Christopher M. & Francesca J. Santomero

To construct a pool and pool house further exceeding 150,000 cubic feet in volume on a 6.33-acre parcel in the RA-2 zone.

| LOCATION: | 46 Vineyard Lane |
| EXISTING ZONING: | RA-2 (2-acre minimum lot size) |
| PARCEL SIZE: | 6.33-acres (275,734.8 sq.ft.) |
| UTILITIES: | Private Septic System and Well |

<table>
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<td>24,816 sq.ft.</td>
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<td>Over 150,000 cu.ft. needs a Special Permit</td>
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**Dwelling**

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**Structure Setbacks**

- Front Yard Depth: 264.4’ | 75’ | No Change
- Side Yard Width: 130.5’ and >35’ | 35’ | No Change
- Rear Yard Setback: >75’ | 75’ | No Change

**Pool House**

**ACCESSORY STRUCTURE**

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**Structure Setbacks**

- Side Yard Width: N/A | 25’ | >25’
- Rear Yard Setback: N/A | 25’ | >25’

**APPLICATION SUMMARY:**

Final Site Plan and Special Permit applications, PLPZ 2022 00001, are submitted by the applicant to construct a pool and pool house further exceeding 150,000 cu. ft. on the site, requiring a special permit on a 6.33-acre parcel located at 46 Vineyard Lane in the RA-2 zone.

**ISSUES/RECOMMENDATIONS:**

1. **The Inland Wetlands Agency (IWWA)** – IWWA issued a green sheet dated 9/21/2021 indicating no action is needed with their department for the proposed work.
2. **The Department of Health** issued a septic approval letter dated 3/4/2022 for an on-site...
sewage disposal system for a 7 bedroom/750 GPD centralized system to connect to the pool house.

3. **The Zoning Enforcement Officer** issued comments dated 3/8/2022 and notes no concerns at this time for the application.

4. **Engineering** – DWP issued comments on 3/7/2022 and requests the applicant resubmit prior to Zoning/Building permit approval.

5. **Landscape Plan** – The Commission may ask the applicant to provide a more developed landscape plan with this special permit application. The Commission may ask the applicant to develop a planting plan with native species to help provide a balance of the proposed paved areas within the site. The Commission may consider if additional plants are recommended other than solely manicured lawn as proposed with this application.

6. **Tree Removal and Mitigation** – Two trees are scheduled for removal: a large mature oak and a smaller hemlock. Both trees are rooted into shallow ledge, which is typically a difficult area to grow substantial vegetation. The Commission may request these trees be mitigation with a 2:1 ratio of native tree species.

7. **Rain Garden** - 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. The rain garden needs further development based on department comments.

**PROPOSAL:**
A Final Site Plan and Special Permit application, PLPZ 2022 00001, is submitted by the applicant to construct a pool and pool house. Under proposed conditions, a total on-site increase of about 3,412 sq.ft. of impervious surfaces from existing conditions is expected. After construction of the proposed pool, pool house and other various hardscape and storm water management facilities, all disturbed areas will be planted or maintained as manicured lawn.

The property is bound by residential development. It is improved with a single-family dwelling, attached garage, tennis court, playground, driveway, other various hardscapes, all of which will remain with this proposed project.

A special permit is required for this application for the below reason:
1) Per Section 6-101(a) of the BZR, as the total volume of buildings on the property is greater than 150,000 cubic feet.

**DEPARTMENT COMMENTS:**
IWWA - see green sheet dated 9/29/2021
DPW - see attached memo of 3/7/2022
ZEO - see attached memo of 3/8/2022
CONSERVATION - expected soon
HEALTH - see attached memo of 3/4/2022

**EXISTING CONDITIONS:** The parcel is located on the western side of Vineyard Lane and is a fronting lot that contains 6.3328-acres in the RA-2 zone. The lot has conforming lot area, lot
shape and frontage on Vineyard Lane. The existing conditions appears to have conforming green area, setbacks and floor area ratio. (per Sec. 6-205 for the RA-2 Zone)

A significant number of wetlands exist on the west side of the property. IWWA staff indicated that all site activity is great than 100-feet away from the wetlands and no wetlands permit is required. IWWA issued a greensheet on 9/29/2021 for this effort.

The property is bound by residential development. It is improved with a single-family dwelling, attached garage, tennis court, playground, driveway, other various hardscapes, all of which will remain with this proposed project.

The site contains many locations of ledge and moderate to steep slopes throughout the property, as noted on the Topographic Survey by Rocco V. D’Andrea, Inc’s office, last revised 1/4/2021.

DRAINAGE: DWP issued comments on 3/7/2022 and requests the applicant resubmit prior to Zoning/Building permit approval. Among other comments DPW requests the rain garden details be developed more.

The applicant submitted two drainage reports, one for the proposed pool effort and another as an as-built addendum of work previously done.

Under “as-built” conditions, impervious coverage increased by approximately 582 sq.ft. when compared to the original approved design. The original design included one LID BMP (rain garden) and two standard BMP (retention systems). The front drywell system needs to expand to account for the approximately 582 sq.ft. of additional impervious area constructed in the front yard. The drainage report suggests two additional Cultec 280 HD units at the front drywell system. It is not clear if the applicant is proposing this work in this current application or not.

The second drainage report, for the proposed pool only considers the rear portion of the site. The proposed pool house is located over a previously installed retention system which will be replaced with the proposed rain garden and detention system.

Under proposed conditions, a total on-site increase of about 3,412 sq.ft. of impervious surfaces from existing conditions is expected. After construction of the proposed pool, pool house and other various hardscape and storm water management facilities, all disturbed areas will be planted or maintained as manicured lawn.

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.

The Commission may also consider if additional plants are recommended other than solely manicured lawn with this application.
**HEALTH:** The Health Department issued a septic approval letter dated 3/4/2022 for an on-site sewage disposal system for a 7 bedroom/750 GPD centralized system to connect to the pool house.

**ZONING:** The proposed development looks to conforms to FAR, Green Area, and setback requirements for the RA-2 zone per Section 6-205 of the BZR.

The Zoning Enforcement Officer issued comments dated 3/8/2022 and notes no concerns at this time for the application.

**VEGETATION:** The applicant submitted a planting plan that shows hardscape improvements, but no proposed planting outside of lawn. The Commission may request the applicant mitigate the two mature trees that are noted to be removed with new native plantings.

**BACKGROUND:** In 2016, Christopher M. & Francesca J. Santomero submitted a Final Site Plan and Special Permit application, PLPZ 2016 00333 and 00334, to construct a basement and first floor addition to the existing northwest side of the residence, relocate a transformer servicing the home, install associated drainage infrastructure and other associated improvements. This application was approved with modifications by the Commission at the 7/19/2016 meeting and a decision letter dated 8/2/2016 was issued.

On 8/12/2016 staff wrote a memorandum endorsing the project for a Zoning Permit.

In December 2016 the applicant submitted a Final Site Plan and Special Permit application, PLPZ 2016 00640 and 00641 to amend the approved plans under application PLPZ 2016 00333 and 00334 and increase the gross floor area and building volume of the dwelling, further exceeding the 150,000 cubic feet building volume of the property. This application was approved with modifications by the Commission at the 1/24/2017 meeting and a decision letter dated 2/7/2017 was issued.

No request for Zoning Permit is found, so it is assumed this work was not done. As five years has passed, the Commission’s approval for this work has expired.

No Certificate of Occupancy (CO) is found for the above applications.

**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.
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: Scott Marucci - Senior Civil Engineer

Date: 3/7/2022

COMMENTS AND CONDITIONS OF APPROVAL: Resubmit Prior to Zoning/Building Permit Approval

1. A revised Form SC-107 needs to be submitted.
2. The Drainage Summary Report is acceptable once the following additional information is submitted prior to the zoning/building permit:
   a. The conveyance and outlet protection computations must be submitted.
3. The construction plan set needs to be revised as follows:
   a. Site Plan Sheets
      i. The callout for the slot drains need to also state that they must be connected to the pool house roof drain and directed to the rain garden.
      ii. It is unclear if the slot drain is proposed for the entire length of the patio along the front of the wall.
      iii. The callout for the rain garden needs to include a callout for a 30-mil impermeable liner between the retaining wall and the rain garden.
      iv. The pipe from the Cultec System into the outlet control structure must be from the bottom of unit.
      v. The 6” horizontal overflow at 183.40 needs to be added to the control structure callout.
      vi. Based on DT 402 ledge is 3.83-feet below existing ground. The proposed Cultec System may need to be shifted if the ledge has the same depth at ground elevation 184.
b. Construction Details Sheets
   i. The rain garden detail needs to include the retaining wall and the 30-mil impermeable liner between the wall and the rain garden material.
   ii. The rain garden detail needs to include the required pea stone between the large stone and the bioretention soil mix.
4. The draft Operations and Maintenance Plan Report needs to be revised as follows:
   a. Exhibit A needs to have the name corrected to 46 Vineyard Lane.

**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).
03/04/2022  
Rocco V D’Andrea Inc  
6 Neil Lane  
Riverside CT 06878  

Re: Centralized Septic System Proposal for 46 Vineyard Lane, Greenwich CT  

Dear Anthony D’Andrea  

This Department has received, reviewed, and approved the submitted design proposal for an on-site sewage disposal system for a 7 bedroom/750 GPD centralized system to connect pool house at 46 VINEYARD LANE.  

*Note: The broken inlet pipe discovered during recent inspection will be fixed during central connection  


Please be advised that this is NOT a Permit to Construct. A Permit to Construct will be issued to a septic system installer licensed in the State of Connecticut. The Application for a Permit to Construct a Sewage Disposal System must be signed by this installer, and the fee of $495 for a sewage disposal permit must be paid prior to issuance of the Permit to Construct. 

Should changes to the State of Connecticut Public Health Code and/or Town of Greenwich Municipal Code be implemented prior to installation of the system, the design must be revised to meet current code requirements.  

Sincerely,  

Claire Durkota  
Division of Environmental Services
Project No. PLPZ202200001  Preliminary  Final  

Reviewed for Planning and Zoning Commission.

TITLE OF PLAN REVIEWED: Santomero

LOCATION: 46 Vineyard Lane

PLAN DATE:

ZONE: RA-2

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

☐ Resubmit the following prior to Site Plan/ Subdivision approval:

☒ 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: 3/8/2022

Note: These comments do not represent Building Inspection Division approval. Plans subject to review by ZEO at time of building permit application.
PERMIT-NEED QUESTIONNAIRE

This form is NOT an IWWA Application

Project Address: 46 Vineyard Lane, Greenwich, CT 06830

Tax ID: 10-2273

Property Owner: Christopher M. & Francesca J. Santoma

Address: 42 Stone Paddock Place, Bedford, NY 10506

Contact information – Email or Cell Phone: ____________________________

Authorized Agent: Heagney, Lennon & Slane, LLP

Address: 248 Greenwich Ave, Greenwich CT 06830

Contact information – Email or Cell Phone: Thomas J. Heagney (203) 661-8400 THeagney@HLS248.com

Has there ever been an IWWA application for this site? YES ☐ NO ☐ Appl. # 84-107; 85-136

ACTIVITY: [Check one] Addition ☐ Demolition ☐ Deck ☐ Garage ☐ Interior renovations ☐
New residence ☐ Tennis Court ☐ Pool ☐ Site Work/Landscaping ☑
Septic ☐ Generator ☐ Other (specify) ☐ Pool & Pool House ☐

Will this activity require an addition to the septic system or a B100a? YES ☐ NO ☐

FEE: $65 for reviews requiring a site visit

A PLOT PLAN IS REQUIRED SHOWING THE PROPOSED ACTIVITY.

IWWA staff will review the project proposal to determine if regulated activities are associated with the proposal and whether an IWWA permit is required. If an IWWA permit is required, the appropriate permit application packet will be provided.

Do not apply for a Building Permit until this review is complete.

No work may begin until an IWWA permit is issued and/or the “Building Permit Application Sign-Off Sheet” has been signed.

The issuance of a building permit alone does not constitute an authorization to proceed.

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

Signature ____________________________ Date ____________

THeagney@HLS248.com

IWWA Questionnaire Revised 3/24/2020
From: Tom Heagney <theagney@hlsctlaw.com>
Sent: Tuesday, March 8, 2022 5:34 PM
To: Pruitt, Jacalyn <jacalyn.pruitt@greenwichct.org>
Subject: RE: 46 Vineyard Lane

[EXTERNAL]

Jackie,

There were two minor changes to the engineering plan. The title block was relabeled CENTRALIZED SEPTIC SYSTEM PROPOSAL and the pool house was labeled (for seasonal use only).

No substantive changes were made. Attached is the revised map.

Let me know if you have any further questions.

Thanks,
Tom

Thomas J. Heagney
Heagney, Lennon & Slane, LLP
31 East Elm Street
Greenwich, CT 06830
D: 203-661-8401
O: 203-661-8400
F: 203-661-7496
theagney@HLS248.com

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From: Pruitt, Jacalyn <jacalyn.pruitt@greenwichct.org>
Sent: Tuesday, March 08, 2022 1:50 PM
To: Tom Heagney <theagney@hlsctlaw.com>
Subject: RE: 46 Vineyard Lane

For the approved Health Plan, is there an additional engineering plan the Commission should see, or is what I have still up-to-date?

Jacalyn Pruitt, Planner II
Town of Greenwich Planning & Zoning
TOWN OF GREENWICH
Town Hall ~ 101 Field Point Road ~ Greenwich, CT 06830
Planning & Zoning Department ~ 203-622-7894 ~ Fax.203-622-3795

Site Plan Application

Property Address: 46 Vineyard Lane, Greenwich, CT 06831
Tax ID: 10-2273

Property Owner: Christopher M. & Francesca J. Santomero
Address: 

Email: ____________________________ Cell Phone: ____________________________ Other Phone: ____________________________

Applicant: Christopher M. & Francesca J. Santomero
Address: 

Email: ____________________________ Cell Phone: ____________________________ Other Phone: ____________________________

Authorized Agent: Heagney, Lennon & Slane, LLP
Address: 31 East Elm Street, Greenwich, CT 06830
Email: jheagney@hlsctlaw.com
Cell Phone: ____________________________ Other Phone: (203) 661-8400

Select One: ☐ Pre-Application  ☑ Final

Zone(s): RA-2 Lot Area: 275,857 sf

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
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<tr>
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pzSitePlanApp 2020
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<th>Christopher M. &amp; Francesca J. Santomero</th>
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<th>Authorized Agent:</th>
<th>Heagney, Lennon &amp; Slane, LLP</th>
<th>Address: 31 East Elm Street, Greenwich, CT 06830</th>
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<td>Email:</td>
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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

Special Permit Application

Property Address: 46 Vineyard Lane, Greenwich, CT 06831

Property Owner: Christopher M. & Francesca J. Santomero

Applicant: Christopher M. & Francesca J. Santomero

Authorized Agent: Heagney, Lennon & Slane, LLP

Email: JHeagney@hisctlaw.com

Address: 31 East Elm Street, Greenwich, CT 06830

Cell Phone: Other Phone: (203) 661-8400

Tax ID: 10-2273

Applicant Cell Phone: Other Phone:

Lot Area: 275,857 sf

Zone(s): RA-2

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
NARRATIVE

Applicant proposes to construct a pool and pool house on the westerly side of the existing home on a 6.33-acre parcel in the RA-2 zone. The existing home is 187,875 cubic feet and the proposed pool house will add an additional 11,028 cubic feet for a total of 198,903 cubic feet. The pool house will add an additional 195 square feet of floor area to the existing home of 16,529.5 square feet whereas 24,827 square feet is permitted.

The Wetland Agency has provided a green sheet for the proposed pool and pool house.

Due to the increase in volume of structures on the property, a site plan and special permit is needed to construct the pool house. Site plan and special permit approval are requested.

Respectfully Submitted,
Thomas J. Heagney
Dated: January 3, 2022
February 25, 2020

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

RE: 46 Vineyard Lane
Greenwich, CT 06830

To Whom It May Concern:

We hereby authorize Heagney, Lennon & Slane, LLP to act as our agent to appear before the Town of Greenwich Planning and Zoning Commission or any other Town Municipal Board in connection with the filing of applications for the above captioned property.

Christopher M. Santomero

Francesca J. Santomero
TOWN OF GREENWICH

AFFIDAVIT OF NOTIFICATION OF SITE PLAN & SPECIAL PERMIT
APPLICATION
TO
PLANNING AND ZONING COMMISSION

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

I, JOHN HEAGNEY, being first duly sworn, do hereby certify that on January 3, 2022, I
caused to be mailed, postage prepaid, evidenced by certificate of mailing, to those persons whose
names are set forth on Exhibit A attached hereto, a copy of the notice Exhibit B. Said persons
are the record owners, as of January 3, 2022, as shown on the Town Tax Assessor’s Office
records of property abutting and across the street from the property for which an application for
site plan and special permit for the property located at 46 Vineyard Lane, Greenwich,
Connecticut has been filed with the Greenwich Planning and Zoning Commission.

[Signature]

JOHN HEAGNEY

Subscribed and sworn to before me
this 3rd day of January, 2022

[Signature]

EMMA A. MUTINO
NOTARY PUBLIC
My Commission Expires Apr. 30, 2025
EXHIBIT A

Abutting property owners of 46 Vineyard Lane:

Roger Seasonwein
56 Round Hill Road
Greenwich, CT 06830
10-3010

50 Vineyard Lane Trust
50 Vineyard Lane
Greenwich, CT 06830
10-3533

Ariane M. H. Matschullat TR
38 Vineyard Lane
Greenwich, CT 06831
10-1434

Robert & Jane Shipman
49 Fox Run Lane
Greenwich, CT 06831
10-1467

Lawrence R. & Lucy Ricciardi
45 Vineyard Lane
Greenwich, CT 06831
10-3007

Morris Obrien TR
57 Vineyard Lane
Greenwich, CT 06831
10-1015

Michael J. & Virginia S. Genereux
55 Fox Run Lane
Greenwich, CT 06831
10-1350

Henrich & Gabriela Rutt
49 Vineyard Lane
Greenwich, CT 06831
10-3009
To Whom It May Concern:

Notice is hereby given that Christopher M. and Francesca J. Santomero have filed an application with the Town of Greenwich Planning and Zoning Commission to request site plan and special permit approval to construct a new pool and pool house and conduct site improvements on their property at 46 Vineyard Lane in Greenwich, Connecticut.

Further information regarding this application may be obtained at the Planning and Zoning Commission or this office.

______________________________
John Heagney

For information contact:
Planning and Zoning Commission
Town Hall, 101 Field Point Road
Greenwich, CT 06836
Tel: 203-622-7894
January 3, 2022

To Whom It May Concern:

Notice is hereby given that Christopher M. and Francesca J. Santomero have filed an application with the Town of Greenwich Planning and Zoning Commission to request site plan and special permit approval to construct a new pool and pool house and conduct site improvements on their property at 46 Vineyard Lane in Greenwich, Connecticut.

Further information regarding this application may be obtained at the Planning and Zoning Commission or this office.

For information contact:
Planning and Zoning Commission
Town Hall, 101 Field Point Road
Greenwich, CT 06836
Tel: 203-622-7894
## RESIDENTIAL

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### TOTAL LAND VALUE

2936500
This map was produced from the Town of Greenwich GIS. The Town expressly disclaims any liability that may result from the use of this map. Basemap: 4/2/08. Parcels: 10/1/12. Copyright 2005 Town of Greenwich.
DRAINAGE SUMMARY REPORT
As-Built Addendum

For

46 Vineyard Lane
Greenwich, Connecticut

Prepared For

Christopher & Francesca
Santomero

November 4, 2021

Leonard C. D’Andrea, PE
CT License No. 14869
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Narrative .......................... 1  
Conclusion ......................... 1

**Exhibit**

"As-Built" Watershed Map .......................... Exhibit A

**Appendices**

Stormwater Management Standards Calculations .......................... Appendix A  
Stage-Area-Storage Tables .......................... Appendix B  
HydroCAD Analysis – As-Built Drainage Facilities .......................... Appendix C  
HydroCAD Analysis – Proposed Conditions (Post DW-2 expansion) .......................... Appendix D
Narrative

The owners of 46 Vineyard Lane have finalized construction of proposed improvements at their property, which include a northerly dwelling addition, parking court, driveway expansion, and related site drainage and grading. For a depiction of the “As-Built” conditions refer to the updated Topographic Survey included herewith, as revised through September 15, 2020 and prepared by this firm. For a depiction of original proposed improvements refer to the approved development plan set entitled, “Construction Site Plan Review Set, Proposed Addition and Parking Court, Location 46 Vineyard Lane, Greenwich, Connecticut, Prepared for Christopher & Francesca Santomero”, prepared by this firm and revised through March 13, 2017. The purpose of this report is to provide an “As-Built” analysis of the stormwater management plan for the development of this site.

Under “As-Built” conditions, impervious coverage to Point of Concern (P.O.C.) “B” has increased by approximately 582 sq ft when compared to the original approved design. As a result, the flow rate increases by approximately 0.05 CFS during the 5-year storm event and the Runoff Reduction Volume (RRV) requirement is not met. Refer to Table 2 at the end of this narrative for a comparison of existing and “As-Built” flow rates and volumes. In order to meet drainage requirements two (2) additional Cultec 280HD units are required at the front drywell system (DW-2). Refer to Table 3 for a comparison of flow rates and volumes to POC “B”, which reflect conditions after the drywell system has been expanded.

In addition to the field corrections noted above, the owners are also proposing to construct a proposed pool, patio, and pool house in the rear yard. A separate drainage summary report and development plan set have been prepared for these proposed improvements.

Conclusion

One LID BMP (rain garden) and two standard BMP (retention systems) were constructed as designed at the project site. The front drywell system will need to expand to account for approximately 582 sq ft of additional impervious area constructed in the front yard. If constructed as proposed the project will meet RRV requirements and reduce flow rates for the 2 through 25 year storm events, and will therefore have no adverse impacts to the site, neighboring properties, or the roadway drainage system.
<table>
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<th>Storm Frequency Event</th>
<th>Flow/Volume</th>
<th>POC &quot;A&quot; (Rear Yard)</th>
<th>&quot;As-Built&quot;</th>
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<th>Δ (%)</th>
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Table 1: Comparison of Existing and "As-Built" Peak Flow Rates and Volumes for POC "A".

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Proposed conditions at POC "B" after front drywell system (DW-2) expansion.

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Table 3: Comparison of Existing and Proposed Peak Flow Rates and Volumes for POC "B" after DW-2 expansion.
Exhibit "A"

"As-Built"

Watershed Map
Appendix "A"

Stormwater Management Standards Calculations
Appendix C: Runoff Volume & Retention System Design Calculations

Name: Christopher & Francesca Santomero
Address: 46 Vineyard Lane, Greenwich, CT
Date: August 10, 2021

\[ \textbf{Water Quality Volume (Area 2A > Drywell-1)} \]

Watershed Data (Area 2A)

\begin{align*}
\text{Watershed Area} & = 1,628 \text{ ft}^2 \\
\text{Impervious Cover} & = 1,628 \text{ ft}^2 \\
\text{Lawn Cover} & = 0 \text{ ft}^2 \\
\end{align*}

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

Where:

\begin{align*}
WQV & = \text{Water quality volume} \\
R & = \text{Site cover runoff coefficient} \\
R, I & = \text{Runoff coefficient for impervious} \\
R, T & = \text{Runoff coefficient for lawn} \\
\%I & = \text{Percent of site as impervious cover} \\
\%T & = \text{Percent of site in lawn} \\
A & = \text{Watershed area}
\end{align*}

\[
R = 0.95(0.95) + 0.20(0.000) = 0.95
\]

\[
WQV = \frac{1}{12} (0.95)(1,628) = 128.9 \text{ ft}^3
\]

\[ WQV = 128.9 \text{ ft}^3 \]

\[ \textbf{Water Quality Volume (Area 4B > Rain Garden)} \]

Watershed Data (Area 4B)

\begin{align*}
\text{Watershed Area} & = 3,921 \text{ ft}^2 \\
\text{Impervious Cover} & = 3,902 \text{ ft}^2 \\
\text{Lawn Cover} & = 19 \text{ ft}^2 \\
\end{align*}

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

Where:

\begin{align*}
WQV & = \text{Water quality volume} \\
R & = \text{Site cover runoff coefficient} \\
R, I & = \text{Runoff coefficient for impervious} \\
R, T & = \text{Runoff coefficient for lawn} \\
\%I & = \text{Percent of site as impervious cover} \\
\%T & = \text{Percent of site in lawn} \\
A & = \text{Watershed area}
\end{align*}

\[
R = 0.95(0.995) + 0.20(0.005) = 0.946
\]

\[
WQV = \frac{1}{12} (0.946)(3,921) = 309.1 \text{ ft}^3
\]

\[ WQV = 309.1 \text{ ft}^3 \]

Rocco V. D’Andrea, Inc
**Groundwater Recharge Volume**

Site Information
- Existing Impervious Cover = 25,972 ft²
- As-Built Impervious Cover = 29,834 ft²
- Net Increase = 3,862 ft²

\[ GRV = F \times I \]

Where:
- \( GRV \) = Required groundwater recharge volume
- \( F \) = Target depth factor = 0.35 in (HSG B)
- \( I \) = Net increase in impervious area = 3,862 ft²

\[ GRV = \frac{0.35}{12} (3,862) = 112.6 \text{ ft}^3 \]

\[ GRV = 121.6 \text{ ft}^3 \]

**Runoff Reduction Volume at POC-A**

1-Year Storm Runoff Data at POC-A
- Pre-development runoff volume = 2,089 ft³
- Post-development runoff volume (No BMPs) = 2,423 ft³

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

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

\[ RRV = 2,423 - 2,089 = 334 \text{ ft}^3 \]

Runoff Reduction Volume (RRV) @ POC A = 334 ft³

**Runoff Reduction Volume at POC-B**

1-Year Storm Runoff Data at POC-B
- Pre-development runoff volume = 3,041 ft³
- Post-development runoff volume (No BMPs) = 3,675 ft³

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

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

\[ RRV = 3,675 - 3,041 = 634 \text{ ft}^3 \]

Runoff Reduction Volume (RRV) @ POC A = 634 ft³
“As-Built” & “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, (1) retention system was installed, which will discharge to the wetland system in the rear yard, and (1) Rain Garden and drywell system was installed, which will discharge to the Vineyard Lane drainage system.

Drywell System (DW-1) to POC “A”
The “As-Built” retention system was designed to retain runoff from Area 2-A to maintain or reduce peak flow rates for the 2, 5, 10, & 25-year storm events. Refer to the end of this section for a structure rating table for DW-1.

| Total Storage Volume (To Top of Stone) | = 486 ft³ |
| Runoff Reduction Volume (RRV) @ POC A | = 334 ft³ |
| Water Quality Volume (Area 2-A)       | = 129 ft³ |

Rain Garden (RG-1) & Retention System (DW-2) to POC “B” (after DW-2 expanded)
The “As-Built” Rain Garden & Retention system were designed to retain runoff from Area 4-B to maintain or reduce peak flow rates for the 2, 5, 10, & 25-year storm events. Refer to the end of this section for a structure rating table for the RG-1 and DW-2.

| Total Storage Vol. –RG-1 (Bottom to Outlet)= | 251 ft³ |
| Total Storage Vol. –DW-2 (Bottom to Outlet)= | 393 ft³ |
| Total Storage Volume (RG-1 + DW-2)            | = 644 ft³ |
| Runoff Reduction Volume (RRV) @ POC B         | = 634 ft³ |
| Water Quality Volume (Area 4-B)               | = 309 ft³ |

BMP Drawdown Calculations

According to the NRCS Web Soil Survey and the information provided in Exhibit “C”, the installed drainage system lies within a mapped area of HSG-B soils. Therefore the following draw down calculations uses a Rawl’s Rate of 1.02 in/hr.

Drywell System (DW-1):

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

Where:
- DV = Design Volume  \( = 518 \text{ ft}^3 \)
- k = Infiltration Rate  \( = 1.02 \text{ in/hr (CL HSG-D)} \)
- A = Bottom Area  \( = 251 \text{ ft}^2 \)

\[ t_{\text{drawdown}} = \frac{518}{(1.02)(\frac{1}{12})(251)} = 24.3 \text{ hr} \]

Drywell-1 will drawdown in 24.3 hrs.
**Rain Garden (RG-1):**

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

Where:
- \( DV \) = Design Volume
- \( k \) = Infiltration Rate
- \( A \) = Bottom Area

\[ t_{\text{drawdown}} = \frac{251}{(1.02)(12)(295)} = 10.0 \text{hr} \]

Rain Garden will drawdown in 10.0 hrs.

**Drywell System (DW-2) after expanding:**

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

Where:
- \( DV \) = Design Volume
- \( k \) = Infiltration Rate
- \( A \) = Bottom Area

\[ t_{\text{drawdown}} = \frac{393}{(1.02)(12)(248)} = 18.6 \text{hr} \]

Drywell-2 will drawdown in 18.6 hrs.
Appendix “B”

Stage – Area - Storage Tables
# Stage-Area-Storage for Pond 5P: DW-1

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<th>Elevation (feet)</th>
<th>Storage (cubic-feet)</th>
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Outlet Orange

Top of Stone

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### Stage-Area-Storage for Pond 6P: RG-1

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*Overflow Grate*

*Outlet Orifice*
### Stage-Area-Storage for Pond 9P: DW-2

<table>
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</table>

*NOTE: The overflow outlet is at 188.40 feet.*
Appendix “C”

HydroCAD Analysis

As-Built Drainage Facilities
<table>
<thead>
<tr>
<th>Area (sq-ft)</th>
<th>CN</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>44,994</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B (1S, 3S, 4S)</td>
</tr>
<tr>
<td>2,410</td>
<td>96.0</td>
<td>Ledge (1S, 3S)</td>
</tr>
<tr>
<td>18,126</td>
<td>98.0</td>
<td>Paved parking, HSG B (3S, 4S)</td>
</tr>
<tr>
<td>9,298</td>
<td>98.0</td>
<td>Roofs, HSG B (1S, 2S)</td>
</tr>
<tr>
<td>74,828</td>
<td>75.7</td>
<td>TOTAL AREA</td>
</tr>
</tbody>
</table>
Summary for Subcatchment 1S: Area 1-A

Runoff = 0.65 cfs @ 12.07 hrs, Volume= 2,061 cf, Depth> 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7,670</td>
<td>98.0</td>
<td>Roofs, HSG B</td>
</tr>
<tr>
<td>22,881</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B</td>
</tr>
<tr>
<td>*</td>
<td>96.0</td>
<td>Ledge</td>
</tr>
<tr>
<td>32,839</td>
<td>72.1</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>25,169</td>
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<td>76.64% Pervious Area</td>
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<tr>
<td>7,670</td>
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<td>23.36% Impervious Area</td>
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</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>
</table>
| 3.7      | 56            | 0.1700        | 0.25              |                | Sheet Flow, Grass: Dense n= 0.240  P2= 3.40"

Subcatchment 1S: Area 1-A

Type III 24-hr
1-Year Rainfall=2.90"
Runoff Area=32,839 sf
Runoff Volume=2,061 cf
Runoff Depth>0.75"
Flow Length=56'
Slope=0.1700 "/'
Tc=3.7 min
CN=72.1
Summary for Subcatchment 2S: Area 2-A

Runoff = 0.13 cfs @ 12.00 hrs, Volume= 362 cf, Depth> 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1,628</td>
<td>98.0</td>
<td>Roofs, HSG B</td>
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<td>1,628</td>
<td>100.0% Impervious Area</td>
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</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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<td>Sheet Flow, Smooth surfaces</td>
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<td></td>
<td>n= 0.011 P2= 3.40&quot;</td>
</tr>
<tr>
<td>0.1</td>
<td>60</td>
<td>0.1800</td>
<td>14.33</td>
<td>2.81</td>
<td>Pipe Channel, 6.0&quot; Round</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Area= 0.2 sf Perim= 1.6' r= 0.13'</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>n= 0.011</td>
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</table>

0.3 73 Total

Subcatchment 2S: Area 2-A

**Type III 24-hr 1-Year Rainfall=2.90"**
Runoff Area=1,628 sf
Runoff Volume=362 cf
Runoff Depth>2.67"
Flow Length=73'
Tc=0.3 min
CN=98.0
Summary for Subcatchment 3S: Area 3-B

Runoff = 0.82 cfs @ 12.11 hrs, Volume= 2,810 cf, Depth> 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.90"

<table>
<thead>
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<td>Paved parking, HSG B</td>
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<tr>
<td>22,094</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B</td>
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<tr>
<td>* 122</td>
<td>96.0</td>
<td>Ledge</td>
</tr>
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<td>36,440</td>
<td>75.6</td>
<td>Weighted Average</td>
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<tr>
<td>22,216</td>
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<tr>
<td>14,224</td>
<td>39.03%</td>
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<table>
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<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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<tr>
<td>6.9</td>
<td>86</td>
<td>0.0830</td>
<td>0.21</td>
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<td>Sheet Flow,</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Grass: Dense n= 0.240 P2= 3.40&quot;</td>
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<tr>
<td>0.5</td>
<td>168</td>
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<td>5.81</td>
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<td>Shallow Concentrated Flow,</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Paved Kv= 20.3 fps</td>
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7.4 254 Total

Subcatchment 3S: Area 3-B

Type III 24-hr
1-Year Rainfall=2.90"
Runoff Area=36,440 sf
Runoff Volume=2,810 cf
Runoff Depth>0.93"
Flow Length=254'
Tc=7.4 min
CN=75.6
Summary for Subcatchment 4S: Area 4-B

Runoff = 0.30 cfs @ 12.01 hrs, Volume= 865 cf, Depth> 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.90"

<table>
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<td>3,902</td>
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<td>3,921</td>
<td>97.8</td>
<td>Weighted Average</td>
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<tr>
<td>19</td>
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<td>0.48% Pervious Area</td>
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<tr>
<td>3,902</td>
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<td>99.52% Impervious Area</td>
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<table>
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<tr>
<th>Tc (min)</th>
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<th>Slope (ft/ft)</th>
<th>Velocity (ft/sec)</th>
<th>Capacity (cfs)</th>
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<td>Sheet Flow, Smooth surfaces</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>n= 0.011 P2= 3.40&quot;</td>
</tr>
<tr>
<td>0.1</td>
<td>62</td>
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<td>11.20</td>
<td>2.20</td>
<td>Pipe Channel, 6.0&quot; Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.011</td>
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0.9 116 Total

Subcatchment 4S: Area 4-B

Hydrograph

Type III 24-hr
1-Year Rainfall=2.90"
Runoff Area=3,921 sf
Runoff Volume=865 cf
Runoff Depth>2.65"
Flow Length=116'
Tc=0.9 min
CN=97.8
Summary for Pond 5P: DW-1

Inflow Area = 1,628 sf, 100.00% Impervious, Inflow Depth > 2.67" for 1-Year event
Inflow = 0.13 cfs @ 12.00 hrs, Volume= 362 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 193.15' @ 24.00 hrs  Surf.Area= 251 sf  Storage= 362 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

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<th>Invert</th>
<th>Avail.Storage</th>
<th>Storage Description</th>
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<td>#1A</td>
<td>191.00'</td>
<td>162 cf</td>
<td>14.75'W x 17.00'L x 2.71'H Field A</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>679 cf Overall - 273 cf Embedded = 406 cf x 40.0% Voids</td>
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<tr>
<td>#2A</td>
<td>191.50'</td>
<td>273 cf</td>
<td>Cultec R-280HD x 6 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size= 46.9&quot;W x 26.0&quot;H =&gt; 6.07 sf x 7.00'L = 42.5 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size= 47.0&quot;W x 26.5&quot;H x 8.00'L with 1.00' Overlap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Row Length Adjustment= +1.00' x 6.07 sf x 3 rows</td>
</tr>
<tr>
<td>#3</td>
<td>193.70'</td>
<td>50 cf</td>
<td>14.75'W x 17.00'L x 0.50'H Prismatoid</td>
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<tr>
<td>#4</td>
<td>194.20'</td>
<td>45 cf</td>
<td>17.00'W x 14.75'L x 1.80'H Prismatoid</td>
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<tr>
<td>#5</td>
<td>196.00'</td>
<td>125 cf</td>
<td>17.00'W x 14.75'L x 0.50'H Prismatoid</td>
</tr>
</tbody>
</table>

Total Available Storage 656 cf

Storage Group A created with Chamber Wizard

Device Routing Invert Outlet Devices
#1 Primary 195.50' 8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=191.00' TW=0.00' (Dynamic Tailwater)
↑1=Orifice/Grate (Controls 0.00 cfs)
Pond 5P: DW-1 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)
Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 6.07 sf x 3 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

2 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 15.00' Row Length +12.0" End Stone x 2 = 17.00' Base Length
3 Rows x 47.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 14.75' Base Width
6.0" Base + 26.5" Chamber Height = 2.71' Field Height

6 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 3 Rows = 273.2 cf Chamber Storage

679.1 cf Field - 273.2 cf Chambers = 405.9 cf Stone x 40.0% Voids = 162.4 cf Stone Storage

Chamber Storage + Stone Storage = 435.6 cf = 0.010 af
Overall Storage Efficiency = 64.1%
Overall System Size = 17.00' x 14.75' x 2.71'

6 Chambers
25.2 cy Field
15.0 cy Stone
Pond 5P: DW-1

Inflow Area = 1,628 sf
Peak Elev = 193.15'
Storage = 362 cf
Summary for Pond 6P: RG-1

Inflow Area = 3,921 sf, 99.52% Impervious, Inflow Depth > 2.65" for 1-Year event
Inflow = 0.30 cfs @ 12.01 hrs, Volume = 865 cf
Outflow = 0.18 cfs @ 12.09 hrs, Volume = 611 cf, Atten= 41%, Lag= 4.3 min
Primary = 0.18 cfs @ 12.09 hrs, Volume = 611 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 192.95' @ 12.09 hrs Surf.Area= 1,198 sf Storage= 322 cf
Plug-Flow detention time= 171.4 min calculated for 611 cf (71% of inflow)
Center-of-Mass det. time= 79.5 min (835.4 - 755.9)

<table>
<thead>
<tr>
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<th>Invert</th>
<th>Avail. Storage</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 190.10'</td>
<td>118 cf</td>
<td><strong>Stone Storage (Prismatic)</strong> Listed below (Recalc) 295 cf Overall x 40.0% Voids</td>
<td></td>
</tr>
<tr>
<td>#2 191.10'</td>
<td>35 cf</td>
<td><strong>Gravel/Pea Stone (Prismatic)</strong> Listed below (Recalc) 89 cf Overall x 40.0% Voids</td>
<td></td>
</tr>
<tr>
<td>#3 191.40'</td>
<td>124 cf</td>
<td><strong>Biofiltration Sand (Prismatic)</strong> Listed below (Recalc) 413 cf Overall x 30.0% Voids</td>
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</tr>
<tr>
<td>#4 192.80'</td>
<td>397 cf</td>
<td><strong>Ponding (Prismatic)</strong> Listed below (Recalc)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>0</td>
</tr>
<tr>
<td>191.10</td>
<td>295</td>
<td>295</td>
<td>295</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------</td>
<td>------------------------</td>
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<td>193.90</td>
<td>427</td>
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<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>192.50'</td>
<td><strong>6.0&quot; Round Culvert</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L= 35.0' CPP, square edge headwall, Ke= 0.500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inlet / Outlet Invert= 192.50' / 188.50' S= 0.1143 /&quot; Cc= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n= 0.011, Flow Area= 0.20 sf</td>
</tr>
<tr>
<td>#2</td>
<td>Device 1</td>
<td>192.50'</td>
<td><strong>3.5&quot; Vert. Orifice-Control</strong> C= 0.600</td>
</tr>
<tr>
<td>#3</td>
<td>Device 1</td>
<td>193.40'</td>
<td><strong>6.0&quot; Horiz. Orifice/Overflow</strong> C= 0.600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limited to weir flow at low heads</td>
</tr>
</tbody>
</table>
Primary Outflow: Max = 0.18 cfs @ 12.09 hrs  HW = 192.95' TW = 187.24' (Dynamic Tailwater)

1 = Culvert  (Passes 0.18 cfs of 0.42 cfs potential flow)
2 = Orifice-Control  (Orifice Controls 0.18 cfs @ 2.65 fps)
3 = Orifice/Overflow  (Controls 0.00 cfs)

Pond 6P: RG-1

Inflow Area = 3,921 sf
Peak Elev = 192.95'
Storage = 322 cf
Summary for Pond 9P: DW-2

Inflow Area = 3,921 sf, 99.52% Impervious, Inflow Depth > 1.87" for 1-Year event
Inflow = 0.18 cfs @ 12.09 hrs, Volume = 611 cf
Outflow = 0.07 cfs @ 12.41 hrs, Volume = 334 cf, Atten= 59%, Lag= 19.6 min
Primary = 0.07 cfs @ 12.41 hrs, Volume = 334 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 188.56' @ 12.41 hrs Surf.Area= 176 sf Storage= 288 cf

Plug-Flow detention time = 202.1 min calculated for 334 cf (55% of inflow)
Center-of-Mass det. time = 95.3 min (930.8 - 835.4)

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert</th>
<th>Avail.Storage</th>
<th>Storage Description</th>
</tr>
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<tbody>
<tr>
<td>#1A 186.00'</td>
<td>153 cf</td>
<td>10.33'W x 17.00'L x 3.21'H Field A</td>
<td>564 cf Overall - 182 cf Embedded = 381 cf x 40.0% Voids</td>
</tr>
<tr>
<td>#2A 186.50'</td>
<td>182 cf</td>
<td>Cultec R-280HD x 4 Inside #1</td>
<td>Effective Size= 46.9&quot;W x 26.0&quot;H =&gt; 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0&quot;W x 26.5&quot;H x 8.00'L with 1.00' Overlap</td>
</tr>
<tr>
<td>#3 189.20'</td>
<td>14 cf</td>
<td>Custom Stage Data (Prismatic) Listed below (Recalc)</td>
<td>140 cf Overall x 10.0% Voids</td>
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</tbody>
</table>

349 cf Total Available Storage

Storage Group A created with Chamber Wizard

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>189.20</td>
<td>175</td>
<td>0</td>
<td>0</td>
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<tr>
<td>190.00</td>
<td>175</td>
<td>140</td>
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Device Routing Invert Outlet Devices

#1 Primary 188.40' 6.0" Round Culvert
L= 25.0' CPP, square edge headwall, Ke= 0.500
Inlet / Outlet Invert = 188.40' / 185.80' S= 0.1040 '/' Cc= 0.900
n= 0.011, Flow Area= 0.20 sf

Primary OutFlow Max=0.07 cfs @ 12.41 hrs HW=188.56' TW=0.00' (Dynamic Tailwater)
↑1=Culvert (Inlet Controls 0.07 cfs @ 1.35 fps)
Pond 9P: DW-2 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)
Effective Size = 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size = 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment = +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

2 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 15.00' Row Length +12.0" End Stone x 2 = 17.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

4 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 182.2 cf Chamber Storage

563.6 cf Field - 182.2 cf Chambers = 381.4 cf Stone x 40.0% Voids = 152.6 cf Stone Storage

Chamber Storage + Stone Storage = 334.7 cf = 0.008 af
Overall Storage Efficiency = 59.4%
Overall System Size = 17.00' x 10.33' x 3.21'

4 Chambers
20.9 cy Field
14.1 cy Stone
Pond 9P: DW-2

Inflow Area = 3,921 sf
Peak Elevation = 188.56'
Storage = 288 cf
6.0"
Round Culvert
n = 0.011
L = 25.0'
S = 0.1040 '/"
**Summary for Link 7L: POC "A"**

Inflow Area = 34,467 sf, 26.98% Impervious, Inflow Depth > 0.72" for 1-Year event  
Inflow = 0.65 cfs @ 12.07 hrs, Volume = 2,061 cf  
Primary = 0.65 cfs @ 12.07 hrs, Volume = 2,061 cf, Atten= 0%, Lag= 0.0 min

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

---

**Link 7L: POC "A"**

![Hydrograph](image_url)

Inflow Area = 34,467 sf
Summary for Link 8L: POC "B"

Inflow Area = 40,361 sf, 44.91% Impervious, Inflow Depth > 0.93" for 1-Year event
Inflow = 0.82 cfs @ 12.11 hrs, Volume= 3,144 cf
Primary = 0.82 cfs @ 12.11 hrs, Volume= 3,144 cf, Atten= 0%, Lag= 0.0 min

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

Link 8L: POC "B"

Hydrograph

Inflow Area=40,361
Subcatchment 1S: Area 1-A  
Runoff Area=32,839 sf  23.36% Impervious  Runoff Depth>0.75"  
Flow Length=56'  Slope=0.1700'"  Tc=3.7 min  CN=72.1  Runoff=0.65 cfs  2,061 cf

Subcatchment 2S: Area 2-A  
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>2.67"  
Flow Length=73'  Tc=0.3 min  CN=98.0  Runoff=0.13 cfs  362 cf

Subcatchment 3S: Area 3-B  
Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>0.93"  
Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=0.82 cfs  2,810 cf

Subcatchment 4S: Area 4-B  
Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>2.65"  
Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.30 cfs  865 cf

Pond 5P: DW-1  
Peak Elev=193.15'  Storage=362 cf  Inflow=0.13 cfs  362 cf  
Outflow=0.00 cfs  0 cf

Pond 6P: RG-1  
Peak Elev=192.95'  Storage=322 cf  Inflow=0.30 cfs  865 cf  
Outflow=0.18 cfs  611 cf

Pond 9P: DW-2  
Peak Elev=188.56'  Storage=288 cf  Inflow=0.18 cfs  611 cf  
6.0" Round Culvert  n=0.011  L=25.0'  S=0.1040'"  Outflow=0.07 cfs  334 cf

Link 7L: POC "A"  
Inflow=0.65 cfs  2,061 cf  
Primary=0.65 cfs  2,061 cf

Link 8L: POC "B"  
Inflow=0.82 cfs  3,144 cf  
Primary=0.82 cfs  3,144 cf

Total Runoff Area = 74,828 sf  Runoff Volume = 6,098 cf  Average Runoff Depth = 0.98"  
63.35% Pervious = 47,404 sf  36.65% Impervious = 27,424 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area 1-A
Runoff Area=32,839 sf  23.36% Impervious  Runoff Depth>1.06''
Flow Length=56'  Slope=0.1700 ''  Tc=3.7 min  CN=72.1  Runoff=0.96 cfs  2,903 cf

Subcatchment 2S: Area 2-A
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>3.17''
Flow Length=73'  Tc=0.3 min  CN=98.0  Runoff=0.15 cfs  430 cf

Subcatchment 3S: Area 3-B
Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>1.27''
Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=1.15 cfs  3,845 cf

Subcatchment 4S: Area 4-B
Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>3.14''
Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.36 cfs  1,027 cf

Pond 5P: DW-1
Peak Elev=193.65'  Storage=430 cf  Inflow=0.15 cfs  430 cf
Outflow=0.00 cfs  0 cf

Pond 6P: RG-1
Peak Elev=193.01'  Storage=343 cf  Inflow=0.36 cfs  1,027 cf
Outflow=0.20 cfs  774 cf

Pond 9P: DW-2
Peak Elev=188.65'  Storage=295 cf  Inflow=0.20 cfs  774 cf
6.0" Round Culvert  n=0.011  L=25.0'  S=0.1040 ''  Outflow=0.16 cfs  496 cf

Link 7L: POC "A"
Inflow=0.96 cfs  2,903 cf
Primary=0.96 cfs  2,903 cf

Link 8L: POC "B"
Inflow=1.15 cfs  4,341 cf
Primary=1.15 cfs  4,341 cf

Total Runoff Area = 74,828 sf  Runoff Volume = 8,204 cf  Average Runoff Depth = 1.32''
63.35% Pervious = 47,404 sf  36.65% Impervious = 27,424 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area 1-A
Runoff Area=32,839 sf  23.36% Impervious  Runoff Depth>1.68"
Flow Length=56'  Slope=0.1700 '/'  Tc=3.7 min  CN=72.1  Runoff=1.58 cfs  4,597 cf

Subcatchment 2S: Area 2-A
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>4.06"
Flow Length=73'  Tc=0.3 min  CN=98.0  Runoff=0.19 cfs  551 cf

Subcatchment 3S: Area 3-B
Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>1.94"
Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=1.80 cfs  5,883 cf

Subcatchment 4S: Area 4-B
Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>4.04"
Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.45 cfs  1,320 cf

Pond 5P: DW-1
Peak Elev=195.50'  Storage=518 cf  Inflow=0.19 cfs  551 cf
Outflow=0.00 cfs  33 cf

Pond 6P: RG-1
Peak Elev=193.14'  Storage=385 cf  Inflow=0.45 cfs  1,320 cf
Outflow=0.23 cfs  1,066 cf

Pond 9P: DW-2
Peak Elev=188.70'  Storage=299 cf  Inflow=0.23 cfs  1,066 cf
6.0" Round Culvert  n=0.011  L=25.0'  S=0.1040 '/'  Outflow=0.23 cfs  789 cf

Link 7L: POC "A"
Inflow=1.58 cfs  4,630 cf
Primary=1.58 cfs  4,630 cf

Link 8L: POC "B"
Inflow=2.02 cfs  6,672 cf
Primary=2.02 cfs  6,672 cf

Total Runoff Area = 74,828 sf  Runoff Volume = 12,352 cf  Average Runoff Depth = 1.98"
63.35% Pervious = 47,404 sf  36.65% Impervious = 27,424 sf
### Subcatchment 1S: Area 1-A
- Runoff Area: 32,839 sf
- 23.36% Impervious
- Runoff Depth: 2.28"
- Flow Length: 56'
- Slope: 0.1700 '/'
- Tc: 3.7 min
- CN: 72.1
- Runoff: 2.18 cfs
- 6,244 cf

### Subcatchment 2S: Area 2-A
- Runoff Area: 1,628 sf
- 100.00% Impervious
- Runoff Depth: 4.86"
- Flow Length: 73'
- Tc: 0.3 min
- CN: 98.0
- Runoff: 0.23 cfs
- 660 cf

### Subcatchment 3S: Area 3-B
- Runoff Area: 36,440 sf
- 39.03% Impervious
- Runoff Depth: 2.58"
- Flow Length: 254'
- Tc: 7.4 min
- CN: 75.6
- Runoff: 2.41 cfs
- 7,832 cf

### Subcatchment 4S: Area 4-B
- Runoff Area: 3,921 sf
- 99.52% Impervious
- Runoff Depth: 4.84"
- Flow Length: 116'
- Tc: 0.9 min
- CN: 97.8
- Runoff: 0.54 cfs
- 1,581 cf

### Pond 5P: DW-1
- Peak Elev: 195.51'
- Storage: 519 cf
- Inflow: 0.23 cfs
- 660 cf
- Outflow: 0.01 cfs
- 141 cf

### Pond 6P: RG-1
- Peak Elev: 193.26'
- Storage: 427 cf
- Inflow: 0.54 cfs
- 1,581 cf
- Outflow: 0.25 cfs
- 1,327 cf

### Pond 9P: DW-2
- Peak Elev: 188.72'
- Storage: 300 cf
- Inflow: 0.25 cfs
- 1,327 cf
- 6.0" Round Culvert
- n=0.011
- L=25.0'
- S=0.1040 '/'
- Outflow: 0.25 cfs
- 1,049 cf

### Link 7L: POC "A"
- Inflow: 2.18 cfs
- 6,385 cf
- Primary: 2.18 cfs
- 6,385 cf

### Link 8L: POC "B"
- Inflow: 2.66 cfs
- 8,881 cf
- Primary: 2.66 cfs
- 8,881 cf

**Total Runoff Area = 74,828 sf**
- **Runoff Volume = 16,317 cf**
- **Average Runoff Depth = 2.62"**
- **63.35% Pervious = 47,404 sf**
- **36.65% Impervious = 27,424 sf**
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area 1-A
- Runoff Area=32,839 sf 23.36% Impervious Runoff Depth>3.33"
- Flow Length=56'  Slope=0.1700 'r'  Tc=3.7 min  CN=72.1  Runoff=3.20 cfs 9,116 cf

Subcatchment 2S: Area 2-A
- Runoff Area=1,628 sf 100.00% Impervious Runoff Depth>6.16"
- Flow Length=73'  Tc=0.3 min  CN=98.0  Runoff=0.28 cfs 836 cf

Subcatchment 3S: Area 3-B
- Runoff Area=36,440 sf 39.03% Impervious Runoff Depth>3.68"
- Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=3.44 cfs 11,179 cf

Subcatchment 4S: Area 4-B
- Runoff Area=3,921 sf 99.52% Impervious Runoff Depth>6.14"
- Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.68 cfs 2,005 cf

Pond 5P: DW-1
- Peak Elev=195.56' Storage=520 cf  Inflow=0.28 cfs 836 cf
  Outflow=0.09 cfs 317 cf

Pond 6P: RG-1
- Peak Elev=193.45' Storage=494 cf  Inflow=0.68 cfs 2,005 cf
  Outflow=0.34 cfs 1,750 cf

Pond 9P: DW-2
- Peak Elev=188.78' Storage=305 cf  Inflow=0.34 cfs 1,750 cf
  6.0" Round Culvert n=0.011 L=25.0' S=0.1040 'l'  Outflow=0.34 cfs 1,472 cf

Link 7L: POC "A"
- Inflow=3.20 cfs 9,433 cf
  Primary=3.20 cfs 9,433 cf

Link 8L: POC "B"
- Inflow=3.78 cfs 12,652 cf
  Primary=3.78 cfs 12,652 cf

Total Runoff Area = 74,828 sf  Runoff Volume = 23,136 cf  Average Runoff Depth = 3.71"
63.35% Pervious = 47,404 sf  36.65% Impervious = 27,424 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area 1-A
Runoff Area=32,839 sf  23.36% Impervious  Runoff Depth>4.35"  
Flow Length=56'  Slope=0.1700 '"  Tc=3.7 min  CN=72.1  Runoff=4.18 cfs  11,914 cf

Subcatchment 2S: Area 2-A
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>7.36"  
Flow Length=73'  Tc=0.3 min  CN=98.0  Runoff=0.34 cfs  999 cf

Subcatchment 3S: Area 3-B
Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>4.74"  
Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=4.42 cfs  14,405 cf

Subcatchment 4S: Area 4-B
Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>7.34"  
Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.80 cfs  2,397 cf

Pond 5P: DW-1
Peak Elev=195.63'  Storage=522 cf  Inflow=0.34 cfs  999 cf  
Outflow=0.31 cfs  480 cf

Pond 6P: RG-1
Peak Elev=193.53'  Storage=525 cf  Inflow=0.80 cfs  2,397 cf  
Outflow=0.55 cfs  2,142 cf

Pond 9P: DW-2
Peak Elev=188.95'  Storage=317 cf  Inflow=0.55 cfs  2,142 cf  
6.0" Round Culvert  n=0.011  L=25.0'  S=0.1040 '"  Outflow=0.52 cfs  1,863 cf

Link 7L: POC "A"
Inflow=4.49 cfs  12,394 cf  
Primary=4.49 cfs  12,394 cf

Link 8L: POC "B"
Inflow=4.94 cfs  16,268 cf  
Primary=4.94 cfs  16,268 cf

Total Runoff Area = 74,828 sf    Runoff Volume = 29,714 cf    Average Runoff Depth = 4.77"  
63.35% Pervious = 47,404 sf    36.65% Impervious = 27,424 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<table>
<thead>
<tr>
<th>Subcatchment 1S: Area 1-A</th>
<th>Runoff Area=32,839 sf 23.36% Impervious Runoff Depth&gt;5.68&quot;</th>
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<tbody>
<tr>
<td></td>
<td>Flow Length=56’ Slope=0.1700 ’/’ Tc=3.7 min CN=72.1 Runoff=5.44 cfs 15,545 cf</td>
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<thead>
<tr>
<th>Subcatchment 2S: Area 2-A</th>
<th>Runoff Area=1,628 sf 100.00% Impervious Runoff Depth&gt;8.86&quot;</th>
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<tbody>
<tr>
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<td>Flow Length=73’ Tc=0.3 min CN=98.0 Runoff=0.40 cfs 1,202 cf</td>
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</tbody>
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<thead>
<tr>
<th>Subcatchment 3S: Area 3-B</th>
<th>Runoff Area=36,440 sf 39.03% Impervious Runoff Depth&gt;6.11&quot;</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Flow Length=254’ Tc=7.4 min CN=75.6 Runoff=5.66 cfs 18,556 cf</td>
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<thead>
<tr>
<th>Subcatchment 4S: Area 4-B</th>
<th>Runoff Area=3,921 sf 99.52% Impervious Runoff Depth&gt;8.83&quot;</th>
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<tbody>
<tr>
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<td>Flow Length=116’ Tc=0.9 min CN=97.8 Runoff=0.96 cfs 2,887 cf</td>
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<table>
<thead>
<tr>
<th>Pond 5P: DW-1</th>
<th>Peak Elev=195.65’ Storage=522 cf Inflow=0.40 cfs 1,202 cf</th>
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</thead>
<tbody>
<tr>
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<td>Outflow=0.40 cfs 683 cf</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Pond 6P: RG-1</th>
<th>Peak Elev=193.61’ Storage=554 cf Inflow=0.96 cfs 2,887 cf</th>
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</thead>
<tbody>
<tr>
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<td>Outflow=0.74 cfs 2,631 cf</td>
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<table>
<thead>
<tr>
<th>Pond 9P: DW-2</th>
<th>Peak Elev=189.21’ Storage=335 cf Inflow=0.74 cfs 2,631 cf</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>6.0” Round Culvert n=0.011 L=25.0’ S=0.1040 ’/’ Outflow=0.71 cfs 2,352 cf</td>
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<table>
<thead>
<tr>
<th>Link 7L: POC &quot;A&quot;</th>
<th>Inflow=5.73 cfs 16,229 cf</th>
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<tbody>
<tr>
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<td>Primary=5.73 cfs 16,229 cf</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Link 8L: POC &quot;B&quot;</th>
<th>Inflow=6.35 cfs 20,909 cf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Primary=6.35 cfs 20,909 cf</td>
</tr>
</tbody>
</table>

Total Runoff Area = 74,828 sf  Runoff Volume = 38,191 cf  Average Runoff Depth = 6.12"
63.35% Pervious = 47,404 sf  36.65% Impervious = 27,424 sf
Appendix “D”

HydroCAD Analysis

Proposed Conditions

(After DW-2 expansion)
## Area Listing (selected nodes)

<table>
<thead>
<tr>
<th>Area (sq-ft)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22,113</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B (3S, 4S)</td>
</tr>
<tr>
<td>122</td>
<td>96.0</td>
<td>Ledge (3S)</td>
</tr>
<tr>
<td>18,126</td>
<td>98.0</td>
<td>Paved parking, HSG B (3S, 4S)</td>
</tr>
<tr>
<td>40,361</td>
<td>77.7</td>
<td>TOTAL AREA</td>
</tr>
</tbody>
</table>
Summary for Subcatchment 3S: Area 3-B

Runoff = 0.82 cfs @ 12.11 hrs, Volume = 2,810 cf, Depth > 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span = 0.00-24.00 hrs, dt = 0.01 hrs
Type III 24-hr 1-Year Rainfall = 2.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>14,224</td>
<td>98.0</td>
<td>Paved parking, HSG B</td>
</tr>
<tr>
<td>22,094</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B</td>
</tr>
<tr>
<td>*</td>
<td>122</td>
<td>Ledge</td>
</tr>
<tr>
<td>36,440</td>
<td>75.6</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>22,216</td>
<td></td>
<td>60.97% Pervious Area</td>
</tr>
<tr>
<td>14,224</td>
<td></td>
<td>39.03% 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>6.9</td>
<td>86</td>
<td>0.0830</td>
<td>0.21</td>
<td></td>
<td>Sheet Flow, Grass: Dense n = 0.240 P2 = 3.40&quot;</td>
</tr>
<tr>
<td>0.5</td>
<td>168</td>
<td>0.0820</td>
<td>5.81</td>
<td></td>
<td>Shallow Concentrated Flow, Paved Kv = 20.3 fps</td>
</tr>
</tbody>
</table>

7.4 254 Total

Subcatchment 3S: Area 3-B

Hydrograph

Type III 24-hr 1-Year Rainfall = 2.90"
Runoff Area = 36,440 sf
Runoff Volume = 2,810 cf
Runoff Depth > 0.93"
Flow Length = 254'
Tc = 7.4 min
CN = 75.6
Summary for Subcatchment 4S: Area 4-B

Runoff = 0.30 cfs @ 12.01 hrs, Volume= 865 cf, Depth> 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1-Year Rainfall=2.90"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,902</td>
<td>98.0</td>
<td>Paved parking, HSG B</td>
</tr>
<tr>
<td>19</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B</td>
</tr>
<tr>
<td>3,921</td>
<td>97.8</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>19</td>
<td>0.48%</td>
<td>Pervious Area</td>
</tr>
<tr>
<td>3,902</td>
<td>99.52%</td>
<td>Impervious Area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tc</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>0.8</td>
<td>54</td>
<td>0.0170</td>
<td>1.17</td>
<td></td>
<td>Sheet Flow, Smooth surfaces n= 0.011 P2= 3.40&quot;</td>
</tr>
<tr>
<td>0.1</td>
<td>62</td>
<td>0.1100</td>
<td>11.20</td>
<td>2.20</td>
<td>Pipe Channel, 6.0&quot; Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.011</td>
</tr>
<tr>
<td>0.9</td>
<td>116</td>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
</tbody>
</table>

Subcatchment 4S: Area 4-B

**Type III 24-hr 1-Year Rainfall=2.90"**
Runoff Area=3,921 sf
Runoff Volume=865 cf
Runoff Depth>2.65"
Flow Length=116'
Tc=0.9 min
CN=97.8
Summary for Pond 6P: RG-1

Inflow Area = 3,921 sf, 99.52% Impervious, Inflow Depth > 2.65" for 1-Year event
Inflow = 0.30 cfs @ 12.01 hrs, Volume= 865 cf
Outflow = 0.18 cfs @ 12.09 hrs, Volume= 611 cf, Atten= 41%, Lag= 4.3 min
Primary = 0.18 cfs @ 12.09 hrs, Volume= 611 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 192.95' @ 12.09 hrs Surf.Area= 1,198 sf Storage= 322 cf

Plug-Flow detention time= 171.4 min calculated for 611 cf (71% of inflow)
Center-of-Mass det. time= 79.5 min (835.4 - 755.9)

<table>
<thead>
<tr>
<th>Volume</th>
<th>Invert (ft)</th>
<th>Avail.Storage (cf)</th>
<th>Storage Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>190.10'</td>
<td>118 cf</td>
<td><strong>Stone Storage (Prismatic)</strong> Listed below (Recalc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>295 cf Overall x 40.0% Voids</td>
</tr>
<tr>
<td>#2</td>
<td>191.10'</td>
<td>35 cf</td>
<td><strong>Gravel/Pea Stone (Prismatic)</strong> Listed below (Recalc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>89 cf Overall x 40.0% Voids</td>
</tr>
<tr>
<td>#3</td>
<td>191.40'</td>
<td>124 cf</td>
<td><strong>Biofiltration Sand (Prismatic)</strong> Listed below (Recalc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>413 cf Overall x 30.0% Voids</td>
</tr>
<tr>
<td>#4</td>
<td>192.80'</td>
<td>397 cf</td>
<td><strong>Ponding (Prismatic)</strong> Listed below (Recalc)</td>
</tr>
</tbody>
</table>

674 cf Total Available Storage

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>190.10</td>
<td>295</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>191.10</td>
<td>295</td>
<td>295</td>
<td>295</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>191.10</td>
<td>295</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>191.40</td>
<td>295</td>
<td>89</td>
<td>89</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>191.40</td>
<td>295</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>192.80</td>
<td>295</td>
<td>413</td>
<td>413</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>192.80</td>
<td>295</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>193.90</td>
<td>427</td>
<td>397</td>
<td>397</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Device</th>
<th>Routing</th>
<th>Invert (ft)</th>
<th>Outlet Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Primary</td>
<td>192.50'</td>
<td><strong>6.0&quot; Round Culvert</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L= 35.0' CPP, square edge headwall, Ke= 0.500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inlet / Outlet Invert= 192.50' / 188.50' S= 0.1143 '/' Cc= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n= 0.011, Flow Area= 0.20 sf</td>
</tr>
<tr>
<td>#2</td>
<td>Device 1</td>
<td>192.50'</td>
<td><strong>3.5&quot; Vert. Orifice-Control</strong> C= 0.600</td>
</tr>
<tr>
<td>#3</td>
<td>Device 1</td>
<td>193.40'</td>
<td><strong>6.0&quot; Horiz. Orifice/Overflow</strong> C= 0.600</td>
</tr>
</tbody>
</table>

Limited to weir flow at low heads
Primary OutFlow \( \text{Max}=0.18 \text{ cfs @ 12.09 hrs} \) \( \text{HW}=192.95' \) \( \text{TW}=186.94' \) (Dynamic Tailwater)

1=Culvert (Passes 0.18 cfs of 0.42 cfs potential flow)

2=Orifice-Control (Orifice Controls 0.18 cfs @ 2.65 fps)

3=Orifice/Overflow (Controls 0.00 cfs)

Pond 6P: RG-1

Inflow Area=3,921 sf
Peak Elev=192.95'
Storage=322 cf
Summary for Pond 9P: DW-2

Inflow Area = 3,921 sf, 99.52% Impervious, Inflow Depth > 1.87" for 1-Year event
Inflow = 0.18 cfs @ 12.09 hrs, Volume= 611 cf
Outflow = 0.01 cfs @ 13.76 hrs, Volume= 214 cf, Atten= 92%, Lag= 100.2 min
Primary = 0.01 cfs @ 13.76 hrs, Volume= 214 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 188.47' @ 13.76 hrs  Surf.Area= 248 sf  Storage= 403 cf

Plug-Flow detention time= 302.5 min calculated for 214 cf (35% of inflow)
Center-of-Mass det. time= 188.6 min ( 1,024.0 - 835.4 )

<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>186.00'</td>
<td>211 cf</td>
<td>10.33'W x 24.00'L x 3.21'H Field A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>796 cf Overall - 267 cf Embedded = 529 cf x 40.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>186.50'</td>
<td>267 cf</td>
<td>Cultec R-280HD x 6 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size= 46.9&quot;W x 26.0&quot;H =&gt; 6.07 sf x 7.00'L = 42.5 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size= 47.0&quot;W x 26.5&quot;H x 8.00'L with 1.00' Overlap</td>
</tr>
<tr>
<td>#3</td>
<td>189.20'</td>
<td>20 cf</td>
<td>Custom Stage Data (Prismatic) Listed below (Recalc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>198 cf Overall x 10.0% Voids</td>
</tr>
</tbody>
</table>

498 cf Total Available Storage

Storage Group A created with Chamber Wizard

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>189.20</td>
<td>248</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>190.00</td>
<td>248</td>
<td>198</td>
<td>198</td>
</tr>
</tbody>
</table>

Device Routing Invert Outlet Devices

<table>
<thead>
<tr>
<th>#1</th>
<th>Primary</th>
<th>188.40'</th>
<th>6.0&quot; Round Culvert</th>
</tr>
</thead>
<tbody>
<tr>
<td>L= 25.0'</td>
<td></td>
<td>CPP, square edge headwall, Ke= 0.500</td>
<td></td>
</tr>
<tr>
<td>Inlet / Outlet Invert= 188.40' / 185.80'</td>
<td>S= 0.1040 '/'</td>
<td>Cc= 0.900</td>
<td></td>
</tr>
<tr>
<td>n= 0.011, Flow Area= 0.20 sf</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Primary OutFlow Max=0.01 cfs @ 13.76 hrs HW=188.47' TW=0.00' (Dynamic Tailwater)

1= Culvert (Inlet Controls 0.01 cfs @ 0.90 fps)
Pond 9P: DW-2 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)
Effective Size = 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size = 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment = +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

3 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 22.00' Row Length +12.0" End Stone x 2 = 24.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

6 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 267.2 cf Chamber Storage

795.7 cf Field - 267.2 cf Chambers = 528.5 cf Stone x 40.0% Voids = 211.4 cf Stone Storage

Chamber Storage + Stone Storage = 478.6 cf = 0.011 af
Overall Storage Efficiency = 60.1%
Overall System Size = 24.00' x 10.33' x 3.21'

6 Chambers
29.5 cy Field
19.6 cy Stone
Pond 9P: DW-2

Hydrograph

Inflow Area = 3,921 sf
Peak Elev = 188.47'
Storage = 403 cf
6.0"
Round Culvert
n = 0.011
L = 25.0'
S = 0.1040 '/'
Summary for Link 8L: POC "B"

Inflow Area = 40,361 sf, 44.91% Impervious, Inflow Depth > 0.90" for 1-Year event
Inflow = 0.82 cfs @ 12.11 hrs, Volume = 3,024 cf
Primary = 0.82 cfs @ 12.11 hrs, Volume = 3,024 cf, Atten= 0%, Lag= 0.0 min

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

Link 8L: POC "B"
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 3S: Area 3-B
Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>0.93" 
Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=0.82 cfs  2,810 cf

Subcatchment 4S: Area 4-B
Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>2.65" 
Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.30 cfs  865 cf

Pond 6P: RG-1
Peak Elev=192.95' Storage=322 cf  Inflow=0.30 cfs  865 cf 
Outflow=0.18 cfs  611 cf

Pond 9P: DW-2
Peak Elev=188.47' Storage=403 cf  Inflow=0.18 cfs  611 cf
6.0" Round Culvert  n=0.011  L=25.0'  S=0.1040 '/'  Outflow=0.01 cfs  214 cf

Link 8L: POC "B"
Inflow=0.82 cfs  3,024 cf
Primary=0.82 cfs  3,024 cf

Total Runoff Area = 40,361 sf  Runoff Volume = 3,675 cf  Average Runoff Depth = 1.09"
55.09% Pervious = 22,235 sf  44.91% Impervious = 18,126 sf
Subcatchment 3S: Area 3-B
Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>1.27"
Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=1.15 cfs  3,845 cf

Subcatchment 4S: Area 4-B
Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>3.14"
Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.36 cfs  1,027 cf

Pond 6P: RG-1
Peak Elev=193.01' Storage=343 cf  Inflow=0.36 cfs  1,027 cf
Outflow=0.20 cfs  774 cf

Pond 9P: DW-2
Peak Elev=188.55' Storage=413 cf  Inflow=0.20 cfs  774 cf
6.0" Round Culvert  n=0.011  L=25.0'  S=0.1040 '/'  Outflow=0.07 cfs  376 cf

Link 8L: POC "B"
Inflow=1.15 cfs  4,221 cf
Primary=1.15 cfs  4,221 cf

Total Runoff Area = 40,361 sf  Runoff Volume = 4,872 cf  Average Runoff Depth = 1.45"
55.09% Pervious = 22,235 sf  44.91% Impervious = 18,126 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 3S: Area 3-B
  Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>1.94"
  Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=1.80 cfs  5,883 cf

Subcatchment 4S: Area 4-B
  Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>4.04"
  Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.45 cfs  1,320 cf

Pond 6P: RG-1
  Peak Elev=193.14'  Storage=385 cf  Inflow=0.45 cfs  1,320 cf
  Outflow=0.23 cfs  1,066 cf

Pond 9P: DW-2
  Peak Elev=188.68'  Storage=426 cf  Inflow=0.23 cfs  1,066 cf
  6.0" Round Culvert  n=0.011  L=25.0'  S=0.1040 '/'  Outflow=0.20 cfs  668 cf

Link 8L: POC "B"
  Inflow=1.80 cfs  6,552 cf
  Primary=1.80 cfs  6,552 cf

Total Runoff Area = 40,361 sf  Runoff Volume = 7,204 cf  Average Runoff Depth = 2.14"
55.09% Pervious = 22,235 sf  44.91% Impervious = 18,126 sf
Time span = 0.00-24.00 hrs, dt = 0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH = SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<table>
<thead>
<tr>
<th>Subcatchment 3S: Area 3-B</th>
<th>Runoff Area = 36,440 sf</th>
<th>39.03% Impervious</th>
<th>Runoff Depth &gt; 2.58&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flow Length = 254'</td>
<td>Tc = 7.4 min</td>
<td>CN = 75.6</td>
</tr>
<tr>
<td></td>
<td>Runoff = 2.41 cfs</td>
<td></td>
<td>7,832 cf</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subcatchment 4S: Area 4-B</th>
<th>Runoff Area = 3,921 sf</th>
<th>99.52% Impervious</th>
<th>Runoff Depth &gt; 4.84&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flow Length = 116'</td>
<td>Tc = 0.9 min</td>
<td>CN = 97.8</td>
</tr>
<tr>
<td></td>
<td>Runoff = 0.54 cfs</td>
<td></td>
<td>1,581 cf</td>
</tr>
</tbody>
</table>

| Pond 6P: RG-1            | Peak Elev = 193.26'    | Storage = 427 cf  |
|                         | Inflow = 0.54 cfs      | 1,581 cf          |
|                         | Outflow = 0.25 cfs     | 1,327 cf          |

| Pond 9P: DW-2            | Peak Elev = 188.71'    | Storage = 430 cf  |
|                         | Inflow = 0.25 cfs      | 1,327 cf          |
|                         | 6.0" Round Culvert n = 0.011 L = 25.0' S = 0.1040 '/' Outflow = 0.25 cfs 929 cf |

| Link 8L: POC "B"        | Inflow = 2.64 cfs       |
|                        | Primary = 2.64 cfs      |
|                        | 8,760 cf                |

Total Runoff Area = 40,361 sf  Runoff Volume = 9,413 cf  Average Runoff Depth = 2.80"
55.09% Pervious = 22,235 sf  44.91% Impervious = 18,126 sf
Subcatchment 3S: Area 3-B
Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>3.68"
Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=3.44 cfs  11,179 cf

Subcatchment 4S: Area 4-B
Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>6.14"
Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.68 cfs  2,005 cf

Pond 6P: RG-1
Peak Elev=193.45'  Storage=494 cf  Inflow=0.68 cfs  2,005 cf
Outflow=0.34 cfs  1,750 cf

Pond 9P: DW-2
Peak Elev=188.78'  Storage=436 cf  Inflow=0.34 cfs  1,750 cf
6.0" Round Culvert  n=0.011  L=25.0'  S=0.1040 '/'  Outflow=0.33 cfs  1,352 cf

Link 8L: POC "B"
Inflow=3.78 cfs  12,531 cf
Primary=3.78 cfs  12,531 cf

Total Runoff Area = 40,361 sf  Runoff Volume = 13,185 cf  Average Runoff Depth = 3.92"
55.09% Pervious = 22,235 sf  44.91% Impervious = 18,126 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 3S: Area 3-B
- Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>4.74"
- Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=4.42 cfs  14,405 cf

Subcatchment 4S: Area 4-B
- Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>7.34"
- Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.80 cfs  2,397 cf

Pond 6P: RG-1
- Peak Elev=193.53'  Storage=525 cf  Inflow=0.80 cfs  2,397 cf
- Outflow=0.55 cfs  2,142 cf

Pond 9P: DW-2
- Peak Elev=188.94'  Storage=452 cf  Inflow=0.55 cfs  2,142 cf
- 6.0" Round Culvert  n=0.011  L=25.0'  S=0.1040 '  Outflow=0.51 cfs  1,743 cf

Link 8L: POC "B"
- Inflow=4.93 cfs  16,147 cf
- Primary=4.93 cfs  16,147 cf

Total Runoff Area = 40,361 sf  Runoff Volume = 16,802 cf  Average Runoff Depth = 5.00"
55.09% Pervious = 22,235 sf  44.91% Impervious = 18,126 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 3S: Area 3-B
Runoff Area=36,440 sf  39.03% Impervious  Runoff Depth>6.11"
Flow Length=254'  Tc=7.4 min  CN=75.6  Runoff=5.66 cfs  18,556 cf

Subcatchment 4S: Area 4-B
Runoff Area=3,921 sf  99.52% Impervious  Runoff Depth>8.83"
Flow Length=116'  Tc=0.9 min  CN=97.8  Runoff=0.96 cfs  2,887 cf

Pond 6P: RG-1
Peak Elev=193.61'  Storage=554 cf  Inflow=0.96 cfs  2,887 cf
Outflow=0.74 cfs  2,631 cf

Pond 9P: DW-2
Peak Elev=189.17'  Storage=475 cf  Inflow=0.74 cfs  2,631 cf
6.0" Round Culvert  n=0.011  L=25.0'  S=0.104 'r"  Outflow=0.68 cfs  2,231 cf

Link 8L: POC "B"
Inflow=6.34 cfs  20,788 cf
Primary=6.34 cfs  20,788 cf

Total Runoff Area = 40,361 sf  Runoff Volume = 21,443 cf  Average Runoff Depth = 6.38"
55.09% Pervious = 22,235 sf  44.91% Impervious = 18,126 sf
DRAINAGE SUMMARY REPORT

For

46 VINEYARD LANE
GREENWICH, CONNECTICUT

Prepared For

CHRISTOPHER & FRANCESCA
SANTOMERO

November 4, 2021

Leonard C. D’Andrea, PE
CT License No. 14869
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2.2 Runoff Reduction Volume  
2.3 Groundwater Recharge Volume  
2.4 Peak Runoff Attenuation  
3.0 Conclusion  

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- Watershed Map - Proposed Conditions  
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- Credits for LID BMPs Checklist  
- Runoff Volume & Retention System Sizing Calculations  
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Appendix B  
Appendix C  
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1. Introduction & LID Techniques

1.1. Project Narrative

The owners of the property located at 46 Vineyard lane in Greenwich, Connecticut, are proposing residential improvements. Under existing conditions, the parcel supports a single-family dwelling, driveway, attached garage, and other various hardscapes, all of which will remain. The proposed development will include the construction of a pool, pool house, patio, retaining walls, and other various hardscape improvements. Additional improvements will include the construction of subsurface stormwater management systems, installation of various underground utilities and associated site grading and landscaping. The proposed development is considered a re-development project under the Greenwich Drainage Manual. The purpose of this report is to outline the stormwater management plan for the development of the site.

For a depiction of existing conditions and the proposed development, refer to a plan set entitled “Construction Site Plan Review Set, Residential Improvements, Location 46 Vineyard Lane, Greenwich, Connecticut, Prepared for Christopher and Francesca Santomero”, as prepared by Rocco V. D’Andrea, Inc.

The parcel is located on the westerly side of Vineyard Lane, approximately 2000 feet south of the intersection of Zaccheus Mead Lane and Vineyard Lane. The parcel is approximately 6.33 acres in size and is located in the “RA-2” residential zone.

Low Impact Development Site Planning and design measures were incorporated into the proposed development to the maximum extent practical.

The proposed pool house is located over a previously installed retention system which will be replaced with a proposed rain garden and detention system. Runoff from a portion of the existing dwelling, the proposed pool house, and the pool patio area will discharge to the proposed bio-filtration system (rain garden) and drywell system. Each system will provide runoff attenuation, thermal cooling, and sedimentation removal prior to discharging downgradient. The proposed development will conform with all applicable stormwater management standards to the maximum extent practical. 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 “RA-2” zone. All applicable zoning setbacks and regulations will be adhered to.

1.3. Site Inventory & Evaluation

Only the rear portion of the site will be considered for this analysis as this is where the proposed improvements are located. The watershed consists of westerly and southerly portions of the
dwelling and the down-gradient lawn area to the south and west. Runoff from a portion of the
dwelling is routed to a sub-surface retention system while the remainder of the house contains
roof drains, which daylight further down slope. The lawn consists of both moderate and steep
slopes with ledge exposed throughout. Runoff predominantly flow west before reaching the
down-gradient wetland system, POC “A”.

According to the NRCS Soil Survey, the on-site soils are primarily classified as Charlton-
Chatfield-Complex with a mapping symbol of 73C (Hydrologic Soil Group Rating “HSGR” of
B) and Charlton-Chatfield Complex with a mapping symbol of 73E (HSGR of B). Refer to
Exhibit “C” for the results of the Initial Feasibility Evaluation from the NRCS Web Soil Survey.
A soil textural analysis was completed in the areas of the proposed development using deep test
pits. The results of these test pits confirmed these SCS classifications throughout the site. Refer
to Appendix “E” for results of completed soil testing.

1.4. Development Envelope

Construction fencing and silt fencing will be installed prior to construction activities to limit the
amount of disturbance during construction. Fencing will be positioned to allow for the
construction of the proposed development while protecting the neighboring properties and down
gradient wetlands.

1.5. LID Control Strategies

One drainage basin was delineated under existing conditions, which includes a total of 9,405
square feet of impervious area. Refer to Exhibit “A” for a watershed map depicting the existing
conditions drainage areas and flow paths. Refer to Appendix “F” for existing conditions ground
cover in each basin and for the results of the Hydrologic Analysis of the existing site including
the computed curve number and time of concentration.

Under proposed conditions, the total amount of impervious coverage will be approximately
1,2817 square feet, for a total on-site increase of approximately 3,412 square feet from existing
conditions. After construction of the proposed pool, pool house, other various hardscapes and
storm water management facilities, all disturbed areas will be planted or maintained as
manicured lawn.

Two drainage basins were delineated under proposed conditions. Refer to Exhibit “B” for a
watershed map depicting the proposed conditions drainage areas and flow paths. Refer to
Appendix “G” for proposed conditions ground cover in each basin and for the results of the
Hydrologic Analysis of the proposed site including the computed curve numbers and times of
concentration.
2. Structural BMPs

2.1. Water Quality Volume and TSS Removal

Refer to Appendix “C” for Water Quality Volume calculations and TSS Removal Efficiency Calculations. The proposed retention systems will provide sufficient retention of the water quality volume from the contributing areas. These systems in conjunction with pretreatment deep sump storm water structures with bell traps will also provide sufficient TSS Removal.

2.2. Runoff Reduction Volume

The proposed development will result in a decrease in runoff volume to POC “A” for the 1-year storm event. Refer to Appendix “C” for Runoff Reduction Volume Calculations.

2.3. Groundwater Recharge Volume

The project does meet the groundwater recharge standards. Refer to Appendix “C” for Groundwater Reduction Volume Calculations.

2.4. Peak Runoff Attenuation

The proposed development will increase the overall amount of on-site impervious coverage by approximately 3,412 square feet as compared to existing conditions. The proposed stormwater management system will maintain or reduce peak flow rates from the proposed development for the 2, 5, 10, and 25-year storm events.

3. Conclusion

The proposed development will increase the impervious coverage of the site and therefore increase the peak rate and volume of runoff generated during a storm event. As a result, a LID BMP, consisting of a rain garden and one subsurface detention system are proposed to provide pre-treatment and attenuation of site-generated runoff prior to discharging off-site. Implementation of this Drainage Management Plan will decrease the volume for the 1-year storm event and will reduce or maintain the peak rate of runoff discharging off-site at P.O.C. “A” for the 2 through 25-year storm events. The proposed development, if constructed as depicted on the development plan, will not have any adverse impacts to the site, neighboring properties, or the down-gradient wetland system.
<table>
<thead>
<tr>
<th>Storm Frequency Event</th>
<th>Flow/Volume</th>
<th>Existing</th>
<th>Proposed</th>
<th>Δ</th>
<th>Δ (%)</th>
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</thead>
<tbody>
<tr>
<td>1 Year</td>
<td>q (ft³/s)</td>
<td>0.90</td>
<td>0.89</td>
<td>-0.01</td>
<td>-1.1%</td>
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<tr>
<td></td>
<td>v (ft³)</td>
<td>3.442</td>
<td>3.397</td>
<td>-45.00</td>
<td>-1.3%</td>
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<tr>
<td>2 Year</td>
<td>q (ft³/s)</td>
<td>1.43</td>
<td>1.39</td>
<td>-0.04</td>
<td>-2.8%</td>
</tr>
<tr>
<td></td>
<td>v (ac ft)</td>
<td>5,014</td>
<td>5,125</td>
<td>111</td>
<td>2.2%</td>
</tr>
<tr>
<td>5 Year</td>
<td>q (ft³/s)</td>
<td>2.52</td>
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<td>-3.6%</td>
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<td>8,623</td>
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<td>12,044</td>
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<td>25 Year</td>
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<td>50 Year</td>
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<td>23,915</td>
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</tr>
<tr>
<td>100 Year</td>
<td>q (ft³/s)</td>
<td>9.98</td>
<td>10.25</td>
<td>0.27</td>
<td>2.7%</td>
</tr>
<tr>
<td></td>
<td>v (ac ft)</td>
<td>30,806</td>
<td>31,570</td>
<td>764</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

Table 1: Comparison of Existing and Proposed Peak Flow Rates and Volumes for POC "A".
Exhibits “A” & “B”

Watershed Maps
Existing & Proposed Conditions
Exhibit "C"

USDA Soil Delineation Map
The map and annotations may be evident.

Other soil types are also present, including:

- Clay
- Silt
- Loam

The soil data is based on the following:

- Soil Survey
- U.S. Geological Survey

The map is intended for use with the following:

- Agricultural applications
- Environmental assessments
- Urban planning

Please refer to the scale on each map sheet for map information.

**MAP INFORMATION**

**MAP LEGEND**
<table>
<thead>
<tr>
<th>%</th>
<th>Total for Area of Interest</th>
<th>Map unit name</th>
<th>Map unit symbol</th>
<th>Soil Unit Name</th>
<th>Soil Unit Symbol</th>
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<td></td>
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</tr>
<tr>
<td>4.2%</td>
<td>66.2%</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>0.1%</td>
<td>2.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hydrologic Soil Type Group—Summarized by Map Unit—State of Connecticut (CT690)
The brown rule: Higher

Component percent culture: None Specified

Aggregation Method: Dominant Condition

Rating Options

Natural condition soils in group D are assigned to dual classes. For drained areas and the second is for undrained areas. Only the soils listed herein

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is

These soils have a very slow rate of water transmission. These soils have a very slow rate of water at or near the surface, and soils that are shallow over nearly impervious material

fluently, soils that have a high water table, soils that have a clay layer

These consist chiefly of clays that have a high shrink/swell

Group D soils having a very slow infiltration rate (high runoff potential)

Group C soils having a slow rate of water transmission

Chiefly of soils having a layer that impedes the downward movement of water or

Chiefly of soils having a layer that impedes the downward movement of water or

These soils consist of clayey or occasionally coarse texture. These soils consist of clayey or occasionally coarse texture. These soils consist of clayey or occasionally coarse texture. These consist

These soils have a very high rate of water transmission.

Group A soils having a high infiltration rate (low runoff potential) when thoroughly

Group B soils having a moderate infiltration rate when thoroughly

Group C soils having a slow rate of water transmission.

Group D soils having a very slow rate of water transmission.

The soils in the United States are assigned to four groups: A, B, C, and D. The groups are defined as follows:

Group A soils are not protected by vegetation, are thoroughly wet, and receive precipitation

Hydrologic soil groups are based on estimates of runoff potential. Soils are

Description

Hydrologic Soil Group—State of Connecticut

46 Vineyard Ln, Greenwich CT
Appendix “A”

Stormwater Management Standards Narrative
Name: Christopher & Francesca Santomero  
Address: 46 Vineyard Lane, Greenwich, Connecticut  
Project: Proposed Pool & Pool House  
Date: November 4, 2021

**Standard 1: Low Impact Development**

Low Impact Development site planning and design techniques are used to the maximum extent practical in the development of the subject parcel.

The proposed development will utilize one LID BMP and one subsurface detention system and will provide runoff treatment, infiltration and attenuation. These systems will aid in controlling flow rates prior to reaching each point of concern.

The rain garden and drywell system are sized to retain volumes that exceed the water quality volume and runoff reduction volume, and will recharge the majority of runoff entering the system. Each system will promote infiltration, temper runoff, and remove sediment prior to discharging offsite. Outlet controls will be used within the detention system to aid in stormwater attenuation.

From the total proposed 3,480 square feet of impervious surfaces plus the 1,628 square feet of impervious roof currently routed to the retention system to be removed, a total of 5,108 square feet, or 100.0 %, of these impervious surfaces will be treated by LID BMPs. The remainder of the impervious area will continue to discharge to the lawn surface or to any discharge point that currently exists.

**Standard 2: Protection of Natural Hydrology**

A. **Site Disturbance**
Site disturbance is minimized to the maximum extent practical. Sedimentation and erosion control measures will be installed during construction to minimize the impact to the surrounding areas.

B. **Soil Compaction**
Only portions of the site required to construct the proposed improvements will be accessed. Silt fence is proposed at the limit of construction in order to reduce the amount of on-site soil compaction.

C. **Time of Concentration**
Post-development time of concentration values will match those of pre-development values.

D. **Grading Plan**
The proposed grading plan is similar in nature to the existing grades on the site. While the grades have been altered the water still has a similar flow path. Refer to the Development Plan for a depiction of the proposed grading.

E. **Compost Amended Soils**
Compost amended soils are not proposed.
F. **Ground Disturbance**
No disturbed ground is to be left as exposed bare soil at project completion. All disturbed areas, excluding the proposed driveway, dwelling, and hardscapes, are proposed to be covered with topsoil and planted with grass or landscaped with vegetation.

G. **Surface Water Systems**
Sub-standard is not applicable to this project.

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

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

**Standard 3: Stormwater Best Management Practices**
One non-structural LID BMP and one standard retention system are proposed to provide runoff treatment and attenuation before discharging off-site.

A. **Hydrologic and Geologic Conditions**
BMPs were incorporated into the site design to take advantage of the natural geological soil conditions to promote groundwater recharge.

B. **Design Calculations**
Design calculations for runoff reduction, groundwater recharge, and pollutant reduction are provided in the attached appendices.

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

D. **Pumping of Stormwater**
Sub-standard is not applicable to this project.

E. **Pumping of Uncontaminated Groundwater**
No pumping is proposed or required for this project.

**Standard 4: Runoff Volume Reduction and Groundwater Recharge**

A. **Runoff Volume Reduction**
The post-development runoff volumes will be controlled to maintain the pre-development runoff volumes for the 1-year, 24-hour storm to the most practical extent. The majority of the increase in runoff volume will be infiltrated in the proposed rain garden and detention system. Refer to Appendix "C" for calculations.
B. **Groundwater Recharge**
The proposed drainage design for the site is compliant with the groundwater recharge standard. Refer to Appendix “C” for calculations.

C. **Runoff Capture**
As the Runoff Volume Reduction standard is met, the proposed drainage design for the site is also compliant with the runoff capture standard.

**Standard 5: Peak Flow Control**

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

B. **Conveyance Protection**
All proposed drainage pipes are 6”pvc with slopes greater than 1.0%, which allows the conveyance of the peak flow rates associated with the 25-year storm event.

C. **Peak Runoff Attenuation**
The subject property discharges flows to the rear wetland system to the southwest and the Vineyard Lane roadway drainage system to the northeast. Refer to Tables 1 & 2 for a summary and comparison of peak flow rates and runoff volumes as well as Appendices “F” and “G” for the result of the Hydrologic Analyses for existing and proposed conditions, respectively.

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

**Standard 6: Pollutant Reduction**

A. **TSS Removal**
The proposed drainage system will provide removal of over 80% of the average post-construction load of Total Suspended Solids (TSS) from the contributing impervious areas. Refer to Appendix “D” for TSS Removal Calculations.

B. **Runoff Reduction Standard Compliance**
As the proposed drainage design is compliant with the runoff reduction standard, the design is also compliant with the pollutant reduction standard.

C. **Groundwater Recharge Standard Compliance**
As the proposed drainage design is compliant with the groundwater recharge standard, the design is also compliant with the pollutant reduction standard.

**Standard 7: High Load Areas**

This site is not classified as a High Load Area. Therefore standard 7 is not applicable to this project.

**Standard 8: Critical Area**
The site is not located within any critical areas.

A. **Source Control, Pollution Prevention Measures, Structural Stormwater BMPs**
The proposed BMP has been designed to meet the pollutant reduction standard and runoff reduction standard.

B. **Higher Potential Pollutant Loads**
This site is not classified as a High Load Area. Therefore this standard is not applicable to this project.

**Standard 9: Redevelopment**

A. **Redevelopment Definition**
This proposal includes the construction of a pool and pool house along with other various hardscapes and related site grading. Since the site activities involve the disturbance of previously re-graded lawn, this project is considered a redevelopment project.

B. **Meet the Standards**
As previously outlined in this report, the proposed project meets the standards to the maximum extent possible, including the evaluation of LID site planning and the inclusion of a stormwater BMP.

C. **Undeveloped Portions of the Property**
Construction activities will be limited to the areas containing proposed improvements and the required construction access surrounding them.

D. **Stormwater Controls**
The proposed stormwater BMP has been designed to reduce pollutant loads, provide filtration of stormwater runoff, reduce runoff volumes, and increase groundwater recharge.

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.

**Standard 10: Construction Erosion and Sediment Control**

A. **Sedimentation and Erosion Control Plan**
Refer to the Sedimentation & Erosion Control Plan for a depiction of the proposed sedimentation and erosion control measures.

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 to appropriately remove these measures at the completion of construction.
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 the approving authority grants final approval.

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

Standard 12: Operation and Maintenance

A. Long Term Maintenance Plan
Refer to the Long Term 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 Long Term Maintenance Plan will identify all applicable items in Section 5 and Section 7 of the Town of Greenwich Drainage Manual.

C. LTM Plan Implementation
The Long Term Maintenance Plan Report will identify the parties legally responsible for implementing the LTM Plan.
D. **LTM 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 LTM 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 LTM Plan**
The appropriate parties will be informed that failure to implement the LTM Plan can result in the municipality assuming responsibility for their implementation and securing reimbursement for associated expenses.

**Standard 13: Stormwater Management Report**
The drainage design depicted on the Development Plan for the site is congruent with the stormwater management plan outlined in this report.

**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 Checklist
<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        | - 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/flaged/flagged 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. |          |              |
| Minimizing Site Disturbance       | 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. |          |              |
| Protecting Sensitive Natural Areas| 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.       |          |              |
| Protecting Riparian Buffers       | 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 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 protected. | 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. |          |              |
## 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>
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</thead>
<tbody>
<tr>
<td><strong>Avoiding Disturbance of Steep Slopes</strong> <em>(Section 4.4.5)</em></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>
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<tr>
<td><strong>Siting on Permeable and Erodible Soils</strong> <em>(Section 4.4.6)</em></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>
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<tr>
<td><strong>Protecting Natural Flow Pathways</strong> <em>(Section 4.4.7)</em></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>
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<tr>
<td><strong>Reducing Impervious Surfaces</strong> <em>(Section 4.4.8)</em></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>
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<tr>
<td><strong>Stormwater Disconnection</strong> <em>(Section 4.4.9)</em></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. All design criteria from section 4.4.9 must be met in order to obtain the credits shown.</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</td>
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<td>disconnected area if the receiving pervious area is HSG C or D soils. For disconnection to LID BMPs, subtract 100% of the disconnected area from the total area in the Water Quality Volume calculation.</td>
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</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:  
    o 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 decompact 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.)  
    o 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. |          |              |
| 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.                                                                                                                      |          |              |
| (Rain Barrels)           |                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                   |          |              |
# Credits for Low Impact Development (LID) Best Management Practices (BMPs)

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<tr>
<th>LID Technique</th>
<th>Compliance Requirements</th>
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<tr>
<td>Rainwater Harvesting</td>
<td>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.</td>
<td>Subtract 100% of the contributing drainage area from the total area in the Water Quality Volume calculation.</td>
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<td>(Cisterns)</td>
<td>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.</td>
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<td>A minimum factor of safety equal to 1.2 must be applied to the calculated cistern volume required.</td>
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<td>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 average annual 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.</td>
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<td>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.</td>
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<td>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.</td>
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<td>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.</td>
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### Credits for Low Impact Development (LID) Best Management Practices (BMPs)

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

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<tr>
<th>LID Technique</th>
<th>Can Credit be Used? Groundwater Recharge Volume (GRV)</th>
<th>Can Credit be Used? Run-off Reduction Volume (RRV)</th>
<th>Can Credit be Used? Water Quality Volume (WQV)</th>
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<td>Minimizing Soil Compaction (Section 4.4.1)</td>
<td>NO</td>
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<td>Minimizing Site Disturbance (Section 4.4.2)</td>
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<td>Protecting Sensitive Natural Areas (Section 4.4.3)</td>
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<td>NO</td>
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<td>Protecting Riparian Buffers (Section 4.4.4)</td>
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<td>YES</td>
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<td>Avoiding Disturbance of Steep Slopes (Section 4.4.5)</td>
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<td>Siting on Permeable and Erodible Soils (Section 4.4.6)</td>
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<td>Protecting Natural Flow Pathways (Section 4.4.7)</td>
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<td>Reducing Impervious Surfaces (Section 4.4.8)</td>
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<td>Stormwater Disconnection (Section 4.4.9)</td>
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<td>Compost-Amended Soils</td>
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<tr>
<td>Rainwater Harvesting (Rain Barrels)</td>
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<tr>
<td>Rainwater Harvesting (Cisterns)</td>
<td>NO</td>
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<td>YES</td>
</tr>
</tbody>
</table>
Appendix “C”

Runoff Volume & Retention System Design Calculations
**Water Quality Volume (Area A-2 > Rain Garden)**

Watershed Data (Area A-2)

- Watershed Area = 5,517 ft²
- Impervious Cover = 5,108 ft²
- Lawn Cover = 409 ft²

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

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 = 0.20 (HSG B)
- %I = Percent of site as impervious cover = 0.926 (decimal)
- %T = Percent of site in lawn = 0.074 (decimal)
- A = Watershed area = 5,517 ft²

\[ R = 0.95(0.926) + 0.20(0.074) = 0.89 \]

\[ WQV = \frac{1}{12} \left( 0.89 \right) \left( 5,517 \right) = 409.2 \text{ ft}^3 \]

**Groundwater Recharge Volume**

Site Information

- Existing Impervious Cover = 9,405 ft²
- Proposed Impervious Cover = 12,817 ft²
- Net Increase = 3,412 ft²

\[ GRV = F \times I \]

Where:

- GRV = Required groundwater recharge volume
- F = Target depth factor = 0.35 in (HSG B)
- I = Net increase in impervious area = 3,412 ft²

\[ GRV = \frac{0.35}{12} \left( 3,412 \right) = 99.5 \text{ ft}^3 \]

GRV = 99.5 ft³
Runoff Reduction Volume at POC-A

1-Year Storm Runoff Data at POC-A
Pre-development runoff volume = 3,442 ft³
Post-development runoff volume (No BMPs) = 4,432 ft³

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

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

\[ RRV = 4,432 - 3,442 = 990 \text{ ft}^3 \]

Runoff Reduction Volume (RRV) @ POC A = 990 ft³

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 a rain garden and detention system, which will discharge to the wetland system in the rear yard.

Rain Garden (RG-Pool) & Detention System (DW-Pool) to POC “A”

The proposed Rain Garden & Retention system was designed to retain runoff from Area A-2 to maintain or reduce peak flow rates for the 2, 5, 10, & 25-year storm events. Refer to the end of this section for a structure rating table for the RG-Pool and DW-Pool.

Total Storage Vol. –RG-Pool (Bottom to Grate) = 542 ft³
Total Storage Vol. –DW-Pool (Bottom to Outlet) = 483 ft³
Total Storage Volume (RG + DW) = 1,025 ft³
Runoff Reduction Volume (RRV) @ POC A = 990 ft³
Water Quality Volume (Area 3-A) = 409 ft³
BMP Drawdown Calculations

According to the NRCS Web Soil Survey and the information provided in Exhibit "C", the proposed drainage system lies within a mapped area of HSG-B soils. Therefore the following draw down calculations use a Rowl’s Rate of 1.02 in/hr.

**Drywell System (RG-Pool):**

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

Where:
- \(DV\) = Design Volume
- \(k\) = Infiltration Rate
- \(A\) = Bottom Area

\[
t_{\text{drawdown}} = \frac{542}{(1.02)(1/12)(394)} = 16.2 \text{hr}
\]

Rain Garden will drawdown in 16.2 hrs.

**Drywell System (DW-Pool):**

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

Where:
- \(DV\) = Design Volume
- \(k\) = Infiltration Rate
- \(A\) = Bottom Area

\[
t_{\text{drawdown}} = \frac{483}{(1.02)(1/12)(354)} = 16.1 \text{hr}
\]

Rain Garden will drawdown in 16.1 hrs.
### Stage-Area-Storage for Pond 3P: RG-Pool

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<tr>
<th>Elevation (feet)</th>
<th>Storage (cubic-feet)</th>
<th>Elevation (feet)</th>
<th>Storage (cubic-feet)</th>
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<tr>
<td>189.85</td>
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</table>
## Stage-Area-Storage for Pond 4P: DW-Pool

<table>
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<tr>
<th>Elevation (feet)</th>
<th>Storage (cubic-feet)</th>
<th>Elevation (feet)</th>
<th>Storage (cubic-feet)</th>
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</tr>
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<td>182.05</td>
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Appendix “D”

TSS Removal Efficiency Calculations
### TSS Removal Calculation Worksheet

<table>
<thead>
<tr>
<th>Location: 46 Vineyard Lane</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMP¹</td>
<td>TSS Removal Rate¹</td>
<td>Starting TSS Load*</td>
<td>Amount Removed (B*C)</td>
<td>Remaining Load (C-D)</td>
</tr>
<tr>
<td>Rain Garden (RG-Pool)</td>
<td>90%</td>
<td>1.00</td>
<td>0.90</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>0.10</td>
<td>0.00</td>
<td>0.00</td>
<td>0.10</td>
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<td>0.10</td>
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</tr>
<tr>
<td></td>
<td>0.10</td>
<td>0.00</td>
<td>0.00</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>0.10</td>
<td>0.00</td>
<td>0.00</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>0.10</td>
<td>0.00</td>
<td>0.00</td>
<td>0.10</td>
</tr>
</tbody>
</table>

**Total TSS Removal =**

*Separate Form Needs to be Completed for Each Outlet or BMP Train*

---

*Equals remaining load from previous BMP (E) which enters the BMP*
INSTRUCTIONS:
2. Complete only highlighted cells

<table>
<thead>
<tr>
<th>Location: 46 Vineyard Lane</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TSS Removal Calculation Worksheet</strong></td>
</tr>
<tr>
<td><strong>A</strong></td>
</tr>
<tr>
<td>BMP$^1$</td>
</tr>
<tr>
<td>Drywell System (DW-Pool)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Total TSS Removal</strong> =</td>
</tr>
</tbody>
</table>

*Equals remaining load from previous BMP (E) which enters the BMP

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 
Prepared By: Rocco V. D'Andrea, Inc.
Date: 4-Nov-21
Appendix “E”

Soil Test Results Forms
# SOIL EVALUATION TEST RESULTS

**Project Name:** Residential Improvements  
**Project Address:** 46 Vineyard Lane, Greenwich, CT

**Engineering Firm's Name:** Rocco V. D'Andrea, Inc.  
**Engineer's Name:** Bryan A. French

## Saturated Hydraulic Conductivity Test Location #:

<table>
<thead>
<tr>
<th>Test Pit #402 (Hand dug)</th>
<th>Ground Elevation</th>
<th>181.5</th>
<th>Depth Range in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation</td>
<td>Soil Texture (Percent Sand, Silt and Clay)</td>
<td>Depth Range in Inches</td>
<td></td>
</tr>
<tr>
<td>181.5</td>
<td>Topsoil</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>180.8</td>
<td>Orange Brown Sandy Loam</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>180.3</td>
<td>Lt. Brown Sand &amp; Gravel</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>177.7</td>
<td></td>
<td>46</td>
<td></td>
</tr>
</tbody>
</table>

**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 infiltrimeter - 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:** Bryan A. French  
**Signature of Test Conductor:** [Signature]  
**Date:** [Date]

---

Form SC-101  
February 2012
**SOIL EVALUATION TEST RESULTS**

**Residential Improvements**

Project Name: 

Project Address: 46 Vineyard Lane, Greenwich, CT

**Engineering Firm's Name:** Rocco V. D'Andrea, Inc.

**Engineer's Name:** Bryan A. French

<table>
<thead>
<tr>
<th>Test Pit #403 (hand dug)</th>
<th>Ground Elevation</th>
<th>188.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation</td>
<td>Soil Texture</td>
<td>Depth Range in Inches</td>
</tr>
<tr>
<td>188.0</td>
<td>Topsoil</td>
<td>0</td>
</tr>
<tr>
<td>187.0</td>
<td>Orange Brown Sandy Loam</td>
<td>12</td>
</tr>
<tr>
<td>184.7</td>
<td>L. Brown Sand &amp; Gravel (w/some fines)</td>
<td>40</td>
</tr>
<tr>
<td>183.7</td>
<td></td>
<td>52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Mottling (Seasonally High Groundwater)</th>
<th>Depth in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Groundwater (Weeping)</td>
<td>N/A</td>
</tr>
<tr>
<td>183.7</td>
<td>Ledge</td>
<td>52</td>
</tr>
</tbody>
</table>

**Saturated Hydraulic Conductivity Test Location #:**

| Ground Elevation: |
| 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 |
| Amoozement 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.

Bryan A. French
Name of Test Conductor

Signature of Test Conductor

Date

February 2012
Appendix "F"

HydroCAD Analysis -
Existing Conditions
### Area Listing (all nodes)

<table>
<thead>
<tr>
<th>Area (sq-ft)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>54,374</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B (1S)</td>
</tr>
<tr>
<td>6,798</td>
<td>96.0</td>
<td>Ledge (1S)</td>
</tr>
<tr>
<td>9,405</td>
<td>98.0</td>
<td>Roofs, HSG B (1S, 2S)</td>
</tr>
<tr>
<td>70,577</td>
<td>69.3</td>
<td>TOTAL AREA</td>
</tr>
</tbody>
</table>
Summary for Subcatchment 1S: Area A-1

Runoff = 5.46 cfs @ 12.09 hrs, Volume= 17,154 cf, Depth> 2.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>7,777</td>
<td>98.0</td>
<td>Roofs, HSG B</td>
</tr>
<tr>
<td>54,374</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B</td>
</tr>
<tr>
<td>6,798</td>
<td>96.0</td>
<td>Ledge</td>
</tr>
<tr>
<td>68,949</td>
<td>68.6</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>61,172</td>
<td></td>
<td>88.72% Pervious Area</td>
</tr>
<tr>
<td>7,777</td>
<td></td>
<td>11.28% 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>5.9</td>
<td>100</td>
<td>0.1680</td>
<td>0.28</td>
<td></td>
<td>Sheet Flow,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grass: Dense n= 0.240 P2= 3.40&quot;</td>
</tr>
<tr>
<td>0.4</td>
<td>127</td>
<td>0.1200</td>
<td>5.58</td>
<td></td>
<td>Shallow Concentrated Flow,</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Unpaved Kv= 16.1 fps</td>
</tr>
</tbody>
</table>

6.3 227 Total

Subcatchment 1S: Area A-1

Hydrograph

Type III 24-hr
25-Year Rainfall=6.40"
Runoff Area=68,949 sf
Runoff Volume=17,154 cf
Runoff Depth>2.99"
Flow Length=227'
Tc=6.3 min
CN=68.6
Summary for Subcatchment 2S: Area A-2

Runoff = 0.24 cfs @ 12.07 hrs, Volume= 835 cf, Depth> 6.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,628</td>
<td>98.0</td>
<td>Roofs, HSG B</td>
</tr>
<tr>
<td>1,628</td>
<td>100.00% Impervious Area</td>
<td></td>
</tr>
</tbody>
</table>

Tc | Length | Slope | Velocity | Capacity | Description |
---|--------|-------|----------|----------|-------------|
5.0 |        |       |          |          | Direct Entry, |

Subcatchment 2S: Area A-2

Hydrograph

Type III 24-hr 25-Year Rainfall=6.40"
Runoff Area=1,628 sf
Runoff Volume=835 cf
Runoff Depth>6.16"
Tc=5.0 min
CN=98.0
Summary for Pond 3P: DW-1

Inflow Area = 1,628 sf, 100.00% Impervious, Inflow Depth > 6.16" for 25-Year event
Inflow = 0.24 cfs @ 12.07 hrs, Volume = 835 cf
Outflow = 0.10 cfs @ 12.31 hrs, Volume = 317 cf, Atten= 57%, Lag= 14.6 min
Primary = 0.10 cfs @ 12.31 hrs, Volume = 317 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 195.56' @ 12.31 hrs Surf.Area= 752 sf Storage= 520 cf
Plug-Flow detention time= 344.1 min calculated for 317 cf (38% of inflow)
Center-of-Mass det. time= 177.5 min ( 920.4 - 742.8 )

<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>191.00'</td>
<td>162 cf</td>
<td>14.75'W x 17.00'L x 2.71'H Field A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>679 cf Overall - 273 cf Embedded = 406 cf x 40.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>191.50'</td>
<td>273 cf</td>
<td>Cultec R-280HD x 6 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size= 46.9&quot;W x 26.0&quot;H =&gt; 6.07 sf x 7.00' = 42.5 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size= 47.0&quot;W x 26.5&quot;H x 8.00'L with 1.00' Overlay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Row Length Adjustment= +1.00' x 6.07 sf x 3 rows</td>
</tr>
<tr>
<td>#3</td>
<td>193.70'</td>
<td>50 cf</td>
<td>14.75'W x 17.00'L x 0.50'H Prismatoid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>125 cf Overall x 40.0% Voids</td>
</tr>
<tr>
<td>#4</td>
<td>194.20'</td>
<td>45 cf</td>
<td>17.00'W x 14.75'L x 1.80'H Prismatoid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>451 cf Overall x 10.0% Voids</td>
</tr>
<tr>
<td>#5</td>
<td>196.00'</td>
<td>125 cf</td>
<td>17.00'W x 14.75'L x 0.50'H Prismatoid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>656 cf Total Available Storage</td>
</tr>
</tbody>
</table>

Storage Group A created with Chamber Wizard

Device Routing Invert Outlet Devices
#1 Primary 195.50' 8.0' Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max= 0.09 cfs @ 12.31 hrs HW=195.56' TW=0.00' (Dynamic Tailwater)
1=Orifice/Grate (Weir Controls 0.09 cfs @ 0.78 fps)
Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)
Effective Size = 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size = 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment = +1.00' x 6.07 sf x 3 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

2 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 15.00' Row Length +12.0" End Stone x 2 = 17.00' Base Length
3 Rows x 47.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 14.75' Base Width
6.0" Base + 26.5" Chamber Height = 2.71' Field Height

6 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 3 Rows = 273.2 cf Chamber Storage

679.1 cf Field - 273.2 cf Chambers = 405.9 cf Stone x 40.0% Voids = 162.4 cf Stone Storage

Chamber Storage + Stone Storage = 435.6 cf = 0.010 af
Overall Storage Efficiency = 64.1%
Overall System Size = 17.00' x 14.75' x 2.71'

6 Chambers
25.2 cy Field
15.0 cy Stone
Pond 3P: DW-1

Inflow Area = 1,628 sf
Peak Elev = 195.56'
Storage = 520 cf
Summary for Link 4L: POC "A"

Inflow Area = 70,577 sf, 13.33% Impervious, Inflow Depth > 2.97" for 25-Year event
Inflow = 5.46 cfs @ 12.09 hrs, Volume= 17,471 cf
Primary = 5.46 cfs @ 12.09 hrs, Volume= 17,471 cf, Atten= 0%, Lag= 0.0 min

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

Link 4L: POC "A"

Inflow Area=70,577 sf

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

Subcatchment 1S: Area A-1
Runoff Area=68,949 sf  11.28% Impervious  Runoff Depth>0.60”
Flow Length=227”  Tc=6.3 min  CN=68.6  Runoff=0.90 cfs  3,442 cf

Subcatchment 2S: Area A-2
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>2.67”
Tc=5.0 min  CN=98.0  Runoff=0.11 cfs  362 cf

Pond 3P: DW-1
Peak Elev=193.15’ Storage=362 cf  Inflow=0.11 cfs  362 cf
Outflow=0.00 cfs  0 cf

Link 4L: POC "A"
Inflow=0.90 cfs  3,442 cf
Primary=0.90 cfs  3,442 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 3,804 cf  Average Runoff Depth = 0.65”
86.67% Pervious = 61,172 sf  13.33% Impervious = 9,405 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
Runoff Area=68,949 sf  11.28% Impervious  Runoff Depth>0.87"  
Flow Length=227'  Tc=6.3 min  CN=68.6  Runoff=1.43 cfs  5,014 cf

Subcatchment 2S: Area A-2
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>3.16"  
Tc=5.0 min  CN=98.0  Runoff=0.13 cfs  429 cf

Pond 3P: DW-1
Peak Elev=193.65'  Storage=429 cf  Inflow=0.13 cfs  429 cf  
Outflow=0.00 cfs  0 cf

Link 4L: POC "A"
Inflow=1.43 cfs  5,014 cf  
Primary=1.43 cfs  5,014 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 5,443 cf  Average Runoff Depth = 0.93"  
86.67% Pervious = 61,172 sf  13.33% Impervious = 9,405 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
Runoff Area=68,949 sf  11.28% Impervious  Runoff Depth>1.44"  
Flow Length=227'  Tc=6.3 min  CN=68.6  Runoff=2.52 cfs  8,254 cf

Subcatchment 2S: Area A-2
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>4.06"  
Tc=5.0 min  CN=98.0  Runoff=0.16 cfs  551 cf

Pond 3P: DW-1
Peak Elev=195.50'  Storage=518 cf  Inflow=0.16 cfs  551 cf  
Outflow=0.00 cfs  33 cf

Link 4L: POC "A"
Inflow=2.52 cfs  8,286 cf  
Primary=2.52 cfs  8,286 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 8,805 cf  Average Runoff Depth = 1.50"  
86.67% Pervious = 61,172 sf  13.33% Impervious = 9,405 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

| Subcatchment 1S: Area A-1 | Runoff Area=68,949 sf  11.28% impervious  Runoff Depth > 2.00"  
Flow Length=227'  Tc=6.3 min  CN=68.6  Runoff=3.59 cfs  11,466 cf |
| Subcatchment 2S: Area A-2 | Runoff Area=1,628 sf  100.00% impervious  Runoff Depth > 4.86"  
Tc=5.0 min  CN=98.0  Runoff=0.19 cfs  659 cf |
| Pond 3P: DW-1 | Peak Elev=195.51'  Storage=519 cf  Inflow=0.19 cfs  659 cf  
Outflow=0.01 cfs  141 cf |
| Link 4L: POC "A" | Inflow=3.59 cfs  11,607 cf  
Primary=3.59 cfs  11,607 cf |

Total Runoff Area = 70,577 sf  Runoff Volume = 12,125 cf  Average Runoff Depth = 2.06"  
86.67% Pervious = 61,172 sf  13.33% Impervious = 9,405 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
Runoff Area=68,949 sf  11.28% Impervious  Runoff Depth>2.99"  
Flow Length=227'  Tc=6.3 min  CN=68.6  Runoff=5.46 cfs  17,154 cf

Subcatchment 2S: Area A-2
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>6.16"  
Tc=5.0 min  CN=98.0  Runoff=0.24 cfs  835 cf

Pond 3P: DW-1
Peak Elev=195.56'  Storage=520 cf  Inflow=0.24 cfs  835 cf
Outflow=0.10 cfs  317 cf

Link 4L: POC "A"
Inflow=5.46 cfs  17,471 cf  
Primary=5.46 cfs  17,471 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 17,989 cf
86.67% Pervious = 61,172 sf  Average Runoff Depth = 3.06"
13.33% Impervious = 9,405 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
Runoff Area=68,949 sf  11.28% Impervious  Runoff Depth>3.96"  
Flow Length=227'  Tc=6.3 min  CN=68.6  Runoff=7.29 cfs  22,768 cf

Subcatchment 2S: Area A-2
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>7.36"  
Tc=5.0 min  CN=98.0  Runoff=0.29 cfs  998 cf

Pond 3P: DW-1
Peak Elev=195.62'  Storage=521 cf  Inflow=0.29 cfs  998 cf  
Outflow=0.30 cfs  479 cf

Link 4L: POC "A"
Inflow=7.29 cfs  23,248 cf  
Primary=7.29 cfs  23,248 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 23,766 cf  
86.67% Pervious = 61,172 sf  Average Runoff Depth = 4.04"  
13.33% Impervious = 9,405 sf
Subcatchment 1S: Area A-1
Runoff Area=68,949 sf  11.28% Impervious  Runoff Depth>5.24"
Flow Length=227'  Tc=6.3 min  CN=68.6  Runoff=9.64 cfs  30,123 cf

Subcatchment 2S: Area A-2
Runoff Area=1,628 sf  100.00% Impervious  Runoff Depth>8.85"
Tc=5.0 min  CN=98.0  Runoff=0.35 cfs  1,201 cf

Pond 3P: DW-1
Peak Elev=195.64'  Storage=522 cf  Inflow=0.35 cfs  1,201 cf
Outflow=0.39 cfs  683 cf

Link 4L: POC "A"
Inflow=9.98 cfs  30,806 cf
Primary=9.98 cfs  30,806 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 31,325 cf  Average Runoff Depth = 5.33"
86.67% Pervious = 61,172 sf  13.33% Impervious = 9,405 sf
Appendix "G"

HydroCAD Analysis -
Proposed Conditions
### Area Listing (all nodes)

<table>
<thead>
<tr>
<th>Area (sq-ft)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>51,120</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B (1S, 2S)</td>
</tr>
<tr>
<td>6,640</td>
<td>96.0</td>
<td>Ledge (1S)</td>
</tr>
<tr>
<td>12,817</td>
<td>98.0</td>
<td>Roofs, HSG B (1S, 2S)</td>
</tr>
<tr>
<td>70,577</td>
<td>71.0</td>
<td>TOTAL AREA</td>
</tr>
</tbody>
</table>
Summary for Subcatchment 1S: Area A-1

Runoff = 5.23 cfs @ 12.09 hrs, Volume= 16,397 cf, Depth> 3.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7,709</td>
<td>98.0</td>
<td>Roofs, HSG B</td>
</tr>
<tr>
<td>50,711</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B</td>
</tr>
<tr>
<td>6,640</td>
<td>96.0</td>
<td>Ledge</td>
</tr>
<tr>
<td>65,060</td>
<td>69.0</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>57,351</td>
<td>88.15% Pervious Area</td>
<td></td>
</tr>
<tr>
<td>7,709</td>
<td>11.85% Impervious Area</td>
<td></td>
</tr>
</tbody>
</table>

Tc | Length  | Slope | Velocity | Capacity | Description                      |
---|---------|-------|----------|----------|----------------------------------|
5.9 | 100     | 0.1680| 0.28     |          | **Sheet Flow,** Grass: Dense n= 0.240 P2= 3.40" |
0.4 | 127     | 0.1200| 5.58     |          | **Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps |

6.3 | 227 | Total |

Subcatchment 1S: Area A-1

Hydrograph

Type III 24-hr
25-Year Rainfall=6.40"
Runoff Area=65,060 sf
Runoff Volume=16,397 cf
Runoff Depth>3.02"
Flow Length=227'
Tc=6.3 min
CN=69.0
Summary for Subcatchment 2S: Area A-2

Runoff = 0.81 cfs @ 12.07 hrs, Volume = 2,685 cf, Depth = 5.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span = 0.00-24.00 hrs, dt = 0.01 hrs
Type III 24-hr 25-Year Rainfall = 6.40"

<table>
<thead>
<tr>
<th>Area (sf)</th>
<th>CN</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,108</td>
<td>98.0</td>
<td>Roofs, HSG B</td>
</tr>
<tr>
<td>409</td>
<td>61.0</td>
<td>&gt;75% Grass cover, Good, HSG B</td>
</tr>
<tr>
<td>5,517</td>
<td>95.3</td>
<td>Weighted Average</td>
</tr>
<tr>
<td>409</td>
<td>7.41% Pervious Area</td>
<td></td>
</tr>
<tr>
<td>5,108</td>
<td>92.59% Impervious Area</td>
<td></td>
</tr>
</tbody>
</table>

Tc | Length | Slope | Velocity | Capacity | Description |
---|--------|-------|----------|----------|-------------|
5.0 | 5.0    | 5.0   | 5.0      | 5.0      | Direct Entry, |

Direct Entry,

Subcatchment 2S: Area A-2

Type III 24-hr 25-Year Rainfall = 6.40"
Runoff Area = 5,517 sf
Runoff Volume = 2,685 cf
Runoff Depth > 5.84"
Tc = 5.0 min
CN = 95.3

Hydrograph
Summary for Pond 3P: RG-Pool

Inflow Area = 5,517 sf, 92.59% Impervious, Inflow Depth > 5.84" for 25-Year event
Inflow = 0.81 cfs @ 12.07 hrs, Volume= 2,685 cf
Outflow = 0.80 cfs @ 12.08 hrs, Volume= 2,141 cf, Atten= 2%, Lag= 0.9 min
Primary = 0.80 cfs @ 12.08 hrs, Volume= 2,141 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 190.65' @ 12.08 hrs Surf.Area= 1,586 sf Storage= 604 cf

Plug-Flow detention time= 137.1 min calculated for 2,141 cf (80% of inflow)
Center-of-Mass det. time= 60.9 min (820.1 - 759.2)

<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>187.30'</td>
<td>158 cf</td>
<td>Gravel (Prismatic) Listed below (Recalc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>394 cf Overall x 40.0% Voids</td>
</tr>
<tr>
<td>#2</td>
<td>188.30'</td>
<td>177 cf</td>
<td>Bioretention Sand (Prismatic) Listed below (Recalc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>591 cf Overall x 30.0% Voids</td>
</tr>
<tr>
<td>#3</td>
<td>189.80'</td>
<td>8 cf</td>
<td>Custom Stage Data (Prismatic) Listed below (Recalc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>79 cf Overall x 10.0% Voids</td>
</tr>
<tr>
<td>#4</td>
<td>190.00'</td>
<td>402 cf</td>
<td>Custom Stage Data (Prismatic) Listed below (Recalc)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>187.30</td>
<td>394</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>188.30</td>
<td>394</td>
<td>0</td>
<td>0</td>
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<table>
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</thead>
<tbody>
<tr>
<td>188.30</td>
<td>394</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>189.80</td>
<td>394</td>
<td>591</td>
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<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>189.80</td>
<td>394</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>190.00</td>
<td>394</td>
<td>79</td>
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<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>190.00</td>
<td>394</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>191.00</td>
<td>409</td>
<td>402</td>
<td>402</td>
</tr>
</tbody>
</table>

<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>188.50'</td>
<td>6.0&quot; Round Culvert</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L= 230.0', CPP, square edge headwall, Ke= 0.500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inlet / Outlet Invert= 188.50' / 182.20' S= 0.0274 '/' Cc= 0.900</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>n= 0.011, Flow Area= 0.20 sf</td>
</tr>
<tr>
<td>#2</td>
<td>Device 1</td>
<td>190.50'</td>
<td>12.0&quot; x 12.0&quot; Horiz. Orifice/Grate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C= 0.600</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Limited to weir flow at low heads</td>
</tr>
</tbody>
</table>
Primary Outflow Max=0.79 cfs @ 12.08 hrs HW=190.65' TW=182.25' (Dynamic Tailwater)

1=Culvert (Passes 0.79 cfs of 1.17 cfs potential flow)
2=Orifice/Grate (Weir Controls 0.79 cfs @ 1.29 fps)

Pond 3P: RG-Pool

Inflow Area=5,517
Peak Elev=190.65'
Storage=604 cf
Summary for Pond 4P: DW-Pool

Inflow Area = 5,517 sf, 92.59% Impervious, Inflow Depth > 4.66" for 25-Year event
Inflow = 0.80 cfs @ 12.08 hrs, Volume= 2,141 cf
Outflow = 0.65 cfs @ 12.15 hrs, Volume= 1,644 cf, Atten= 19%, Lag= 4.0 min
Primary = 0.65 cfs @ 12.15 hrs, Volume= 1,644 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 183.56' @ 12.15 hrs Surf.Area= 708 sf Storage= 725 cf

Plug-Flow detention time= 122.2 min calculated for 1,644 cf (77% of inflow)
Center-of-Mass det. time= 43.6 min ( 863.6 - 820.1 )

<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>179.50'</td>
<td>294 cf</td>
<td>14.75'W x 24.00'L x 3.21'H Field A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,136 cf Overall - 401 cf Embedded = 735 cf x 40.0% Voids</td>
</tr>
<tr>
<td>#2A</td>
<td>180.00'</td>
<td>401 cf</td>
<td>Cultec R-280HD x 9 Inside #1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Effective Size= 46.9&quot;W x 26.0&quot;H =&gt; 6.07 sf x 7.00'L = 42.5 cf</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Overall Size= 47.0&quot;W x 26.5&quot;H x 8.00'L with 1.00' Overlap</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Row Length Adjustment= +1.00' x 6.07 sf x 3 rows</td>
</tr>
<tr>
<td>#3</td>
<td>182.70'</td>
<td>53 cf</td>
<td>14.75'W x 24.00'L x 1.50'H Prismatoid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>531 cf Overall x 10.0% Voids</td>
</tr>
</tbody>
</table>

748 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device | Routing | Invert  | Outlet Devices |
-------|---------|---------|----------------|
#1     | Primary | 181.50' | 6.0" Round Culvert |
|       |         |         | L= 25.0' CPP, square edge headwall, Ke= 0.500 |
|       |         |         | Inlet / Outlet Invert= 181.50' / 178.60' S= 0.1160 '/" Cc= 0.900 |
|       |         |         | n= 0.011, Flow Area= 0.20 sf |
#2     | Device 1| 181.50' | 3.0" Vert. Orifice/Grate |
|       |         |         | C= 0.600 |
#3     | Device 1| 183.40' | 6.0" Horiz. Orifice/Grate |
|       |         |         | C= 0.600 Limited to weir flow at low heads |

Primary OutFlow Max=0.64 cfs @ 12.15 hrs HW=183.55' TW=0.00' (Dynamic Tailwater)
1=Culvert (Passes 0.64 cfs of 1.27 cfs potential flow)
2=Orifice/Grate (Orifice Controls 0.33 cfs @ 6.69 fps)
3=Orifice/Grate (Weir Controls 0.31 cfs @ 1.28 fps)
Pond 4P: DW-Pool - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)
Effective Size = 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size = 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment = +1.00' x 6.07 sf x 3 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

3 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 22.00' Row Length +12.0" End Stone x 2 = 24.00' Base Length
3 Rows x 47.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 14.75' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

9 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 3 Rows = 400.7 cf Chamber Storage

1,135.7 cf Field - 400.7 cf Chambers = 735.0 cf Stone x 40.0% Voids = 294.0 cf Stone Storage

Chamber Storage + Stone Storage = 694.7 cf = 0.016 af
Overall Storage Efficiency = 61.2%
Overall System Size = 24.00' x 14.75' x 3.21'

9 Chambers
42.1 cy Field
27.2 cy Stone
Pond 4P: DW-Pool

Inflow Area=5,517 sf
Peak Elev=183.56'
Storage=725 cf
Summary for Link 5L: POC "A"

Inflow Area = 70,577 sf, 18.16% Impervious, Inflow Depth > 3.07" for 25-Year event
Inflow = 5.43 cfs @ 12.10 hrs, Volume= 18,041 cf
Primary = 5.43 cfs @ 12.10 hrs, Volume= 18,041 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
Runoff Area=65,060 sf 11.85% Impervious  Runoff Depth=0.62"  
Flow Length=227'  Tc=6.3 min  CN=69.0  Runoff=0.89 cfs 3,338 cf

Subcatchment 2S: Area A-2
Runoff Area=5,517 sf 92.59% Impervious  Runoff Depth=2.38"  
Tc=5.0 min  CN=95.3  Runoff=0.35 cfs 1,094 cf

Pond 3P: RG-Pool
Peak Elev=190.55' Storage=562 cf  Inflow=0.35 cfs 1,094 cf  
Outflow=0.15 cfs 551 cf

Pond 4P: DW-Pool
Peak Elev=181.55' Storage=494 cf  Inflow=0.15 cfs 551 cf  
Outflow=0.00 cfs 59 cf

Link 5L: POC "A"
Inflow=0.89 cfs 3,397 cf  
Primary=0.89 cfs 3,397 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 4,432 cf  Average Runoff Depth = 0.75"
81.84% Pervious = 57,760 sf  18.16% Impervious = 12,817 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
Runoff Area=65,060 sf 11.85% Impervious  Runoff Depth>0.89"  
Flow Length=227’  Tc=6.3 min  CN=69.0  Runoff=1.39 cfs 4,842 cf

Subcatchment 2S: Area A-2
Runoff Area=5,517 sf 92.59% Impervious  Runoff Depth>2.87"  
Tc=5.0 min  CN=95.3  Runoff=0.41 cfs 1,320 cf

Pond 3P: RG-Pool
Peak Elev=190.59' Storage=577 cf  Inflow=0.41 cfs 1,320 cf  
Outflow=0.35 cfs 776 cf

Pond 4P: DW-Pool
Peak Elev=181.59' Storage=505 cf  Inflow=0.35 cfs 776 cf  
Outflow=0.02 cfs 283 cf

Link 5L: POC "A"
Inflow=1.39 cfs 5,125 cf  
Primary=1.39 cfs 5,125 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 6,161 cf  Average Runoff Depth = 1.05"  
81.84% Pervious = 57,760 sf  18.16% Impervious = 12,817 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
- Runoff Area=65,060 sf  11.85% Impervious  Runoff Depth>1.46"
- Flow Length=227'  Tc=6.3 min  CN=69.0  Runoff=2.43 cfs  7,934 cf

Subcatchment 2S: Area A-2
- Runoff Area=5,517 sf  92.59% Impervious  Runoff Depth>3.76"
  Tc=5.0 min  CN=95.3  Runoff=0.53 cfs  1,727 cf

Pond 3P: RG-Pool
- Peak Elev=190.62'  Storage=589 cf  Inflow=0.53 cfs  1,727 cf
  Outflow=0.52 cfs  1,184 cf

Pond 4P: DW-Pool
- Peak Elev=181.76'  Storage=543 cf  Inflow=0.52 cfs  1,184 cf
  Outflow=0.09 cfs  690 cf

Link 5L: POE "A"
- Inflow=2.43 cfs  8,623 cf
- Primary=2.43 cfs  8,623 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 9,661 cf  Average Runoff Depth = 1.64"
81.84% Pervious = 57,760 sf  18.16% Impervious = 12,817 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
Runoff Area=65,060 sf  11.85% Impervious  Runoff Depth>2.03''
Flow Length=227'  Tc=6.3 min  CN=69.0  Runoff=3.45 cfs  10,992 cf

Subcatchment 2S: Area A-2
Runoff Area=5,517 sf  92.59% Impervious  Runoff Depth>4.55''
Tc=5.0 min  CN=95.3  Runoff=0.64 cfs  2,092 cf

Pond 3P: RG-Pool
Peak Elev=190.63'  Storage=595 cf  Inflow=0.64 cfs  2,092 cf
Outflow=0.63 cfs  1,548 cf

Pond 4P: DW-Pool
Peak Elev=182.23'  Storage=627 cf  Inflow=0.63 cfs  1,548 cf
Outflow=0.18 cfs  1,052 cf

Link 5L: POC "A"
Inflow=3.45 cfs  12,044 cf
Primary=3.45 cfs  12,044 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 13,083 cf  Average Runoff Depth = 2.22''
81.84% Pervious = 57,760 sf  18.16% Impervious = 12,817 sf
Subcatchment 1S: Area A-1
Runoff Area=65,060 sf  11.85% Impervious  Runoff Depth>3.02"
Flow Length=227'  Tc=6.3 min  CN=69.0  Runoff=5.23 cfs  16,397 cf

Subcatchment 2S: Area A-2
Runoff Area=5,517 sf  92.59% Impervious  Runoff Depth>5.84"
Tc=5.0 min  CN=95.3  Runoff=0.81 cfs  2,685 cf

Pond 3P: RG-Pool
Peak Elev=190.65'  Storage=604 cf  Inflow=0.81 cfs  2,685 cf
Outflow=0.80 cfs  2,141 cf

Pond 4P: DW-Pool
Peak Elev=183.56'  Storage=725 cf  Inflow=0.80 cfs  2,141 cf
Outflow=0.65 cfs  1,644 cf

Link 5L: POC "A"
Inflow=5.43 cfs  18,041 cf
Primary=5.43 cfs  18,041 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 19,082 cf  Average Runoff Depth = 3.24"
81.84% Pervious = 57,760 sf  18.16% Impervious = 12,817 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
Runoff Area=65,060 sf  11.85% Impervious  Runoff Depth>4.01"
Flow Length=227'  Tc=6.3 min  CN=69.0  Runoff=6.95 cfs  21,724 cf

Subcatchment 2S: Area A-2
Runoff Area=5,517 sf  92.59% Impervious  Runoff Depth>7.03"
Tc=5.0 min  CN=95.3  Runoff=0.97 cfs  3,234 cf

Pond 3P: RG-Pool
Peak Elev=190.67'  Storage=612 cf  Inflow=0.97 cfs  3,234 cf
Outflow=0.95 cfs  2,689 cf

Pond 4P: DW-Pool
Peak Elev=183.79'  Storage=733 cf  Inflow=0.95 cfs  2,689 cf
Outflow=0.94 cfs  2,191 cf

Link 5L: POC "A"
Inflow=7.89 cfs  23,915 cf
Primary=7.89 cfs  23,915 cf

Total Runoff Area = 70,577 sf  Runoff Volume = 24,957 cf  Average Runoff Depth = 4.24"
81.84% Pervious = 57,760 sf  18.16% Impervious = 12,817 sf
Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: Area A-1
- Runoff Area=65,060 sf
- 11.85% Impervious
- Runoff Depth>5.29"
- Flow Length=227’
- Tc=6.3 min
- CN=69.0
- Runoff=9.18 cfs
- 28,694 cf

Subcatchment 2S: Area A-2
- Runoff Area=5,517 sf
- 92.59% Impervious
- Runoff Depth>8.53"
- Tc=5.0 min
- CN=95.3
- Runoff=1.16 cfs
- 3,921 cf

Pond 3P: RG-Pool
- Peak Elev=190.71'
- Storage=628 cf
- Inflow=1.16 cfs
- Outflow=1.09 cfs
- 3,921 cf

Pond 4P: DW-Pool
- Peak Elev=183.97'
- Storage=740 cf
- Inflow=1.09 cfs
- Outflow=1.07 cfs
- 3,376 cf

Link 5L: POC "A"
- Inflow=10.25 cfs
- Primary=10.25 cfs
- 31,570 cf

Total Runoff Area = 70,577 sf
Runoff Volume = 32,615 cf
Average Runoff Depth = 5.55"
81.84% Pervious = 57,760 sf
18.16% Impervious = 12,817 sf
LONG TERM MAINTENANCE PLAN

For

46 VINEYARD LANE
Greenwich, Connecticut

Prepared For

Christopher & Francesca Santomero

November 4, 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

[Owner(s) Name]

[Address]

hereinafter referred to as “Owner(s)” of the “Property” as more fully described in a deed recorded in Book ______ at Page ______ 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:
  o Building Division
  o Inland Wetlands and Watercourses Agency
  o 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 readily 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 ______ at Page ______ 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

COUNTY OF FAIRFIELD

) ss: Greenwich

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 With Log
Exhibit A  
Long Term Maintenance Plan  
7 Cherry Valley Road, Greenwich  
August 22, 2019

Scope:

The purpose of the Operations and Maintenance Plan is to ensure that the existing and proposed stormwater components installed at 46 Vineyard 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.

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.
Long Term Maintenance Log (Page 1 of 3)
46 Vineyard Lane, Greenwich
November 4, 2021

Type of Inspection: □ Spring □ Fall □ Other

Inspector’s Name: __________________________ Date of Inspection: ________________
Affiliation: __________________________ Phone #: ________________

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

Notes:

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:
Long Term Maintenance Log (Page 2 of 3)
46 Vineyard Lane, Greenwich
November 4, 2021

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

Signature of Inspector:  Date:
CONSTRUCTION SITE PLAN REVIEW SET RESIDENTIAL IMPROVEMENTS LOCATION 46 VINEYARD LANE GREENWICH, CONNECTICUT PREPARED FOR CHRISTOPHER & FRANCESCA SANTOMERO

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SANTOMERO POOL HOUSE
46 VINEYARD LANE
GREENWICH, CT 06831

ARCHITECTURAL DRAWING LIST

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CIVIL ENGINEER
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Greenwich, CT 06830
203 625 0491
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WWW.RIDARCH.COM

PROJECT:
SANTOMERO POOL HOUSE
46 VINEYARD LANE
GREENWICH, CT 06831

ISSUED
12/12/21 FOR SPECIAL PERMIT APPLICATION

ARCHITECT:
R+A JOB NUMBER:
20050

OWNER:
Santomero

LAND PLANNER, ENGINEER, AND LAND SURVEYOR

ISSUED: 12-12-21 FOR SPECIAL PERMIT APPLICATION

ARCHITECTURAL DRAWING LIST

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</table>
NEW SLATE ROOF TO MATCH EXISTING.
RENSON "AERO" LOUVERED PERGOLA.
AZEK OR EQUAL TRIM BOARDS.
MAHOGANY DOOR
MAHOGANY BOXED OUT COLUMNS.

PROPOSED BUILDING HGT. 19' - 4"

WET BAR

MAX ROOF HEIGHT (EL=219.0') 24' - 0"

STONE VENEER TO MATCH EXISTING DWELLING.
LIMESTONE OR EQUAL CASING. PROFILE T.M.E.
BLUESTONE SLOPED TILE T.M.E.
LIMESTONE OR EQUAL CROWN MOULDING T.M.E.
SLATE ROOF T.M.E.
CLAD CASEMENT WINDOWS T.M.E.
STONE FIREPLACE T.M.E.

RIDBERG + Associates Architects, P.C.
P.O. BOX 1687
Greenwich, CT 06830
203 625 0491
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WWW.RIDARCH.COM

DATE 12-12-21
SCALE 1/4" = 1'-0"
ISSUE CAE
DRAWN BY CCA
PROJECT No. 20050

NOTES

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DRAWING TITLE

SANTICERO POOL HOUSE
46 VINEYARD LANE
GREENWICH, CT 06831

1/4" = 1' - 0" 1 NORTH ELEVATION
1/4" = 1' - 0" 2 SOUTH ELEVATION
1/4" = 1' - 0" 3 EAST ELEVATION
1/4" = 1' - 0" 4 WEST ELEVATION