC A: POC A
Inflow=12.37 cfs  56,188 cf
Primary=12.37 cfs  56,188 cf

Link POC B: POC B
Inflow=3.22 cfs  14,234 cf
Primary=3.22 cfs  14,234 cf

Link POC C: POC C
Inflow=0.24 cfs  602 cf
Primary=0.24 cfs  602 cf

Total Runoff Area = 197,688 sf  Runoff Volume = 74,814 cf  Average Runoff Depth = 4.54"
90.57% Pervious = 179,046 sf  9.43% Impervious = 18,642 sf
Time span = 0.00-36.00 hrs, dt = 0.01 hrs, 3601 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 A-1a: Area A-1a
Runoff Area = 115,841 sf   0.00% Impervious   Runoff Depth = 5.55"   Flow Length = 691'   Tc = 17.6 min   CN = 71   Runoff = 12.27 cfs   53,553 cf

Subcatchment A-1b: Area A-1b
Runoff Area = 19,799 sf   49.01% Impervious   Runoff Depth = 7.28"   Tc = 5.0 min   CN = 85   Runoff = 3.84 cfs   12,009 cf

Subcatchment A-1c: Area A-1c
Runoff Area = 10,726 sf   72.07% Impervious   Runoff Depth = 8.01"   Tc = 5.0 min   CN = 91   Runoff = 2.20 cfs   7,161 cf

Subcatchment A-1d: Area A-1d
Runoff Area = 1,209 sf   100.00% Impervious   Runoff Depth = 8.86"   Tc = 5.0 min   CN = 98   Runoff = 0.26 cfs   893 cf

Subcatchment A-1e: Area A-1e
Runoff Area = 3,883 sf   0.00% Impervious   Runoff Depth = 5.92"   Tc = 5.0 min   CN = 74   Runoff = 0.64 cfs   1,916 cf

Subcatchment A-1f: Area A-1f
Runoff Area = 4,181 sf   0.00% Impervious   Runoff Depth = 5.42"   Tc = 5.0 min   CN = 70   Runoff = 0.63 cfs   1,890 cf

Subcatchment B-1: Area B-1
Runoff Area = 40,344 sf   0.00% Impervious   Runoff Depth = 5.55"   Flow Length = 517'   Tc = 18.3 min   CN = 71   Runoff = 4.21 cfs   18,651 cf

Subcatchment C-1: DA C-1
Runoff Area = 1,705 sf   0.00% Impervious   Runoff Depth = 5.55"   Tc = 0.0 min   CN = 71   Runoff = 0.31 cfs   788 cf

Pond PP D: Permeable Pavers (Driveway)
Peak Elev = 415.72'   Storage = 3,309 cf   Inflow = 2.20 cfs   7,161 cf   6.0" Round Culvert n = 0.011   L = 188.0'   S = 0.0848 '/'   Outflow = 1.22 cfs   4,727 cf

Pond RG: Rain Garden
Peak Elev = 399.53'   Storage = 2,196 cf   Inflow = 3.84 cfs   12,009 cf   Outflow = 3.52 cfs   10,912 cf

Pond RS: Cultec System
Peak Elev = 414.31'   Storage = 300 cf   Inflow = 0.26 cfs   893 cf   6.0" Round Culvert n = 0.011   L = 426.0'   S = 0.0480 '/'   Outflow = 0.24 cfs   634 cf

Link POC A: POC A
Inflow = 15.89 cfs   73,630 cf
Primary = 15.89 cfs   73,630 cf

Link POC B: POC B
Inflow = 4.21 cfs   18,651 cf
Primary = 4.21 cfs   18,651 cf

Link POC C: POC C
Inflow = 0.31 cfs   788 cf
Primary = 0.31 cfs   788 cf

Total Runoff Area = 197,688 sf   Runoff Volume = 96,860 cf   Average Runoff Depth = 5.88"
90.57% Pervious = 179,046 sf   9.43% Impervious = 18,642 sf
## Area Listing (all nodes)

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<thead>
<tr>
<th>Area (sq-ft)</th>
<th>CN</th>
<th>Description</th>
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<tbody>
<tr>
<td>70,755</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C (A-1a, A-1b, A-1c, A-1e, B-1, C-1)</td>
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<td>8,939</td>
<td>98</td>
<td>Driveway, HSG C (A-1c, A-1d)</td>
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<td>5,652</td>
<td>98</td>
<td>Dwelling, HSG C (A-1b)</td>
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<tr>
<td>2,195</td>
<td>98</td>
<td>Pool Patio, HSG C (A-1b)</td>
</tr>
<tr>
<td>1,000</td>
<td>98</td>
<td>Pool, HSG C (A-1b)</td>
</tr>
<tr>
<td>856</td>
<td>98</td>
<td>Terrace, HSG C (A-1b)</td>
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<tr>
<td>102,878</td>
<td>70</td>
<td>Woods, Good, HSG C (A-1a, A-1b, B-1)</td>
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<tr>
<td>5,413</td>
<td>70</td>
<td>Woods, HSG C (A-1f, C-1)</td>
</tr>
<tr>
<td><strong>197,688</strong></td>
<td><strong>74</strong></td>
<td><strong>TOTAL AREA</strong></td>
</tr>
</tbody>
</table>
Summary for Subcatchment A-1a: Area A-1a

Runoff = 7.11 cfs @ 12.24 hrs, Volume= 31,125 cf, Depth= 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

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<th>Area (sf)</th>
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<td>75,485</td>
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<td>Woods, Good, HSG C</td>
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<tr>
<td>40,356</td>
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<td>&gt;75% Grass cover, Good, HSG C</td>
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<tr>
<td>115,841</td>
<td>71</td>
<td>Weighted Average</td>
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<tr>
<td>115,841</td>
<td>100%</td>
<td>Pervious Area</td>
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<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>15.3</td>
<td>100</td>
<td>0.0430</td>
<td>0.11</td>
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<td>Sheet Flow, First 100'</td>
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<tr>
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<td></td>
<td></td>
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<td>Woods: Light underbrush  n= 0.400  P2= 3.40&quot;</td>
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<tr>
<td>2.3</td>
<td>591</td>
<td>0.0720</td>
<td>4.32</td>
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<td>Shallow Concentrated Flow, Up to POC A</td>
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<td></td>
<td></td>
<td></td>
<td>Unpaved  Kv= 16.1 fps</td>
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<tr>
<td>17.6</td>
<td>691</td>
<td>Total</td>
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</tbody>
</table>

Subcatchment A-1a: Area A-1a

Hydrograph

Type III 24-hr 25-Year Rainfall=6.40"
Runoff Area=115,841 sf
Runoff Volume=31,125 cf
Runoff Depth=3.22"
Flow Length=691'
Tc=17.6 min
CN=71
Summary for Subcatchment A-1b: Area A-1b

Runoff = 2.53 cfs @ 12.07 hrs, Volume= 7,723 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
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<tbody>
<tr>
<td>* 5,652</td>
<td>98</td>
<td>Dwelling, HSG C</td>
</tr>
<tr>
<td>* 2,195</td>
<td>98</td>
<td>Pool Patio, HSG C</td>
</tr>
<tr>
<td>* 1,000</td>
<td>98</td>
<td>Pool, HSG C</td>
</tr>
<tr>
<td>* 856</td>
<td>98</td>
<td>Terrace, HSG C</td>
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<tr>
<td>8,221</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
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<tr>
<td>1,875</td>
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<td>Woods, Good, HSG C</td>
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<td>19,799</td>
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<td>Weighted Average</td>
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<td>10,096</td>
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<td>50.99% Pervious Area</td>
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<tr>
<td>9,703</td>
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<td>49.01% Impervious Area</td>
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</table>

Tc Length Slope Velocity Capacity Description
(min) (feet) (ft/ft) (ft/sec) (cfs)

5.0 Direct Entry, 5 Minutes Minimum Required Time

Subcatchment A-1b: Area A-1b

Hydrograph

Type III 24-hr 25-Year Rainfall=6.40"
Runoff Area=19,799 sf
Runoff Volume=7,723 cf
Runoff Depth=4.68"
Tc=5.0 min
CN=85
**Summary for Subcatchment A-1c: Area A-1c**

Runoff = 1.51 cfs @ 12.07 hrs, Volume= 4,781 cf, Depth= 5.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>7,730</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>2,996</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>10,726</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>2,996</td>
<td>27.93% Pervious Area</td>
</tr>
<tr>
<td></td>
<td>7,730</td>
<td>72.07% Impervious Area</td>
</tr>
</tbody>
</table>

**Tc**  
Length | Slope | Velocity | Capacity | Description
---|-------|----------|----------|-------------
5.0 | Direct Entry, 5 Minutes Minimum Required Time

**Subcatchment A-1c: Area A-1c**

Type III 24-hr
25-Year Rainfall=6.40"
Runoff Area=10,726 sf
Runoff Volume=4,781 cf
Runoff Depth=5.35"
Tc=5.0 min
CN=91
Summary for Subcatchment A-1d: Area A-1d

Runoff = 0.18 cfs @ 12.07 hrs, Volume= 621 cf, Depth= 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 1,209</td>
<td>98</td>
<td>Driveway, HSG C</td>
</tr>
<tr>
<td>1,209</td>
<td></td>
<td>100.00% Impervious Area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc (min)</th>
<th>Length (feet)</th>
<th>Slope (ft/ft)</th>
<th>Velocity (ft/sec)</th>
<th>Capacity (cfs)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Direct Entry, 5 Minutes Minimum Required Time</td>
</tr>
</tbody>
</table>

Subcatchment A-1d: Area A-1d

Type III 24-hr 25-Year Rainfall=6.40"
Runoff Area=1,209 sf
Runoff Volume=621 cf
Runoff Depth=6.16"
Tc=5.0 min
CN=98
Summary for Subcatchment A-1e: Area A-1e

Runoff = 0.38 cfs @ 12.07 hrs, Volume= 1,140 cf, Depth= 3.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,883</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>3,883</td>
<td></td>
<td>100.00% Pervious Area</td>
</tr>
</tbody>
</table>

Tc (min) Length (feet) Slope (ft/ft) Velocity (ft/sec) Capacity (cfs) Description
5.0       5.0       0.1        0.01        0.38          Direct Entry, 5 Minutes Minimum Required Time

Subcatchment A-1e: Area A-1e

Type III 24-hr
25-Year Rainfall=6.40"
Runoff Area=3,883 sf
Runoff Volume=1,140 cf
Runoff Depth=3.52"
Tc=5.0 min
CN=74
Summary for Subcatchment A-1f: Area-1f

Runoff = 0.36 cfs @ 12.08 hrs, Volume= 1,089 cf, Depth= 3.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,181</td>
<td>70</td>
<td>Woods, HSG C</td>
</tr>
<tr>
<td>4,181</td>
<td>100.00% Pervious Area</td>
<td></td>
</tr>
</tbody>
</table>

Tc (min) Length (feet) Slope (ft/ft) Velocity (ft/sec) Capacity (cfs) Description
5.0 Direct Entry, 5 Minutes Minimum Required Time

Subcatchment A-1f: Area-1f

Hydrograph

Type III 24-hr 25-Year Rainfall=6.40"
Runoff Area=4,181 sf
Runoff Volume=1,089 cf
Runoff Depth=3.13"
Tc=5.0 min
CN=70
Summary for Subcatchment B-1: Area B-1

Runoff = 2.44 cfs @ 12.26 hrs, Volume= 10,840 cf, Depth= 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>25,518</td>
<td>70</td>
<td>Woods, Good, HSG C</td>
</tr>
<tr>
<td>14,826</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>40,344</td>
<td>71</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>40,344</td>
<td></td>
<td>100.00% Pervious Area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc</th>
<th>Length</th>
<th>Slope</th>
<th>Velocity</th>
<th>Capacity</th>
<th>Description</th>
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<tbody>
<tr>
<td>16.5</td>
<td>100</td>
<td>0.0360</td>
<td>0.10</td>
<td></td>
<td>Sheet Flow, First 100'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Woods: Light underbrush n= 0.400  P2= 3.40&quot;</td>
</tr>
<tr>
<td>1.8</td>
<td>417</td>
<td>0.0600</td>
<td>3.94</td>
<td></td>
<td>Shallow Concentrated Flow, Up to POC B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Unpaved  Kv= 16.1 fps</td>
</tr>
<tr>
<td>18.3</td>
<td>517</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subcatchment B-1: Area B-1

Type III 24-hr
25-Year Rainfall=6.40"
Runoff Area=40,344 sf
Runoff Volume=10,840 cf
Runoff Depth=3.22"
Flow Length=517'
Tc=18.3 min
CN=71
Summary for Subcatchment C-1: DA C-1

Runoff = 0.18 cfs @ 12.00 hrs, Volume= 458 cf, Depth= 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>* 1,232</td>
<td>70</td>
<td>Woods, HSG C</td>
</tr>
<tr>
<td>473</td>
<td>74</td>
<td>&gt;75% Grass cover, Good, HSG C</td>
</tr>
<tr>
<td>1,705</td>
<td>71</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>1,705</td>
<td>100.00% Pervious Area</td>
<td></td>
</tr>
</tbody>
</table>

Subcatchment C-1: DA C-1

Hydrograph

Type III 24-hr
25-Year Rainfall=6.40"
Runoff Area=1,705 sf
Runoff Volume=458 cf
Runoff Depth=3.22"
Tc=0.0 min
CN=71
Summary for Pond PP D: Permeable Pavers (Driveway)

Inflow Area = 10,726 sf, 72.07% Impervious, Inflow Depth = 5.35" for 25-Year event
Inflow = 1.51 cfs @ 12.07 hrs, Volume= 4,781 cf
Outflow = 0.41 cfs @ 12.41 hrs, Volume= 2,347 cf, Atten= 73%, Lag= 20.3 min
Primary = 0.41 cfs @ 12.41 hrs, Volume= 2,347 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 414.24' @ 12.41 hrs Surf.Area= 1,600 sf Storage= 2,711 cf

Plug-Flow detention time= 260.3 min calculated for 2,346 cf (49% of inflow)
Center-of-Mass det. time= 143.6 min ( 921.7 - 778.1 )

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Avail.Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>410.00'</td>
<td>3,200 cf</td>
<td><strong>No.57 Stone (Prismatic)</strong> Listed below (Recalc) 8,000 cf Overall x 40.0% Voids</td>
</tr>
<tr>
<td>#2</td>
<td>415.00'</td>
<td>109 cf</td>
<td><strong>No.8 Stone (Prismatic)</strong> Listed below (Recalc) 272 cf Overall x 40.0% Voids</td>
</tr>
</tbody>
</table>

3,309 cf Total Available Storage

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>410.00</td>
<td>1,600</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>415.00</td>
<td>1,600</td>
<td>8,000</td>
<td>8,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>415.00</td>
<td>1,600</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>415.17</td>
<td>1,600</td>
<td>272</td>
<td>272</td>
</tr>
</tbody>
</table>

Device Routing Invert Outlet Devices
#1 Primary 413.80' 6.0" Round Culvert L= 188.0' Ke= 0.500
Inlet / Outlet Invert= 413.80' / 397.85' S= 0.0848 '/' Cc= 0.900
n= 0.011, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.41 cfs @ 12.41 hrs HW=414.24' TW=0.00' (Dynamic Tailwater)
↑↑↑1=Culvert (Inlet Controls 0.41 cfs @ 2.25 fps)
Pond PP D: Permeable Pavers (Driveway)

Inflow Area=10,726 sf
Peak Elev=414.24'
Storage=2,711 cf
6.0''
Round Culvert
n=0.011
L=188.0'
S=0.0848 '/"
Summary for Pond RG: Rain Garden

Inflow Area = 19,799 sf, 49.01% Impervious, Inflow Depth = 4.68" for 25-Year event
Inflow = 2.53 cfs @ 12.07 hrs, Volume = 7,723 cf
Outflow = 1.71 cfs @ 12.15 hrs, Volume = 6,626 cf, Atten= 32%, Lag= 4.7 min
Primary = 1.71 cfs @ 12.15 hrs, Volume = 6,626 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 399.12' @ 12.15 hrs  Surf.Area= 3,612 sf  Storage= 1,608 cf

Plug-Flow detention time= 99.6 min calculated for 6,626 cf (86% of inflow)
Center-of-Mass det. time= 37.9 min (835.2 - 797.4)

Volume Invert Avail.Storage Storage Description
--- --- ---- ------------------
#1 396.50' 450 cf Bioretention Soil Mix (Prismatic) Listed below (Recalc)
     1,500 cf Overall x 30.0% Voids
#2 398.00' 27 cf mulch or topsoil (Prismatic) Listed below (Recalc)
     269 cf Overall x 10.0% Voids
#3 398.25' 1,719 cf Ponding (Prismatic) Listed below (Recalc)
     2,196 cf Total Available Storage

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>396.50</td>
<td>1,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>398.00</td>
<td>1,000</td>
<td>1,500</td>
<td>1,500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>398.00</td>
<td>1,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>398.25</td>
<td>1,150</td>
<td>269</td>
<td>269</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>398.25</td>
<td>1,150</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>399.50</td>
<td>1,600</td>
<td>1,719</td>
<td>1,719</td>
</tr>
</tbody>
</table>

Device Routing Invert Outlet Devices
--- --- ---- ------------------
#1 Primary 395.60' 6.0" Round Culvert L = 12.0'  Ke= 0.500
       Inlet / Outlet Invert= 395.60' / 395.00'  S = 0.0500 '/'  Cc= 0.900
       n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf
#2 Device 1 398.75' 24.0" Horiz. Orifice/Grate C= 0.600
       Limited to weir flow at low heads
#3 Primary 399.50' 81.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=1.71 cfs @ 12.15 hrs HW=399.12' TW=0.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 1.71 cfs @ 8.70 fps)
2=Orifice/Grate (Passes 1.71 cfs of 4.55 cfs potential flow)
3=Sharp-Crested Rectangular Weir ( Controls 0.00 cfs)
Inflow Area=19,799 sf
Peak Elevation=399.12'
Storage=1,608 cf
Summary for Pond RS: C ultec System

Inflow Area = 1.209 sf, 100.00% Impervious, Inflow Depth = 6.16" for 25-Year event
Inflow = 0.18 cfs @ 12.07 hrs, Volume= 621 cf
Outflow = 0.15 cfs @ 12.12 hrs, Volume= 362 cf, Atten= 15%, Lag= 2.8 min
Primary = 0.15 cfs @ 12.12 hrs, Volume= 362 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 414.24' @ 12.12 hrs Surf.Area= 195 sf Storage= 290 cf

Plug-Flow detention time= 237.0 min calculated for 362 cf (58% of inflow)
Center-of-Mass det. time= 122.1 min (865.4 - 743.3)

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Avail.Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1A</td>
<td>412.00'</td>
<td>184 cf</td>
<td>**11.17'W x 17.50' L x 3.54'H **Field A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>692 cf Overall - 231 cf Embedded = 461 cf x 40.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>412.50'</td>
<td>231 cf</td>
<td><strong>C ultec R-330XLHD</strong> x 4 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size= 47.8&quot;W x 30.0&quot;H =&gt; 7.45 sf x 7.00' L = 52.2 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size= 52.0&quot;W x 30.5&quot;H x 8.50'L with 1.50' Overlap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Row Length Adjustment= +1.50' x 7.45 sf x 2 rows</td>
</tr>
</tbody>
</table>

415 cf Total Available Storage

Storage Group A created with Chamber Wizard

<table>
<thead>
<tr>
<th>Device</th>
<th>Routing</th>
<th>Invert</th>
<th>Outlet Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Primary</td>
<td>414.00'</td>
<td><strong>6.0&quot; Round Culvert</strong> L= 426.0' Ke= 0.500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inlet / Outlet Invert= 414.00' / 393.55' S= 0.0480 '/' Cc= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n= 0.011, Flow Area= 0.20 sf</td>
</tr>
</tbody>
</table>

**Primary OutFlow** Max= 0.15 cfs @ 12.12 hrs HW= 414.24' TW= 0.00' (Dynamic Tailwater)

→ 1=C ulvert (Inlet Controls 0.15 cfs @ 1.66 fps)
Pond RS: Cultec System - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size = 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size = 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment = +1.50' x 7.45 sf x 2 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

2 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 15.50' Row Length +12.0" End Stone x 2 = 17.50' Base Length
2 Rows x 52.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.17' Base Width
6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

4 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 2 Rows = 231.0 cf Chamber Storage

692.1 cf Field - 231.0 cf Chambers = 461.1 cf Stone x 40.0% Voids = 184.4 cf Stone Storage

Chamber Storage + Stone Storage = 415.4 cf = 0.010 af
Overall Storage Efficiency = 60.0%

4 Chambers
25.6 cy Field
17.1 cy Stone
Pond RS: Cultec System

Inflow Area=1,209 sf
Peak Elev=414.24'
Storage=290 cf
6.0"
Round Culvert
n=0.011
L=426.0'
S=0.0480 '/'
Summary for Link POC A: POC A

Inflow Area = 155,639 sf, 11.98% Impervious, Inflow Depth = 3.29" for 25-Year event
Inflow = 9.44 cfs @ 12.26 hrs, Volume= 42,689 cf
Primary = 9.44 cfs @ 12.26 hrs, Volume= 42,689 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link POC A: POC A

Hydrograph

Inflow Area=155,639 sf
Summary for Link POC B: POC B

Inflow Area = 40,344 sf, 0.00% Impervious, Inflow Depth = 3.22" for 25-Year event
Inflow = 2.44 cfs @ 12.26 hrs, Volume = 10,840 cf
Primary = 2.44 cfs @ 12.26 hrs, Volume = 10,840 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link POC B: POC B

Hydrograph

Inflow Area=40,344 sf
Summary for Link POC C: POC C

Inflow Area = 1,705 sf, 0.00% Impervious, Inflow Depth = 3.22" for 25-Year event
Inflow = 0.18 cfs @ 12.00 hrs, Volume= 458 cf
Primary = 0.18 cfs @ 12.00 hrs, Volume= 458 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Link POC C: POC C

Hydrograph

Inflow Area=1,705 sf
Appendix “F”

Pipe Conveyance Computations
The following is a summary of the computations performed to design the proposed storm drainage system drain sizes. The proposed watershed flows were taken from the results of the HyrdoCAD storm drainage analysis performed on the site. Refer to Appendix “E” for HydroCAD model input data, computations, and results. Refer to Exhibit “B” for a depiction of the proposed on-site watershed areas. HydroCAD runoff computations are based on the 25-year design storm frequency event. Culvert conveyance computations are based on the Manning’s Equation.

**Watershed Analysis Results**

<table>
<thead>
<tr>
<th>Drainage Area</th>
<th>Area (S.F.)</th>
<th>Impervious Area (S.F.)</th>
<th>CN</th>
<th>25-Year Peak Flow Rate (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1a</td>
<td>120,318</td>
<td>0</td>
<td>71.0</td>
<td>7.39</td>
</tr>
<tr>
<td>A-1b</td>
<td>15,161</td>
<td>9,703</td>
<td>89.0</td>
<td>2.07</td>
</tr>
<tr>
<td>A-1c</td>
<td>8,000</td>
<td>8,000</td>
<td>98.0</td>
<td>1.19</td>
</tr>
<tr>
<td>A-1d</td>
<td>1,100</td>
<td>1,100</td>
<td>98.0</td>
<td>0.16</td>
</tr>
<tr>
<td>A-1e</td>
<td>3,883</td>
<td>0</td>
<td>74.0</td>
<td>0.38</td>
</tr>
<tr>
<td>A-1f</td>
<td>2,996</td>
<td>0</td>
<td>74.0</td>
<td>0.29</td>
</tr>
<tr>
<td>A-1g</td>
<td>4,181</td>
<td>0</td>
<td>70.0</td>
<td>0.36</td>
</tr>
<tr>
<td>B-1</td>
<td>40,344</td>
<td>0</td>
<td>71.0</td>
<td>2.44</td>
</tr>
<tr>
<td>C-1</td>
<td>1,705</td>
<td>0</td>
<td>71.0</td>
<td>0.18</td>
</tr>
</tbody>
</table>

**Culvert Capacity Summary Table**

Maximum pipe capacities were calculated using the Manning equation for full flow conditions. The proposed pipe information, 25-year peak design flows, and corresponding maximum capacities are summarized in the following table. Refer to the Development Plan for pipe and structure locations. All pipes have been sized to convey the flow rates for at least the 25-year design storm frequency event.

<table>
<thead>
<tr>
<th>Pipe #</th>
<th>Diameter (inches)</th>
<th>Roughness (n)</th>
<th>Slope (%)</th>
<th>Contributing Watershed</th>
<th>25-Year Peak Design Flow (c/s)</th>
<th>Max Capacity (c/s)</th>
</tr>
</thead>
</table>

Pipe conveyance calculations will be provided at Planning & Zoning reviewing stage.
Appendix “G”

Soils Results Forms
&
Hydraulic Conductivity Tests
SOIL EVALUATION TEST RESULTS

Project Name: Single Family Home
Project Address: 2 Crown Lane

Engineering Firm’s Name: RVD Inc.
Engineer’s Name: Rich Regan

Saturated Hydraulic Conductivity Test Location #: B

Ground Elevation:
Top Elevation of Proposed Infiltration System: 398.25
Bottom Elevation of Proposed Infiltration System: 296.1

Elevation of Test:
Test Method (check one of the following acceptable methods**):
- Borehole infiltration test (NHDES, 2008)
- Guelph permeameter - ASTM D5126-90 Method
- Falling head permeameter - ASTM D5126-90 Method
- Double ring permeameter or infiltrometer - ASTM D3385-03, D5093-02, D5126-90 Methods
- Amoozegar or Amoozegar (constant head) permeameter – Amoozegar 1992

Attach field data forms for the respective infiltration test method.

Calculated Saturated Hydraulic Conductivity Rate:

**A percolation test, performed in accordance with the guidelines of the Connecticut State Health Code or otherwise, is not an acceptable test for saturated hydraulic conductivity. Percolation tests overestimate the saturated hydraulic conductivity rate.

* All test pits or soil borings shall be excavated to an elevation four feet below the proposed bottom elevation of the infiltration system.

* All field infiltration tests must be conducted in the actual location and soil layer where stormwater infiltration is proposed.

TEST CERTIFICATION

I HEREBY CERTIFY THAT THE INFORMATION CONTAINED IN THIS REPORT IS TRUE AND CORRECT.

Name of Test Conductor: Rich Regan
Signature of Test Conductor: RVD Inc.
Date: 7-8-21

Tests Conducted: 7-15-21
SOIL EVALUATION TEST RESULTS

Engineering Firm's Name: RVD Inc
Engineer's Name: Rich Reiger PE

Saturated Hydraulic Conductivity Test Location #:

Ground Elevation:
Top Elevation of Proposed Infiltration System: 411.0
Bottom Elevation of Proposed Infiltration System: 410.0

Elevation of Test*:
Test Method (check one of the following acceptable methods**):
  Borehole infiltration test (NHDES, 2008)
  Guelph permeameter - ASTM D5126-90 Method
  Falling head permeameter - ASTM D5126-90 Method
  Double ring permeameter or infiltrometer - ASTM D3385-83, D5093-02, D5126-90 Methods
  Amoozegar or Amoozegar (constant head) permeameter - Amoozegar 1992

Attach field data forms for the respective infiltration test method.

Calculated Saturated Hydraulic Conductivity Rate: ____________________________

**A percolation test, performed in accordance with the guidelines of the Connecticut State Health Code or otherwise, is not an acceptable test for saturated hydraulic conductivity. Percolation tests overestimate the saturated hydraulic conductivity rate.

* All field infiltration tests must be conducted in the actual location and soil layer where stormwater infiltration is proposed.

TEST CERTIFICATION

I HEREBY CERTIFY THAT THE INFORMATION CONTAINED IN THIS REPORT IS TRUE AND CORRECT.

Name of Test Conductor: Rich Reiger
Signature of Test Conductor: RVD Inc
Date: 7-15-21
Tests Conducted: 7-8-21

Form SC-101
February 2012
SOIL EVALUATION TEST RESULTS

Engineering Firm's Name: RVD Inc.
Engineer's Name: Rich Ryan P.E.

Test Pit or Soil Boring #: Dw #8 Ground Elevation: 411.5

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Soil Texture (Percent Sand, Silt and Clay)</th>
<th>Depth Range in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>411.5</td>
<td>Top Soil</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Silty</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Orange Brown Loam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wet Gray Compact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sandy 15 (11)</td>
<td>9.9</td>
</tr>
<tr>
<td></td>
<td>Mottles at 22&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Saturated Hydraulic Conductivity Test Location #:

Ground Elevation:
Top Elevation of Proposed Infiltration System: 411.5
Bottom Elevation of Proposed Infiltration System: 412
Elevation of Test*:
Test Method (check one of the following acceptable methods**):
- Borehole infiltration test (NHDES, 2008)
- Guelph permeameter - ASTM D5126-90 Method
- Falling head permeameter - ASTM D5126-90 Method
- Double ring permeameter or infiltrometer - ASTM D3385-03, D5093-02, D5126-90 Methods
- Amoozemeeter or Amoozegear (constant head) permeameter – Amoozegear 1992

Attach field data forms for the respective infiltration test method.

Calculated Saturated Hydraulic Conductivity Rate:

**A percolation test, performed in accordance with the guidelines of the Connecticut State Health Code or otherwise, is not an acceptable test for saturated hydraulic conductivity. Percolation tests overestimate the saturated hydraulic conductivity rate.

* All test pits or soil borings shall be excavated to an elevation four feet below the proposed bottom elevation of the infiltration system.

* All field infiltration tests must be conducted in the actual location and soil layer where stormwater infiltration is proposed.

TEST CERTIFICATION

I HEREBY CERTIFY THAT THE INFORMATION CONTAINED IN THIS REPORT IS TRUE AND CORRECT.

Name of Test Conductor: Rich Ryan
Signature of Test Conductor: RVD Inc.
Date: 7-15-21

Form SC-101
# SOIL EVALUATION TEST RESULTS

**Project Name:** Single Family Home  
**Project Address:** 2 Crown Lanes

**Engineering Firm's Name:** RVD Inc  
**Engineer's Name:** Rich Roger

### Saturated Hydraulic Conductivity Test Location #:

<table>
<thead>
<tr>
<th>Ground Elevation:</th>
<th>Top Elevation of Proposed Infiltration System:</th>
<th>Bottom Elevation of Proposed Infiltration System:</th>
<th>Elevation of Test*:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Test Method (check one of the following acceptable methods**):  
- Borehole infiltration test (NHDES, 2008)  
- Guelph permeameter - ASTM D5126-90 Method  
- Falling head permeameter – ASTM D5126-90 Method  
- Double ring permeameter or infiltrometer - ASTM D3385-03, D5093-02, D5126-90 Methods  
- Amoozegar or Amoozegar (constant head) permeameter – Amoozegar 1992

Attach field data forms for the respective infiltration test method.

**Calculated Saturated Hydraulic Conductivity Rate:**

**- A percolation test, performed in accordance with the guidelines of the Connecticut State Health Code or otherwise, is not an acceptable test for saturated hydraulic conductivity. Percolation tests overestimate the saturated hydraulic conductivity rate.**

**- All field infiltration tests must be conducted in the actual location and soil layer where stormwater infiltration is proposed.**

### Test Certification

I HEREBY CERTIFY THAT THE INFORMATION CONTAINED IN THIS REPORT IS TRUE AND CORRECT.

**Name of Test Conductor:** Rich Roger  
**Signature of Test Conductor:** RVD Inc  
**Date:** 7-15-21

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Soil Texture (Percent Sand, Silt and Clay)</th>
<th>Depth Range in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>392.75</td>
<td>Topsoil</td>
<td>0</td>
</tr>
<tr>
<td>392.75</td>
<td>B. B. S. L.</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Tan Sand &amp; Silt</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Tan Sand &amp; TSP</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Mottly &amp; Compact</td>
<td>90</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Depth in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>392.75</td>
<td>Mottling (Seasonally High Groundwater)</td>
</tr>
<tr>
<td></td>
<td>Groundwater</td>
</tr>
<tr>
<td></td>
<td>Ledge</td>
</tr>
</tbody>
</table>

* All test pits or soil borings shall be excavated to an elevation four feet below the proposed bottom elevation of the infiltration system.

* All field infiltration tests must be conducted in the actual location and soil layer where stormwater infiltration is proposed.
**SOIL EVALUATION TEST RESULTS**

**Project Name:** Single Family Home  
**Project Address:** 2 Crown Lane

**Saturated Hydraulic Conductivity Test Location #:**

<table>
<thead>
<tr>
<th>Depth Range in Inches</th>
<th>Ground Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Topsoil</td>
</tr>
<tr>
<td>15</td>
<td>C.B. S.C.</td>
</tr>
<tr>
<td>54</td>
<td>Tan Grey Sand Silt</td>
</tr>
<tr>
<td>90</td>
<td>Mottling 9 (compact 0 at 42&quot;)</td>
</tr>
</tbody>
</table>

**Test Method (check one of the following acceptable methods)**:
- Borehole infiltration test (NHDES, 2008)
- Guelph permeameter - ASTM D5126-90 Method
- Falling head permeameter - ASTM D5126-90 Method
- Double ring permeameter or infiltrometer - ASTM D3385-03, D5093-02, D5126-90 Methods
- Amoozometer or Amoozegar (constant head) permeameter - Amoozegar 1992

**Attach field data forms for the respective infiltration test method.**

**Calculated Saturated Hydraulic Conductivity Rate:**

**Note:**
- **A percolation test, performed in accordance with the guidelines of the Connecticut State Health Code or otherwise, is not an acceptable test for saturated hydraulic conductivity. Percolation tests overestimate the saturated hydraulic conductivity rate.**
- **All field infiltration tests must be conducted in the actual location and soil layer where stormwater infiltration is proposed.**

**TEST CERTIFICATION**

I HEREBY CERTIFY THAT THE INFORMATION CONTAINED IN THIS REPORT IS TRUE AND CORRECT.

**Name of Test Conductor:** Richard Regan  
**Signature of Test Conductor:** [Signature]  
**Date:** 7-15-21
## SOIL EVALUATION TEST RESULTS

### Project Name: Single Family Home
### Project Address: 2 Crown Lakes

<table>
<thead>
<tr>
<th>Test Pit or Soil Boring #:</th>
<th>Ground Elevation: 4-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation</td>
<td>Soil Texture (Percent Sand, Silt and Clay)</td>
</tr>
<tr>
<td>410</td>
<td>Topsoil</td>
</tr>
<tr>
<td>0,15,5 L</td>
<td>Tan Grey Sand &amp; Silt</td>
</tr>
<tr>
<td>Wet Grey Clastic Sandy Silt</td>
<td>Motilled at 30&quot;</td>
</tr>
</tbody>
</table>

### Saturated Hydraulic Conductivity Test Location #:

- **Ground Elevation:**
- **Top Elevation of Proposed Infiltration System:**
- **Bottom Elevation of Proposed Infiltration System:**
- **Elevation of Test:**
- **Test Method (check one of the following acceptable methods**):
  - Borehole infiltration test (NHDES, 2008)
  - Guelph permeameter - ASTM D5126-90 Method
  - Falling head permeameter – ASTM D5126-90 Method
  - Double ring permeameter or infiltrometer - ASTM D3385-03, D5093-02, D5126-90 Methods
  - Amoozemeter or Amoozezag (constant head) permeameter – Amoozezag 1992

Attach field data forms for the respective infiltration test method.

### Calculated Saturated Hydraulic Conductivity Rate:

**A percolation test, performed in accordance with the guidelines of the Connecticut State Health Code or otherwise, is not an acceptable test for saturated hydraulic conductivity. Percolation tests overestimate the saturated hydraulic conductivity rate.**

* All test pits or soil borings shall be excavated to an elevation four feet below the proposed bottom elevation of the infiltration system.

* All field infiltration tests must be conducted in the actual location and soil layer where stormwater infiltration is proposed.

### TEST CERTIFICATION

I HEREBY CERTIFY THAT THE INFORMATION CONTAINED IN THIS REPORT IS TRUE AND CORRECT.

**Name of Test Conductor:**

**Signature of Test Conductor:**

**Date:** 7-8-21
**Notes:** Depths are in inches, measures taken from top of pipe.

**Saturated Hydraulic Conductivity Test A:** pipe Depth = 24" into ground (top of pipe 7" above ground)

<table>
<thead>
<tr>
<th>Test</th>
<th>Start</th>
<th>Finish</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour 1</td>
<td>11.0</td>
<td>18.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Hour 2</td>
<td>18.0</td>
<td>24.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Hour 3</td>
<td>7.0</td>
<td>15.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Hour 4</td>
<td>15.0</td>
<td>22.0</td>
<td>7.0</td>
</tr>
<tr>
<td>Average</td>
<td>-</td>
<td>-</td>
<td>7.0</td>
</tr>
<tr>
<td>Divide by 2 (factor of safety)</td>
<td>-</td>
<td>-</td>
<td>3.5</td>
</tr>
</tbody>
</table>

**Saturated Hydraulic Conductivity Test B:** Pipe Depth = 29" into ground (top of pipe 2" above ground)

<table>
<thead>
<tr>
<th>Test</th>
<th>Start</th>
<th>Finish</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour 1</td>
<td>6.0</td>
<td>27.0</td>
<td>21.0</td>
</tr>
<tr>
<td>Hour 2</td>
<td>6.0</td>
<td>20.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Hour 3</td>
<td>6.0</td>
<td>15.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Hour 4</td>
<td>15.0</td>
<td>20.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Average</td>
<td>-</td>
<td>-</td>
<td>12.3</td>
</tr>
<tr>
<td>Divide by 2 (factor of safety)</td>
<td>-</td>
<td>-</td>
<td>6.1</td>
</tr>
</tbody>
</table>

**Saturated Hydraulic Conductivity Test C:** Pipe Depth = 24" into ground (top of pipe 6" above ground)

<table>
<thead>
<tr>
<th>Test</th>
<th>Start*</th>
<th>Finish</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour 1</td>
<td>7.0</td>
<td>16.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Hour 2</td>
<td>5.0</td>
<td>10.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Hour 3</td>
<td>6.0</td>
<td>10.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Hour 4</td>
<td>6.0</td>
<td>11.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Average</td>
<td>-</td>
<td>-</td>
<td>5.8</td>
</tr>
<tr>
<td>Divide by 2 (factor of safety)</td>
<td>-</td>
<td>-</td>
<td>2.9</td>
</tr>
</tbody>
</table>
**Saturated Hydraulic Conductivity Test D:** pipe Depth = 36 "into ground
(top of pipe 0" above ground)

<table>
<thead>
<tr>
<th>Test</th>
<th>Start</th>
<th>Finish</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour 1</td>
<td>12.0</td>
<td>15.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Hour 2</td>
<td>15.0</td>
<td>21.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Hour 3</td>
<td>12.0</td>
<td>16.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Hour 4</td>
<td>16.0</td>
<td>19.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Average</td>
<td>-</td>
<td>-</td>
<td>4.0</td>
</tr>
<tr>
<td>by 2 (factor of)</td>
<td>-</td>
<td>-</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Saturated Hydraulic Conductivity Test E:** Pipe Depth = 24" into ground
(top of pipe 6" above ground)

<table>
<thead>
<tr>
<th>Test</th>
<th>Start</th>
<th>Finish</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hour 1</td>
<td>6.0</td>
<td>12.5</td>
<td>6.5</td>
</tr>
<tr>
<td>Hour 2</td>
<td>12.5</td>
<td>17.5</td>
<td>5.0</td>
</tr>
<tr>
<td>Hour 3</td>
<td>6.0</td>
<td>11.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Hour 4</td>
<td>11.0</td>
<td>15.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Average</td>
<td>-</td>
<td>-</td>
<td>5.3</td>
</tr>
<tr>
<td>by 2 (factor of)</td>
<td>-</td>
<td>-</td>
<td>2.6</td>
</tr>
</tbody>
</table>
LONG TERM MAINTENANCE PLAN

For

2 Crown Lane
Greenwich, Connecticut

Prepared For

Two Crown Lane, LLC

July 15, 2021
Stormwater Management
Practices Maintenance Declaration
Stormwater Management Practices Maintenance Declaration

THIS DECLARATION is made this date, __________, 20___, by and between the Town of Greenwich, a municipal corporation with principal offices located at 101 Field Point Road, Greenwich, CT 06830 and

Two Crown Lane, LLC

[Owner(s) Name]

Crompi Development & Construction 242 South Water St

[Address]

hereinafter referred to as “Owner(s)” of the “Property,” as more fully described in a deed recorded in Book 7823 at Page 19 of the Greenwich Land Records. In accordance with the Town of Greenwich Drainage Manual as Amended, the “Owner(s)” agree to install and maintain stormwater management practice(s) on the subject Property in accordance with approved plans and conditions. The Owner further agrees to the terms stated in this document to ensure that the stormwater management practice(s) continues serving the intended function in perpetuity. This Declaration includes the following exhibits located in the project files of one or all of the following Town of Greenwich Departments:

- Building Division – Permit # ________________
- Inland Wetlands and Watercourses Agency – Application # ________________
- Planning and Zoning – Application # ________________

**Exhibit A:** Long-term Maintenance Plan that prescribes those activities that must be carried out to maintain compliance with this Declaration. Approved Maintenance Plan dated ________________.

**Exhibit B:** Improvement Location Survey depicting “As-Built” conditions and showing an accurate location of each stormwater management practice affected by this Declaration. Approved Improvement Location Survey dated ________________.

Note: After construction has been verified and accepted by the Town of Greenwich for the stormwater management practices, this declaration shall be recorded by the Owner on the Greenwich Land Records and copies of the recorded document shall be submitted to all of the following Town of Greenwich Departments involved in the approval:

- Building Division
- Inland Wetlands and Watercourses Agency
- Planning and Zoning

Through this Declaration, the Owner(s) hereby subjects the Property to the following covenants, conditions, and restrictions:

1. The Owner(s), at its expense, shall secure from any affected owners of land all easements and releases of rights-of-way necessary for utilization of the stormwater practices identified in Exhibit B and shall record them with the Town Clerk. These easements and releases of rights-of-way shall
not be altered, amended, vacated, released or abandoned without prior written approval of the Town of Greenwich.

2. The Owner(s) shall be solely responsible for the installation, maintenance and repair of the stormwater management practices, drainage easements and associated landscaping identified in Exhibit B in accordance with the Operation and Maintenance Plan (Exhibit A).

3. No alterations or changes to the stormwater management practice(s) identified in Exhibit B shall be permitted unless they are deemed to comply with this Declaration and are approved in writing by the Town of Greenwich.

4. The Owner(s) shall retain the services of a qualified inspector (as described in Exhibit A) to operate and ensure the maintenance of the stormwater management practice(s) identified in Exhibit B in accordance with the Operation and Maintenance Plan (Exhibit A).

5. The Owners(s) must maintain all records (logs, invoices, reports, data, etc.) and have them ready available for inspection at all times. Inspection Documentation must be maintained as frequently as required in Exhibit A.

6. The Town of Greenwich or its designee is authorized to access the property as necessary to conduct inspections of the stormwater management practices or drainage easements to ascertain compliance with the intent of this Declaration and the activities prescribed in Exhibit A. Upon written notification by the Town of Greenwich or their designee of required maintenance or repairs, the Owner(s) shall complete the specified maintenance or repairs within a reasonable time frame determined by the Town of Greenwich. The Owner(s) shall be liable for the failure to undertake any maintenance or repairs so that the public health, safety, general welfare or the environment shall not be endangered.

7. If the Owner(s) does not keep the stormwater management practice(s) in reasonable order and condition, or complete maintenance activities in accordance with the Operation and Maintenance Plan contained in Exhibit A, or the required maintenance or repairs under 6 above within the specified time frames, the Town of Greenwich is authorized, but not required, to perform the specified inspections, maintenance or repairs in order to preserve the intended functions of the practice(s) and prevent the practice(s) from becoming a threat to public health, safety, general welfare or the environment. In the case of an emergency, as determined by the Town of Greenwich, no notice shall be required prior to the Town of Greenwich performing emergency maintenance or repairs. The Town of Greenwich may levy the costs and expenses of such inspections, maintenance, repairs and appropriate fees against the Owner(s). The Town of Greenwich at the time of entering upon said stormwater management practice for the purpose of maintenance or repair may file a notice of lien upon the property affected by the lien. If said costs and expenses are not paid by the Owner(s), the Town of Greenwich may pursue the collection of same through appropriate court actions.

8. The Owner(s) hereby conveys to the Town of Greenwich an easement over, on and in the Property for the purpose of access to the stormwater management practice(s) for the inspection, maintenance and repair thereof, should the Owner(s) fail to properly inspect, maintain and repair the practice(s). The Town of Greenwich’s execution of any repair or maintenance does not alter the Owner(s) responsibility to maintain in future.
9. The Owner(s) agrees that this Declaration shall be recorded and that the land described in a deed recorded in Book 7633 at Page 19 of the Greenwich Land Records shall be subject to the covenants and obligations contained herein, and this Declaration shall bind all current and future owners of the property.

10. The Owner(s) agrees in the event that the Property is sold, transferred, or leased to provide information to the new owner, operator, or lessee regarding proper inspection, maintenance and repair of the stormwater management practice(s). The information shall accompany the first deed transfer and include Exhibits A and B and this Declaration. The transfer of this information shall also be required with any subsequent sale, transfer or lease of the Property.

11. The Owner(s) agree that the rights, obligations and responsibilities hereunder shall commence upon execution of the Declaration.

12. The parties whose signatures appear below hereby represent and warrant that they have the authority and capacity to sign this declaration and bind the respective parties hereto.

13. The Proprietor, its agents, representatives, successors and assigns shall defend, indemnify and hold the Town of Greenwich harmless from and against any claims, demands, actions, damages, injuries, costs or expenses of any nature whatsoever, hereinafter “Claims”, fixed or contingent, known or unknown, arising out of or in any way connected with the design, construction, use, maintenance, repair or operation (or omissions in such regard) of the storm drainage system referred to in the permit as Exhibit “A” hereto, appurtenances, connections and attachments thereto which are the subject of this Declaration. The Proprietor, its agents, representatives, successors and assigns shall not be required to indemnify the Town, its officers, agents, servants, or employees, against any such damages occasioned solely by acts or omissions of the Town, its officers, agents, servants or employees, other than supervisory acts or omissions of the Town, its officers, agents; servants, or employees, in connection with such Claims or the enforcement of this Declaration.
IN WITNESS WHEREOF, the “Owner(s)” have executed this Declaration on this _____ day of
____________________, 20____.

By: ______________________
[Owner(s)]

By: ______________________
[Owner(s)]

STATE OF CONNECTICUT )
 ) ss: Greenwich
COUNTY OF FAIRFIELD )

The foregoing instrument was acknowledged before me on this __________ day of
____________________, 20____, by ______________________, the
[Owner(s)]

“Owner(s)” of ______________________
[Address]

________________________________
Notary Public

My Commission Expires On:

WHEN RECORDED RETURN COPY TO:
[All of the following departments involved in approval:
Building Division, Inland Wetlands & Watercourses Agency, and Planning & Zoning]
Exhibit "A"

Long Term Maintenance Plan
Exhibit A

Operations and Maintenance Plan

2 Crown Lane

Scope:

The purpose of the Operations and Maintenance Plan is to ensure that the existing and proposed stormwater components installed at 2 Crown Lane are maintained in operational condition throughout the life of the project. The service procedures associated with this plan shall be performed as required by the parties legally responsible for their maintenance.

Recommended Frequency of Service:

As further defined below, all stormwater components should be checked on a periodic basis and kept in full working order. Ultimately, the required frequency of inspection and service will depend on runoff quantities, pollutant loading, and clogging due to debris. At a minimum, we recommend that all stormwater components be inspected and serviced twice per year, once before winter begins and once during spring cleanup.

Qualified Inspector:

The inspections must be completed by an individual experienced in the construction and maintenance of stormwater drainage systems. Once every five years the inspections must be completed by a professional engineer.

Service Procedures:

1. Catch Basins & Drainage Inlets:
   a. Catch basins and drainage inlets shall be completely cleaned of accumulated debris and sediments at the completion of construction.
   b. For the first year, catch basins and drainage inlets shall be inspected on a quarterly basis.
   c. Any accumulated debris within the catch basins/inlets shall be removed and any repairs as required.
   d. From the second year onward, visual inspections shall occur twice per year, once in the spring and once in the fall, after fall cleanup of leaves has occurred.
   e. Accumulated debris within the catch basins/inlets shall be removed and repairs made as required.
   f. Accumulated sediments shall be removed at which time they are within 12 inches of the invert of the outlet pipe.
   g. Any additional maintenance required per the manufacturer’s specifications shall also be completed.

2. Storm Drainage Piping and Manholes/Junction Boxes:
   a. All storm drainage piping shall be completely flushed of debris and accumulated sediment at the completion of construction.
   b. Manholes/Junction Boxes shall be inspected and repaired on an annual basis.
c. Unless system performance indicates degradation of piping, comprehensive video inspection of storm drainage piping shall occur once every ten years.

d. Any additional maintenance required per the manufacturer’s specifications shall also be completed.

3. Stormwater Control Structures:

   a. All control structures (orifice, weir, etc.) shall be completely cleaned of accumulated debris and sediments at the completion of construction. Any repairs shall be performed.
   
   b. For the first year, control structures (orifice, weir, etc.) shall be inspected on a quarterly basis.
   
   c. Any accumulated debris shall be removed and any repairs made to the control structures (orifice, weir, etc.) as required.
   
   d. From the second year onward, visual inspections shall occur twice per year, once in the spring and once in the fall, after fall cleanup of leaves has occurred.
   
   e. Accumulated debris shall be removed and repairs made as required.
   
   f. Any additional maintenance required per the manufacturer’s specifications shall also be completed.

4. Drainage Outfalls/Splash Pads/Scour Holes/Level Spreaders:

   a. All outfalls shall be completely cleaned of accumulated debris and sediments at the completion of construction. Any repairs to outlet protection material (rip rap) shall be performed.
   
   b. For the first year, outfalls shall be inspected on a quarterly basis.
   
   c. Any accumulated debris shall be removed and any repairs made to the outfalls as required.
   
   d. From the second year onward, visual inspections shall occur twice per year, once in the spring and once in the fall, after fall cleanup of leaves has occurred.
   
   e. Accumulated debris shall be removed and repairs made as required.
   
   f. Any erosion shall be promptly repaired and the cause of the erosion shall be identified and corrected.
   
   g. Any additional maintenance required per the manufacturer’s specifications shall also be completed.

5. Bioretention/Biofiltration Basins and Rain Gardens:

   a. Bioretention/Biofiltration basins and rain gardens shall be cleaned of debris and sediments upon the completion of construction. Any filter media (bioretention soil) impacted by the construction activities shall be removed and replaced at this time.
   
   b. The filter media (bioretention soil) shall be visually inspected on a monthly basis for the first 6 months. Any erosion or displacement of the filter media (bioretention soil) shall be promptly repaired and the cause of the problem shall be identified and corrected. Monthly inspections shall continue until successful operation of the system is confirmed.
   
   c. Bioretention/Biofiltration areas and rain gardens with grass shall not be mowed more than twice during the growing season, preferably only in late October. More frequent mowing will eliminate native forbs and sedges from the meadow cover.
   
   d. Bioretention/Biofiltration areas and rain gardens with mulch and plantings shall be inspected during spring cleanup and one just prior to the winter season.
   
   e. All dead plants and missing mulch shall be replaced and any necessary pruning of vegetation shall be completed.
f. The surface of these structures shall be inspected on a quarterly basis after the first six
months of successful operation and after heavy runoff events (e.g. >3.0' in a 24-hour
period). One inspection shall occur immediately following the completion of winter
sanding and subsequent sweeping operations, and one shall occur just prior to the
winter season. Any accumulated debris and sediments shall be removed.

g. Check draining time of bioretention/biofiltration areas and rain gardens annually.
Check within 72 hours after a minimum one inch rain event. If there is no standing
water, infiltration is acceptable. If draining time is excessive, quantitatively determine
infiltration rate. Use a double ring infiltrometer or monitor drop in water level after a
significant storm. If infiltration rate <0.5 in./hour, remedial action shall be taken.

h. A soil-core investigation may be used to identify the clogged portion of stormwater
facility and depth of clogging. Remedial measures may include removal of clogged soil
layer and replacement with suitable media, aeration, and mixing upper strata with lower
soil strata. After corrective measures have been implemented, infiltration rate and
draining time shall be retested.

6. **Drywells and Infiltration Systems:**

   a. All drywells/infiltrators shall be completely cleaned of accumulated debris and
      sediments upon the completion of construction.
   b. For the first year, the drywells/infiltrators shall be inspected on a quarterly basis.
   c. Any accumulated debris within the drywells/infiltrators shall be removed and any
      repairs made to the units as required.
   d. From the second year onward, visual inspection shall occur twice per year, once in the
      spring and once in the fall, after fall cleanup of leaves has occurred.
   e. Accumulated debris within the units shall be removed and repairs made as required.
   f. Any additional maintenance required per the manufacturer's specifications shall also
      be completed.

7. **Porous Pavement (Pervious Concrete, Porous Asphalt, Permeable Interlocking Concrete
   Pavers, Flexi pave, Etc.):**

   a. Changing the porous pavement surface to an impervious surface requires the review
      and approval of the Town of Greenwich DPW Engineering Division.
   b. Clean and vacuum (Regenerative Air Vacuum for Permeable Interlocking Concrete
      Pavers) the porous pavement upon the completion of construction.
   c. Check for standing water on the surface of the pavement after a precipitation event. If
      standing water remains within 30 minutes after rainfall had ended, cleaning of porous
      pavement is recommended.
   d. Vacuum sweeper shall be used regularly to remove sediment and organic debris on
      the pavement surface. The sweeper may be fitted with water jets.
   e. Pavement vacuuming should occur during spring cleanup following the last snow event
      to remove accumulated debris, at a minimum.
   f. Pavement vacuuming should occur during fall cleanup to remove dead leaves, at a
      minimum.
g. Power washing can be an effective tool for cleaning clogged areas. See manufacturer's specifications.

h. Check for debris accumulating on pavement, especially debris buildup in winter. For loose debris, a power/leaf blower or gutter broom can be used to remove leaves and trash.

i. In the event that the porous surface becomes clogged an engineer must be retained to determine how to restore the porous surface to its original condition.

j. Any additional maintenance required per the manufacturer's specifications shall also be completed.

8. Roof Gutters:

   a. Remove accumulated debris and inspect for damage. Any damage should be repaired as required.

Disposal of Debris and Sediment:

All debris and sediment removed from the stormwater structures and bioretention/biofiltration basins shall be disposed of legally. There shall be no dumping of silt or debris into or in proximity to any inland or tidal wetlands.

Maintenance Records:

The Owners(s) must maintain all records (logs, invoices, reports, data, etc.) and have them readily available for inspection at all times.
Operations and Maintenance Log (Page 1 of 3)
2 Crown Lane

<table>
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<th>Type of Inspection:</th>
<th>☐ Spring</th>
<th>☐ Fall</th>
<th>☐ Other</th>
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<table>
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<th>Inspector's Name:</th>
<th>Date of Inspection:</th>
<th>Affiliation:</th>
<th>Phone #:</th>
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**Catch Basins & Drainage Inlets:**
- Has accumulated debris been removed from grates? ☐ Yes ☐ No ☐ N/A
- Do any basins require additional repair? (identify below): ☐ Yes ☐ No ☐ N/A
- Have sumps been cleaned of sediment? ☐ Yes ☐ No ☐ N/A

**Storm Drainage Piping and Manholes/Junction Boxes:**
- Has accumulated debris been removed? ☐ Yes ☐ No ☐ N/A
- Do any manholes require additional repair? (identify below): ☐ Yes ☐ No ☐ N/A
- Is there any evidence of stormwater piping failure? ☐ Yes ☐ No ☐ N/A
- Has a comprehensive video inspection been completed? ☐ Yes ☐ No ☐ N/A

**Notes:**

**Stormwater Control Structures:**
- Has accumulated debris been removed? ☐ Yes ☐ No ☐ N/A
- Are any repairs required? (identify below): ☐ Yes ☐ No ☐ N/A
- Have orifices and weirs been cleaned of debris? ☐ Yes ☐ No ☐ N/A

**Notes:**
**Operations and Maintenance Log (Page 2 of 3)**

2 Crown Lane

### Drainage Outfalls/Splash Pads/Scour Holes/Level Spreaders:
- Have all drainage outlets been cleared of debris? □ Yes □ No □ N/A
- Have all outlet protections been inspected/repaiired? □ Yes □ No □ N/A
- Have all erosion issues been repaired? □ Yes □ No □ N/A

### Notes:

### Bioretention/Biofiltration Basins/Rain Gardens:
- Have basins been cleared of debris/sediments? □ Yes □ No □ N/A
- Have draining times of basins been verified? □ Yes □ No □ N/A
- Has vegetation been mowed (twice/year max.)? □ Yes □ No □ N/A
- Has plantings and mulch been replaced (twice/year)? □ Yes □ No □ N/A

### Notes:

### Drywells and Infiltration Systems:
- Have units been cleared of debris/sediments? □ Yes □ No □ N/A
- Do units require additional repair? (identify below): □ Yes □ No □ N/A
- Has draining times of system been verified? □ Yes □ No □ N/A

### Notes:
Operations and Maintenance Log (Page 3 of 3)
2 Crown Lane

Permeable Pavers:
- Have pavers been vacuumed? □ Yes □ No □ N/A
- Has draining times been verified? □ Yes □ No □ N/A

Notes:

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Roof Gutters:
- Has accumulated debris been removed from gutters? □ Yes □ No □ N/A
- Do any gutters require additional repair? (identify below): □ Yes □ No □ N/A

Notes:

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Please make additional notes/observations and particular concerns below. Also record any additional maintenance that has been performed:

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Signature of Inspector: __________________________ Date: ____________

21AU LTMP 1
Exhibit “B”

Improvement Location Survey
Depicting “As-Built” Conditions
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