Stormwater Pollution Prevention Plan

For

Buttermilk Falls

A Proposed

Hotel and Resort

Situate: North Road
Town of Marlborough
Ulster County, New York

Prepared for:

220 Road, LLC/ Robert Pollock

Prepared by:

Medenbach, Eggers and Carr
Civil Engineering and Land Surveying, PC
Stone Ridge, New York
Ph: 845-687-0047

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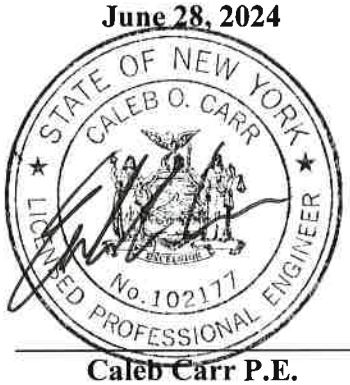

Caleb Carr P.E.
NY Lic. No. 102177

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SECTION 1: General Project Information

1.1 Project Summary:

Buttermilk Falls is an existing Bed and Breakfast facility with a restaurant known as Henry's and Spa, banquet hall, and accessory facilities situated on 62 acres overlooking the Hudson River on east side of North Road in Milton New York. The proposal is to add a 65-room hotel, 35 individual cabins, 60 seat restaurant and 300 seat banquet hall among other accessory facilities. This will include adding 5.3 adjacent acres to the main parcel and 6 acres on the west side of North Road on corner of Mahoney Road for parking.

The main hotel building will be located on top of a hill overlooking the Hudson River with the restaurant and banquet hall attached. The cabins will be situated in a wooded area to the north with some on piers to protect the old growth trees. Two existing single-family homes with access from VanOrden Road and Two on North Road will remain for workforce housing. The proposed parking lot site on the west side of North Road contains an existing warehouse and parking lot. A small portion of the warehouse will be removed, and balance renovated for facility storage and accept deliveries. Two of the existing single-family homes to remain exist along the frontage of North Road on this site.

Since part of the project disturbs some existing impervious areas, the project constitutes a partial redevelopment project. Therefore, the project will follow the design criteria outlined in Chapter 9 of the New York State Stormwater Design Manual for the existing impervious areas to be disturbed. Quantity and quality controls will be provided meeting the requirements of section 9.2.1 of the New York State Stormwater Management Design Manual. The SPDES coverage will be under the general permit.

The facility will include trails for walking and some farm animals onsite and adjacent parcels for guests' use and education. The applicant has a single-family home on 3.5 acres on a separate parcel situated within the proposed development site. A small area (0.3acres) will be conveyed from this lot to the development site to provide required setback for the proposed banquet hall.

The intent of this report is to prepare the calculations and sizing of the sites proposed and existing stormwater facilities including a Storm Water Pollution Prevention Plan (SWPPP) meeting standards of design of Storm water Management Practices (SMP) of the State of New York in accordance with National Pollutant Discharge Elimination System (NPDES).

The stormwater management facilities for the project will include temporary erosion controls during construction as well as permanent post construction controls, such as swales, culverts, bio-retention areas, dry swales, and an existing pond.The plan will mitigate the impacts of the proposed development for the expected runoff quantity and provide quality improvements to remove pollutants from the stormwater before it is discharged into the Hudson River.

Design point #1 is a discharge from an existing pond (Pond #1) into the Hudson River. Design point #2 is an existing stream that discharges into the Hudson River. Design point #3 discharge water that is. See the Pre-Development Drainage area map for locations of Design points. The HydroCAD calculations can be found in Appendix H. The changes of water flow at each of these design points are indicated in the tables in Section 4.1 of this report. The table below shows the change in Peak flows of stormwater from the site for the 1, 10, and 100 year storm events.

Total Stormwater Discharge Rates (From Disturbed Areas)			
Storm	**Pre-development (cfs)**	**Post-development (cfs)**	**% Change**
1 Year	10.3	9.84	-4%
10 Year	36.7	36.8	+0%
100 Year	121.8	120.3	-1%

1.2 Contact Information/Responsible Parties:

SWPPP Contact/Prepared by:

Medenbach, Eggers, and Carr Civil Engineering and Land Surveying, P.C.
Caleb Carr, PE.
4305 US Highway 209
Stone Ridge, NY 12484
P: 845-687-0047
E-mail: Caleb@mecels.com

Owner/Operator(s):

220 North Road, LLC
c/o Robert Pollock
220 North Road
Milton, NY 12547
roblpollock@gmail.com

Project Manager(s) or Site Supervisor(s): (To be filled in before construction)

Company or Organization:
Contact Name:
P:
E-mail:

Emergency 24-Hour Contact:

Company or Organization:
P:

Subcontractor(s)*:

Company or Organization:
Contact Name:
Address:
City, State, Zip:
P:

*Insert additional subcontractor contacts below as needed

1.3 Existing Soils, Slopes, Vegetation and Drainage Patterns:

The existing site is within the Hudson River watershed. The project has been split into 5 watersheds. A small unnamed stream flows across the frontage of this site near and along the east side of North Roads south into a large manmade pond located onsite. Discharge from the pond is regulated by an overflow dam. The flow then cascades east down a steep slope with mostly exposed rock to the Hudson River.

Slopes across the site range from flat to steep. Almost all of the construction is located on flat and moderate slopes.

The site has 9 separate soil classifications according to the USDA-NRCS soil survey. The chart below shows the percentage of each hydrological soil group, the soil survey can be found in appendix H. During our on-site soil investigation over 30 test holes were dug and found silt loam, sandy loam, sand and gravel. All good draining soil.

The water table was found to be greater than 60 inches below the surface. The test holes data is located in the site plans.

Percentage of Each Hydrological Soil Group (HsG) at Heartwood Site			
A	B	C	D
45%	7%	24%	24%

1.4 Changes in Cover Estimates:

The following are estimates of the proposed development.

Total project area:	62.0 acres
Approximate construction site area to be disturbed:	15.3 acres
Percentage impervious area before construction:	13.2%
Runoff coefficient before construction:	CN =66
Percentage impervious area after construction:	18.5%
Runoff coefficient after construction:	CN =68
Future Impervious Cover:	2.6 acres
Conservation of natural areas:	0 acres

1.5 Receiving Waters:

The runoff from the existing site flows directly into the Hudson River. The proposed development will continue the discharge location from the site. The Hudson River is greater than a fifth order stream as per NYDEC.

1.6 Sensitive Site Features to Be Protected:

A phase IIA archaeological study was performed on the site and identified a sensitive area that has been mapped. The project was designed to avoid any disturbance or impact to this area and includes a 50ft buffer. A detail Archaeological Avoidance Plan is included it the site plans.

Construction along the top of a steep slope for the Hotel and Banquet Hall is of primary concern. Special care will be implemented to protect this area with silt fencing along the construction in addition to orange safety fencing prior to construction or any grading on the site. Please see the site plans for details.

1.7 Potential Sources of Pollution

Potential sources of sediment to stormwater runoff:

- Clearing and grubbing
- Grading and site excavation
- Vehicle tracking
- Topsoil stripping and stockpiling
- Landscaping/stabilization operations

Potential pollutants and sources, other than sediment, to stormwater runoff:

- Re-fueling activities
- Minor equipment maintenance
- Sanitary facilities
- Materials storage of general building materials, solvents, adhesives, paving materials, paints, aggregates, trash, etc.
- General construction activities — paving, concrete pouring building construction
- Concrete Washout Areas

1.8 Historic Preservation:

The site has been reviewed by the New York State Historic Preservation Office and there are no known sensitive historic site features known. The Parks, Recreation, and Historic Preservation letter is in appendix D.3.

Archaeological Avoidance Plan. See section 1.6 above and sheet 19 of site plan.

SECTION 2: Erosion and Sediment Control BMPS

2.1 Minimizing Disturbed Areas, Protecting Natural Features and Soil:

Site disturbance and clearing will be kept within the limits of disturbance as indicated on the site plans. Any sensitive areas such as wetland vegetation areas to be preserved will be clearly flagged prior to disturbance. All contractors will be instructed not to disturb these sensitive areas.

All topsoil from disturbed areas will be stripped prior to grading and stockpiled as indicated on the soil erosion control plans. Topsoil will be re-spread on disturbed areas after final grading is complete. A temporary seed will be applied to the topsoil during storage to prevent erosion.

2.2 Temporary BMPS:

The following temporary erosion and sediment controls will be used during construction. The locations and detailed designs of each practice is located within the accompanying site plan drawings.

- Silt Fence: to capture sediment in lateral sheet flow leaving disturbed areas.
- Stabilized Construction Entrances: to capture sediment from vehicles leaving site.
- Inlet Sediment Traps: to prevent sediment in concentrated runoff collected from disturbed areas from leaving the site through catch basins.
- Temporary Seeding: to stabilize inactive areas or soil stockpiles.
- Rock Check Dam: to stop scouring and erosion within swales.

2.3 Sequence of Construction Activity:

The following sequence of soil erosion and sediment control measures shall be followed during the duration of the project. In addition, the guidelines in Section 3 of this report shall be implemented where applicable.

1. **Schedule a pre-construction meeting:** a pre-construction meeting shall be held to review plans and inspect site with town officials including the Town Engineer, Contractors, and Project Managers at least one week prior to the start of construction, equipment staging and site disturbance.

2. **Establish Limits of Clearing and Sensitive Areas to be Protected:** Prior to any construction and/or demolition activities commence all vegetation to be persevered shall be protected. In addition, the property boundaries and/or limits of clearing shall be clearly marked. A pre-construction meeting shall be held prior to any land disturbance or grading to review plans and inspect the site.

3. **Construct Stabilized Access to Site:** Install the stabilized construction entrances along North Road at each site entrance as indicated on the site plans to provide access for construction traffic on and off the site.

4. **Establish Perimeter Controls and Sediment Barriers:** Silt fences will be installed along downstream portions of the limit of disturbance and around any topsoil stockpiles. Silt fences will be installed as per the detail on site plans in Appendix I. Locations of installation are indicated on the soil erosion and sediment control plans.

5. **Land Clearing and Rough Grading:** Begin clearing activities for each phase as per the site plans in Appendix J. The site plans show how the construction of the proposed development will not disturb more than 5 acres at a time. The ground surface to be used for roads and parking shall be cleared of all trees, stumps, brush, weeds, roots, matted leaves, small structures, debris, and any other unsuitable material, except as otherwise directed by the engineer. The contractor is to get permission from the owner prior to removal of any trees or other vegetation. Material accumulated by clearing as described above shall be disposed of by the contractor per state and local regulations. After clearing and demolition all topsoil shall be stripped and stockpiled for use in final grading as indicated on plans. Excess topsoil not required for final grading may be removed from the site per state and local regulations. Then the remaining permanent drainage structures and conveyance system shall be installed. (inlet protection, rip rap outlet protection, etc.) Bio-retention zones shall **not** be constructed until all contributing drainage areas are stabilized (i.e. parking and driveways paved, and permanent vegetation established) Establish temporary vegetation on any areas which will not be disturbed for a period 14 days or more. Parking and driveway areas may be stabilized with road base material.

6. **Soil Stabilization:** In areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures must be initiated by the end of the next business day and completed within (14) days from the date the current.

7. **Soil Restoration:** All disturbed areas that are to remain vegetated after construction shall be restored as described in the New York State Stormwater Management Design Manual Table 5.3 “Soil Restoration Requirements”.

8. **Building Construction:** During the building construction maintain erosion controls.

9. **Landscaping and Final Stabilization:** Place topsoil and install landscaping as indicated on the landscaping plans. Construct bio-retention zones in conjunction with final stabilization.

10. **Final Inspection and Removal of Temporary BMPS:** Perform final inspection of site to ensure all disturbed areas are stabilized. If all disturbed areas are stabilized temporary erosion control measures shall be removed. Once temporary erosion control measures are removed, any area disturbed by their removal should also be stabilized.

SECTION 3: Good Housekeeping BMPS

3.1 General Construction Equipment and Material Storage Guidelines:

- Construction equipment and maintenance materials will be stored at a centrally located staging area when not in use around the site. Any smaller hand tools or equipment will be stored here in weatherproof containers or covered when not in use. The staging area will consist of a temporary gravel pad and all concentrated stormwater runoff will be diverted away from or around the pad.

- Large building materials such as framing material may be stored in the staging area. Such materials will be elevated on wood blocks to minimize contact with runoff.

- The storage areas shall be inspected on a weekly basis and after each storm event. Storage areas will be kept clean and well organized to minimize contamination of stormwater runoff.

3.2 General Construction Waste Management Guidelines:

- All waste building and construction waste materials will be collected and disposed of in trash dumpsters located in a central staging area. Dumpsters will be placed away from stormwater conveyances and meet all local and state solid-waste management regulations. Only trash and construction debris from the site will be deposited in the dumpsters. All personnel working on the jobsite will be instructed regarding the correct procedure for disposal of trash and construction debris. The individual who manages day-to-day site operations will be responsible for seeing that these practices are followed.

- All dumpsters will be inspected on a weekly basis and after large storm events to ensure no debris are entering stormwater runoff.

- Dumpsters will be emptied as needed and no trash will be stored outside a dumpster if it is full.

- All dumpsters will be removed from the site immediately after all waste generating construction activities are complete.

3.3 Hazardous and Sanitary Waste Management Guidelines:

- All hazardous waste materials such as oil filters, petroleum products, paint and equipment maintenance fluids will be stored in structurally sound and sealed designated hazardous material storage area(s). Secondary

containment will be provided for hazardous materials in these areas in the form of spill pallets.

- All hazardous materials will be disposed of in accordance with local, state and federal regulations. All personnel will be instructed regarding the correct procedure for disposing off hazardous waste. The individual who manages day-to-day site operations will be responsible for seeing that these practices are followed.

- All storage areas will be kept clean, inspected weekly and after storm events, have ample cleanup supplies in the event of a spill, material safety data sheets and the contact numbers of appropriate emergency spill response personnel shall be posted in the construction office.

- If necessary, sanitary facilities will be provided at the site in the form of portable toilets. Toilets will be located away from concentrated stormwater flows and checked daily for leakage. All sanitary waste generated from the toilets will be disposed of offsite in accordance with local laws and regulations.

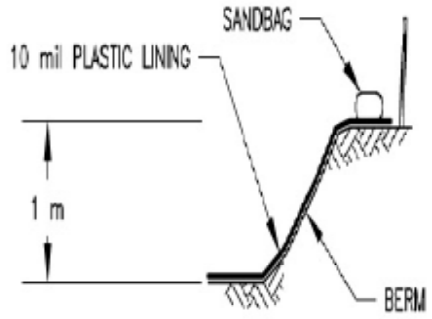
3.4 On-Site Equipment Fueling and Maintenance Guidelines:

- Several types of vehicles and equipment will be used on-site throughout the project, including graders, excavators, loaders, paving equipment, rollers, trucks and trailers, backhoes, etc. All major equipment/vehicle fueling and maintenance will be performed off-site. A small pickup bed fuel tank will be kept on-site in the combined staging area. When vehicle fueling must occur on-site, the fueling activity will occur in the staging area. Only minor equipment maintenance will occur on-site. All equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallets in accordance with Section 3.3. Absorbent, spill-cleanup materials and spill kits will be available at the combined staging and materials storage area. Drip pans will be placed under all equipment receiving maintenance.

- Equipment/vehicle storage areas and fuel tanks will be inspected weekly and after storm events. Vehicles and equipment will be inspected on each day of use. Leaks will be repaired immediately, or the problem vehicle(s) or equipment will be removed from the project site. Ample supplies of spill-cleanup materials will be kept on-site to immediately clean up any spills.

3.5 Concrete Washouts:

- Designated temporary, below ground concrete washout facilities will be constructed as shown below. Washouts will be centrally located at the discretion of the individuals who manage day to day construction activities. Washouts shall have a minimum length and width of 10 feet but must have sufficient volume to contain all liquid concrete waste generated from washout operations. The washout areas will be lined with plastic sheeting at least 10 mils thick and free of any holes or tears. Signs will be posted marking the location of the washout areas.



Section A-A

Washout Plan View

- Temporary concrete washout facilities will be located a minimum of (100 feet) from storm drain inlets.

- The washout areas will be inspected daily to ensure that all concrete washing is being discharged into the washout area, no leaks or tears are present, and to identify when concrete waste needs to be removed. The washout areas will be cleaned out once the area is filled to 75 percent of the holding capacity. Once the area's holding capacity has been reached the concrete waste will be allowed to harden, the concrete will be broken up, removed, and disposed of in accordance with local regulations. The plastic sheeting will be replaced if tears occur during removal of concrete waste from the washout area. Lined roll-off containers are also acceptable for concrete washout.

SECTION 4: Post-Construction BMPS

4.1 Post-Development Drainage Improvements and Mitigation:

To mitigate all the potential stormwater impacts of the project a drainage study has been preformed and a stormwater management plan has been prepared in accordance with the New York State Stormwater Management Design Manual (NYSSMDM), SPDES general permit for stormwater discharges GP-0-20-001. Post-development drainage calculations are included in Appendix H. All nodes have descriptions of each sub catchment provided in the calculations. A detailed work sheet is included in Appendix H showing the location of all post development nodes.

When completed the proposed drainage system will reduce peak runoff rates to less than pre-development levels. The proposed drainage improvements will also reduce pollutant levels in the runoff though several proposed treatment practices. The following sections give a detailed description of the proposed drainage system and on-site mitigations.

4.1.1 Peak Runoff Rate Reduction:

To mitigate the impacts of increased runoff rates after development the project will use bio-retention areas, grass swales and stormwater pond practices to reduce post-development runoff rates to less than pre-development rates. As required by the NYSSMDM the proposed drainage system will provide the required channel protection volume, overbank flood protection, and extreme storm protection.

To meet channel protection requirements or extended 24-hour detention of the 1-year design storm, the Bioretention Areas (F-5) and the Existing Pond have been designed to capture the 1-year storm and infiltrate or release it.

Since the project site is discharging into the Hudson River, we are not require to meet the requirements of overbank flood protection and extreme storm protection. The Hudson River is greater than a fourth order stream. However, we still meet the requirements for overbank flood protection and extreme storm protection for the overall site discharges. The bio-retention ponds and existing pond practices will accomplish this through detention. Then infiltrating through the bioretention soil or releasing it through the existing outlet structure.

When the proposed practice is constructed, it will reduce the total post-development peak flows from the site to be less than the predevelopment rates. Therefore, there will be no negative impacts on downstream waters or adjacent lands caused by increased peak flow rates. A detailed description of each practice to be used is provided in section 4.3 Post Development BMP’s.

4.1.2 Pre and Post-development Runoff Rate Comparison:

The tables below show the change in pre and post-development total runoff rates. Runoff rates are calculated in HydroCAD at each of the discharge points indicated on the pre and post development maps.

Design Point #1 Discharge from existing pond to Hudson River			
Storm	**Pre-development (cfs)**	**Post-development (cfs)**	**% Change**
1 Year	0.3	0.4	33%
10 Year	2.4	2.9	20%
100 Year	8.5	8.5	0%

Design Point #2 Discharge from existing stream to Hudson River			
Storm	**Pre-development (cfs)**	**Post-development (cfs)**	**% Change**
1 Year	6.5	6.1	-6%
10 Year	23.2	22.8	-2%
100 Year	80.9	79.4	-2%

Design Point #3 Discharge from drainage area #5			
Storm	**Pre-development (cfs)**	**Post-development (cfs)**	**% Change**
1 Year	3.3	3.3	0%
10 Year	11.2	11.2	0%
100 Year	32.4	32.4	0%

4.1.3 Runoff Calculation Methodology:

Drainage analyses performed for the 1-, 10- and 100-year design storms used the Runoff Curve Method as developed by the Soil Conservation Service (SCS), with peak discharge rates, hydrographs, and routing analyses generated using HydroCAD based upon the SCS TR-20 method. Curve numbers and times of concentration were determined using methodology in the SCS Technical Release 55. These calculations are detailed in Appendix H. Curve numbers were selected from soil type and ground cover which were determined from infield inspections and USGS Soil report. The rain fall depths used in the HydroCAD calculations were taken off the Isohyet maps in Section 4 of the 2015 New York State Stormwater Design Manual.

4.2 Runoff Reduction and Water Quality Volumes:

To mitigate the impacts of pollutants in stormwater from the proposed project 14 bio-retention areas, 1 dry swale and a existing pond will be used to treat stormwater from the project and remove pollutants before they are discharged into downstream waters. In accordance with the NYSSMDM the required Runoff Reduction Volume (RRv) and Water Quality Volumes (WQv) have been calculated for all proposed on-site development.

Runoff Reduction for the site is accomplished with the bio retention zones. The bio retention zones filter water through a layer of soil before discharging into the surrounding soil or to the proposed stormwater pond. The RRv is calculated as a percentage of the required WQv. The percentage depends on the site's soil's Hydraulic conductivity classification. See Table 3.5 Runoff Reduction Capacity for standard SMPs in the NYSSMDM. The bio retention areas are all proposed in the sites soil with hydraulic conductivity classification A, C and D, We have provided the bioretention area printouts of the excel spreadsheets in appendix H. The required WQv for the new impervious cover is 27,646. The required WQv for the disturbed impervious cover is 3,452.

The Water Quality Volume is being treated by using the bio retention areas and the existing pond. A detailed description of each practice and their treatment methods is provided in the following section. Below is a table with the required and provided RRv and WQv. The provided storage of WQV is the combination of the volume provided in the Bioretention areas and the provided storage in the existing pond. We do not treat 100% of the required WQV with Runoff Reduction practices due to the slopes and the soil types of the site. The proposed bio retention areas and dry swale provide 22,785 CF of WQv and 13,809 CF of RRv. The existing pond provides WQv below and above the stone weir.

Runoff Reduction Volume and Water Quality Volume			
Required WQv (cubic feet)	**Provided Storage of WQV (cubic feet)**	**Minimum Runoff Reduction Volume (cubic feet)**	**Provided Runoff Reduction Volume (cubic feet)**
31,098	± 97,053	4,963	13,809

4.3 Channel Protection Volume

Channel protection volume is the 24 hour extended detention of post-developed 1-year, 24-hour storm event; remaining after runoff reduction. The channel protection volume is not required due to the that the stormwater discharges directly to a river that is larger than a 5th order stream.

4.4 Post-Development BMP's:

4.4.1 Bio-Retention (Green Infrastructure Practice):

- Feasibility: 14 bio-retention areas (F-5) will be used to treat runoff from the proposed parking areas and proposed building roof areas. Bio-retention areas were selected because they are a green infrastructure practice with relatively small contributing drainage areas and the ability to integrate well into the proposed landscaping of the site. 6 of the 14 bio-retention areas are in locations that are to be infiltration bio retention areas.

- Conveyance: Runoff will be conveyed to Bio-retention areas as overland sheet flow, shallow concentrated flow and roof drainage pipes. A ponding depth of 6 inches will occur before runoff overflows into the overflow structures.

- Pretreatment: Pretreatment for the Bio-retention zones will be provided in the form of gravel diaphragms, grass filter strips and a mulch layer on the planting beds.

- Treatment: Runoff entering the bio-retention zones will be treated through infiltrating the runoff into the planting soil bed. Calculations for determining the required water quality volume is included in Appendix H. A maximum ponding depth of six inches has been provided as well as a mulch layer on top of the planting soil bed. Criteria for the planting soil are outlined in the site plan set.
  Appendix H.2 has all the bio-retention zone calculations. The calculations indicate the required water quality volume, required planting bed area based on the required water quality volume of the bio-retention zone. The calculation also indicates the provided water quality volume and provided filter bed area.

- Landscaping: A detailed landscaping plan is to be provided in the plan set.

- Maintenance: The bioretention area will be monitored on a monthly basis and after heavy rain events for sediment accumulation. In addition, any areas needing to be re-mulched, dead or diseased plants will be replaced at this time. Any sediment removed from the site shall be tested for contamination and disposed of offsite in accordance with local laws and regulations.

4.4.2 Existing Pond

- General Description: An Existing Pond is proposed to provide water quality volume for the proposed construction of new and 25% of the disturbed impervious area.

- Inlet Protection: Inlet protection for the pond will be provided in the form of a rip-rap protection.

- Outfall Protection: The outfall point from the existing pond is a concrete weir

- Pretreatment: Pretreatment for the stormwater pond is provided in the Bio-retention areas.

- Water Quality Volume: The water quality provided in the existing pond is being used toward our total water quality volume.

- Pond Maintenance: The pond outlet should be inspected monthly and after any large rain events.

SECTION 5: Inspections

5.1 Site Inspection Frequency:

The owner or operator shall have a qualified inspector to conduct site inspections in conformance with the following requirements.

- When soil disturbances are ongoing inspections shall be conducted by a qualified professional at least every seven (7) calendar days.

- When soil disturbance activities have been temporarily suspended (winter shutdown etc.) and temporary stabilization measures have been applied to all disturbed areas, the qualified inspector shall conduct a site inspection at least once every thirty (30) calendar days. The owner or operator must notify the Town of Marlborough in writing prior to reducing the inspection frequency.

- For sites where the soil disturbance activities have been shut down with partial project completion, the qualified inspector can stop conducting inspections if all areas disturbed as of the project shutdown date have achieved final stabilization and all post-construction stormwater management practices required for the completion of the project portion are in place and constructed in accordance with the SWPPP. The owner or operator shall notify the Town of Marlborough in writing prior to the shutdown. If soil disturbance is not resumed within 2 years from the shutdown date the owner operator shall have the qualified inspector perform a final inspection to certify all disturbed areas have achieved final stabilization, and all temporary, structural erosion and sediment control measures have been removed; and all post-construction stormwater management practices have been constructed in conformance with the SWPPP by signing the “Final Stabilization” and “Post-Construction Stormwater Management Practice” certification statements on the Notice of Termination. The completed Notice of Termination shall be submitted to NYS DEC.

5.2 Site Inspection Reports:

The qualified inspector shall prepare an inspection report subsequent to each and every inspection. All Inspection reports must be signed by a qualified inspector. At a minimum, the inspection report shall include and/or address the following:

1. Date and time of inspection;

2. Name and title of person(s) performing inspection;

3. A description of the weather and soil conditions (e.g. dry, wet, saturated) at the time of the inspection;

4. A description of the condition of the runoff at all points of discharge from the construction site. This shall include identification of any discharges of sediment from the construction site. Include discharges from conveyance systems (i.e. pipes, culverts, ditches, etc.) and overland flow;

5. Identification of all erosion and sediment control practices that need repair or maintenance;

6. Identification of all erosion and sediment control practices that were not installed properly or are not functioning as designed and need to be reinstalled or replaced;

7. Description and sketch of areas that are disturbed at the time of the inspection and areas that have been stabilized (temporary and/or final) since the last inspection;

8. Current phase of construction of all post-construction stormwater management practices and identification of all construction that is not in conformance with the SWPPP and technical standards; and

9. Corrective action(s) that must be taken to install, repair, replace or maintain erosion and sediment control practices; and to correct deficiencies identified with the construction of the post-construction stormwater management practice(s).

(See Appendix B for Inspection Forms)

5.3 Corrective Actions:

Within one business day of the completion of an inspection, the qualified inspector shall notify the owner or operator and appropriate contractor (or subcontractor) of any corrective actions that need to be taken. The contractor (or subcontractor) shall begin implementing the corrective actions within one business day of this notification and shall complete the corrective actions in a reasonable time frame.

(See Appendix C for Corrective Action Log)

SECTION 6: Reporting and Retention of Records

6.1 Record Keeping:

The following documents shall be retained for a period of five (5) years from the date the site achieves final stabilization:

1. Notice of Intent
2. Notice of Intent Acknowledgment Letter
3. SWPPP
4. Reports and inspections generated during implementation of the plan
5. Notice of Termination

SECTION 7: Stabilization

7.1 Final Stabilization:

Permanent seeding will be applied immediately after the final design grades are achieved on portions of the site but no later than 14 days after construction activities have permanently ceased. Construction debris, trash and temporary BMPs (including silt fences, material storage areas, sanitary toilets, and inlet protection etc.) will also be removed and any areas disturbed during removal will be seeded immediately.

Seedbed Preparation:

1. In areas where disturbance results in subsoil being the final grade surface, topsoil will be spread over the finished area at minimum depth of 6 inches.
2. The seedbed will be free of large clods, rocks, woody debris and other objectionable materials.
3. Fertilizer and lime will be applied to the seedbed according to the manufacturer's recommendations or soil tests.
4. The top layer of soil will be loosened to a depth of 3–5 inches by raking, tilling, disking or other suitable means.

See accompanying plans for seed and application rates.

SECTION 8: Contractor Certifications

- **Contractors Certification**

"I hereby certify under penalty of law that I understand and agree to comply with the terms and conditions of the SWPPP and agree to implement any corrective actions identified by the qualified inspector during a site inspection. I also understand that the owner or operator must comply with the terms and conditions of the most current version of the New York State Pollutant Discharge Elimination System ("SPDES") general permit for stormwater discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards. Furthermore, I am aware that there are significant penalties for submitting false information, that I do not believe to be true, including the possibility of fine and imprisonment for knowing violations"

Contractor #1:

Name (please print): _____

Title _____ **Date:** _____

Address: _____

Phone: _____ **Email:** _____

Signature: _____

Contractor #2:

Name (please print): _____

Title _____ **Date:** _____

Address: _____

Phone: _____ **Email:** _____

Signature: _____

Appendices available electronically upon request

Appendix A

Pre-Construction Meeting Documents and Inspection

I. PRE-CONSTRUCTION MEETING DOCUMENTS

Project Name_____
Permit No._____ **Date of Authorization**_____
Name of Operator _____
Prime Contractor _____

a. Preamble to Site Assessment and Inspections -The Following Information To Be Read By All Person's Involved in The Construction of Stormwater Related Activities:

The Operator agrees to have a qualified professional[1] conduct an assessment of the site prior to the commencement of construction[2] and certify in this inspection report that the appropriate erosion and sediment controls described in the SWPPP have been adequately installed or implemented to ensure overall preparedness of the site for the commencement of construction.

Prior to the commencement of construction, the Operator shall certify in this site logbook that the SWPPP has been prepared in accordance with the State's standards and meets all Federal, State and local erosion and sediment control requirements.

When construction starts, site inspections shall be conducted by the qualified professional at least every 7 calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater (Construction Duration Inspections). The Operator shall maintain a record of all inspection reports in this site logbook. The site logbook shall be maintained on site and be made available to the permitting authorities upon request. The Operator shall post at the site, in a publicly accessible location, a summary of the site inspection activities on a monthly basis (Monthly Summary Report).

The operator shall also prepare a written summary of compliance with this general permit at a minimum frequency of every three months (Operator's Compliance Response Form), while coverage exists. The summary should address the status of achieving each component of the SWPPP.

Prior to filing the Notice of Termination or the end of permit term, the Operator shall have a qualified professional perform a final site inspection. The qualified professional shall certify that the site has undergone final stabilization[3] using either vegetative or structural stabilization methods and that all temporary erosion and sediment controls (such as silt fencing) not needed for long-term erosion control have been removed. In addition, the Operator must identify and certify that all permanent structures described in the SWPPP have been constructed and provide the owner(s) with an operation and maintenance plan that ensures the structure(s) continuously functions as designed.

1 "Qualified Professional means a person knowledgeable in the principles and practice of erosion and sediment controls, such as a Certified Professional in Erosion and Sediment Control (CPESC), soil scientist, licensed engineer or someone working under the direction and supervision of a licensed engineer (person must have experience in the principles and practices of erosion and sediment control).
2 "Commencement of construction" means the initial removal of vegetation and disturbance of soils associated with clearing, grading or excavating activities or other construction activities.
3 "Final stabilization" means that all soil-disturbing activities at the site have been completed and a uniform, perennial vegetative cover with a density of eighty (80) percent has been established or equivalent stabilization measures (such as the use of mulches or geotextiles)

have been employed on all unpaved areas and areas not covered by permanent structures.

b. Pre-construction Site Assessment Checklist

(NOTE: Provide comments below as necessary)

1. Notice of Intent, SWPPP, and Contractors Certification:

Yes No NA
[ ] [ ] [ ] Has a Notice of Intent been filed with the NYS Department of Conservation?
[ ] [ ] [ ] Is the SWPPP on-site? Where?_____
[ ] [ ] [ ] Is the Plan current? What is the latest revision date?_____
[ ] [ ] [ ] Is a copy of the NOI (with brief description) onsite? Where?_____
[ ] [ ] [ ] Have all contractors involved with stormwater related activities signed a contractor's certification?

2. Resource Protection

Yes No NA
[ ] [ ] [ ] Are construction limits clearly flagged or fenced?
[ ] [ ] [ ] Important trees and associated rooting zones, on-site septic system absorption fields, existing vegetated areas suitable for filter strips, especially in perimeter areas, have been flagged for protection.
[ ] [ ] [ ] Creek crossings installed prior to land-disturbing activity, including clearing and blasting.

3. Surface Water Protection

Yes No NA
[ ] [ ] [ ] Clean stormwater runoff has been diverted from areas to be disturbed.
[ ] [ ] [ ] Bodies of water located either on site or in the vicinity of the site have been identified and protected.
[ ] [ ] [ ] Appropriate practices to protect on-site or downstream surface water are installed.
[ ] [ ] [ ] Are clearing and grading operations divided into areas <5 acres?

4. Stabilized Construction Entrance

Yes No NA
[ ] [ ] [ ] A temporary construction entrance to capture mud and debris from construction vehicles before they enter the public highway has been installed.
[ ] [ ] [ ] Other access areas (entrances, construction routes, equipment parking areas) are stabilized immediately as work takes place with gravel or other cover.
[ ] [ ] [ ] Sediment tracked onto public streets is removed or cleaned on a regular basis.

5. Perimeter Sediment Controls

Yes No NA
[ ] [ ] [ ] Silt fence material and installation comply with the standard drawing and specifications.
[ ] [ ] [ ] Silt fences are installed at appropriate spacing intervals
[ ] [ ] [ ] Sediment/detention basin was installed as first land disturbing activity.
[ ] [ ] [ ] Sediment traps and barriers are installed.

6. Pollution Prevention for Waste and Hazardous Materials

Yes No NA
[ ] [ ] [ ] The Operator or designated representative has been assigned to implement the spill prevention avoidance and response plan.
[ ] [ ] [ ] The plan is contained in the SWPPP on page _____
[ ] [ ] [ ] Appropriate materials to control spills are onsite. Where? _____

Appendix B

Weekly Construction Inspection Reports

Weekly Stormwater Construction Site Inspection Report

General Information			
Project Name			
NPDES Tracking No.		**Location**	
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1		❑Yes ❑No	❑Yes ❑No	
2		❑Yes ❑No	❑Yes ❑No	
3		❑Yes ❑No	❑Yes ❑No	
4		❑Yes ❑No	❑Yes ❑No	
5		❑Yes ❑No	❑Yes ❑No	
6		❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	
8		❑Yes ❑No	❑Yes ❑No	
9		❑Yes ❑No	❑Yes ❑No	
10		❑Yes ❑No	❑Yes ❑No	

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
11		❑Yes ❑No	❑Yes ❑No	
12		❑Yes ❑No	❑Yes ❑No	
13		❑Yes ❑No	❑Yes ❑No	
14		❑Yes ❑No	❑Yes ❑No	
15		❑Yes ❑No	❑Yes ❑No	
16		❑Yes ❑No	❑Yes ❑No	
17		❑Yes ❑No	❑Yes ❑No	
18		❑Yes ❑No	❑Yes ❑No	
19		❑Yes ❑No	❑Yes ❑No	
20		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	Are washout facilities (e.g., paint, stucco,	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
	concrete) available, clearly marked, and maintained?			
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature:_____ **Date:**_____

CONSTRUCTION DURATION INSPECTION

SITE PLAN/SKETCH

Inspector (print name)	**Date of Inspection**
Qualified Professional (print name)	**Qualified Professional Signature**

The above signed acknowledges that, to the best of his/her knowledge, all information provided on the forms is accurate and complete.

Appendix C

Corrective Action Log

Corrective Action Log

Inspection Date	Inspector Name(s)	Description of BMP Deficiency	Corrective Action Needed (including planned date/responsible person)	Date Action Taken/Responsible person

Appendix D

1. **Notice of Intent**
2. **Letter of Acknowledgment**
3. **OPRHP Clearance Letter**
4. **MS4 SWPPP acceptance form**

Appendix D.1

Notice of Intent

Appendix D.2

Letter of Acknowledgement

Appendix D.3

OPRHP Clearance Letter

Appendix D.4

MS4 SWPPP Acceptance Form

NYS Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505

MS4 Stormwater Pollution Prevention Plan (SWPPP) Acceptance Form

for

Construction Activities Seeking Authorization Under SPDES General Permit

*(NOTE: Attach Completed Form to Notice Of Intent and Submit to Address Above)

I. Project Owner/Operator Information
1. Owner/Operator Name:
2. Contact Person:
3. Street Address:
4. City/State/Zip:
II. Project Site Information
5. Project/Site Name:
6. Street Address:
7. City/State/Zip:
III. Stormwater Pollution Prevention Plan (SWPPP) Review and Acceptance Information
8. SWPPP Reviewed by:
9. Title/Position:
10. Date Final SWPPP Reviewed and Accepted:
IV. Regulated MS4 Information
11. Name of MS4:
12. MS4 SPDES Permit Identification Number: NYR20A
13. Contact Person:
14. Street Address:
15. City/State/Zip:
16. Telephone Number:

MS4 SWPPP Acceptance Form - continued

V. Certification Statement - MS4 Official (principal executive officer or ranking elected official) or Duly Authorized Representative

I hereby certify that the final Stormwater Pollution Prevention Plan (SWPPP) for the construction project identified in question 5 has been reviewed and meets the substantive requirements in the SPDES General Permit For Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s). Note: The MS4, through the acceptance of the SWPPP, assumes no responsibility for the accuracy and adequacy of the design included in the SWPPP. In addition, review and acceptance of the SWPPP by the MS4 does not relieve the owner/operator or their SWPPP preparer of responsibility or liability for errors or omissions in the plan.

Printed Name:

Title/Position:

Signature:

Date:

VI. Additional Information

(NYS DEC - MS4 SWPPP Acceptance Form - January 2015)

Appendix E

Notice of Termination

New York State Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505
(NOTE: Submit completed form to address above)

NOTICE OF TERMINATION for Storm Water Discharges Authorized under the SPDES General Permit for Construction Activity

Please indicate your permit identification number: NYR ___ ___ ___ ___ ___ ___

I. Owner or Operator Information

1. Owner/Operator Name:

2. Street Address:

3. City/State/Zip:

4. Contact Person: | 4a.Telephone:

4b. Contact Person E-Mail:

II. Project Site Information

5. Project/Site Name:

6. Street Address:

7. City/Zip:

8. County:

III. Reason for Termination

9a. □ All disturbed areas have achieved final stabilization in accordance with the general permit and SWPPP. ***Date final stabilization completed** (month/year): _____

9b. □ Permit coverage has been transferred to new owner/operator. Indicate new owner/operator's permit identification number: NYR ___ ___ ___ ___ ___ ___
(Note: Permit coverage can not be terminated by owner identified in I.1. above until new owner/operator obtains coverage under the general permit)

9c. □ Other (Explain on Page 2)

IV. Final Site Information:

10a. Did this construction activity require the development of a SWPPP that includes post-construction stormwater management practices? □ yes □ no (If no, go to question 10f.)

10b. Have all post-construction stormwater management practices included in the final SWPPP been constructed? □ yes □ no (If no, explain on Page 2)

10c. Identify the entity responsible for long-term operation and maintenance of practice(s)?

_____

NOTICE OF TERMINATION for Storm Water Discharges Authorized under the SPDES General Permit for Construction Activity - continued

10d. Has the entity responsible for long-term operation and maintenance been given a copy of the operation and maintenance plan required by the general permit? □ yes □ no

10e. Indicate the method used to ensure long-term operation and maintenance of the post-construction stormwater management practice(s):

□ Post-construction stormwater management practice(s) and any right-of-way(s) needed to maintain practice(s) have been deeded to the municipality.

□ Executed maintenance agreement is in place with the municipality that will maintain the post-construction stormwater management practice(s).

□ For post-construction stormwater management practices that are privately owned, a mechanism is in place that requires operation and maintenance of the practice(s) in accordance with the operation and maintenance plan, such as a deed covenant in the owner or operator's deed of record.

□ For post-construction stormwater management practices that are owned by a public or private institution (e.g. school, university or hospital), government agency or authority, or public utility; policy and procedures are in place that ensures operation and maintenance of the practice(s) in accordance with the operation and maintenance plan.

10f. Provide the total area of impervious surface (i.e. roof, pavement, concrete, gravel, etc.) constructed within the disturbance area? _____ (acres)

11. Is this project subject to the requirements of a regulated, traditional land use control MS4? □ yes □ no

(If Yes, complete section VI - "MS4 Acceptance" statement

V. Additional Information/Explanation:

(Use this section to answer questions 9c. and 10b., if applicable)

VI. MS4 Acceptance - MS4 Official (principal executive officer or ranking elected official) or Duly Authorized Representative (Note: Not required when 9b. is checked -transfer of coverage)

I have determined that it is acceptable for the owner or operator of the construction project identified in question 5 to submit the Notice of Termination at this time.

Printed Name:	
Title/Position:	
Signature:	Date:

NOTICE OF TERMINATION for Storm Water Discharges Authorized under the SPDES General Permit for Construction Activity - continued

VII. Qualified Inspector Certification - Final Stabilization:

I hereby certify that all disturbed areas have achieved final stabilization as defined in the current version of the general permit, and that all temporary, structural erosion and sediment control measures have been removed. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

Printed Name:	
Title/Position:	
Signature:	Date:

VIII. Qualified Inspector Certification - Post-construction Stormwater Management Practice(s):

I hereby certify that all post-construction stormwater management practices have been constructed in conformance with the SWPPP. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

Printed Name:	
Title/Position:	
Signature:	Date:

IX. Owner or Operator Certification

I hereby certify that this document was prepared by me or under my direction or supervision. My determination, based upon my inquiry of the person(s) who managed the construction activity, or those persons directly responsible for gathering the information, is that the information provided in this document is true, accurate and complete. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of the referenced permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

Printed Name:	
Title/Position:	
Signature:	Date:

(NYS DEC Notice of Termination - January 2015)

Appendix F

BMP Construction/Installation Guidelines

Stormwater/Wetland Pond Construction Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
Pre-Construction/Materials and Equipment		
Pre-construction meeting		
Pipe and appurtenances on-site prior to construction and dimensions checked		
1. Material (including protective coating, if specified)		
2. Diameter		
3. Dimensions of metal riser or pre-cast concrete outlet structure		
4. Required dimensions between water control structures (orifices, weirs, etc.) are in accordance with approved plans		
5. Barrel stub for prefabricated pipe structures at proper angle for design barrel slope		
6. Number and dimensions of prefabricated anti-seep collars		
7. Watertight connectors and gaskets		
8. Outlet drain valve		
Project benchmark near pond site		
Equipment for temporary de-watering		

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
2. Subgrade Preparation		
Area beneath embankment stripped of all vegetation, topsoil, and organic matter		
3. Pipe Spillway Installation		
Method of installation detailed on plans		
A. Bed preparation		
Installation trench excavated with specified side slopes		
Stable, uniform, dry subgrade of relatively impervious material (If subgrade is wet, contractor shall have defined steps before proceeding with installation)		
Invert at proper elevation and grade		
B. Pipe placement		
Metal / plastic pipe		
1. Watertight connectors and gaskets properly installed		
2. Anti-seep collars properly spaced and having watertight connections to pipe		
3. Backfill placed and tamped by hand under “haunches” of pipe		
4. Remaining backfill placed in max. 8 inch lifts using small power tamping equipment until 2 feet cover over pipe is reached		

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
3. Pipe Spillway Installation		
Concrete pipe		
1. Pipe set on blocks or concrete slab for pouring of low cradle		
2. Pipe installed with rubber gasket joints with no spalling in gasket interface area		
3. Excavation for lower half of anti-seep collar(s) with reinforcing steel set		
4. Entire area where anti-seep collar(s) will come in contact with pipe coated with mastic or other approved waterproof sealant		
5. Low cradle and bottom half of anti-seep collar installed as monolithic pour and of an approved mix		
6. Upper half of anti-seep collar(s) formed with reinforcing steel set		
7. Concrete for collar of an approved mix and vibrated into place (protected from freezing while curing, if necessary)		
8. Forms stripped and collar inspected for honeycomb prior to backfilling. Parge if necessary.		
C. Backfilling		
Fill placed in maximum 8 inch lifts		
Backfill taken minimum 2 feet above top of anti-seep collar elevation before traversing with heavy equipment		

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
4. Riser / Outlet Structure Installation		
Riser located within embankment		
A. Metal riser		
Riser base excavated or formed on stable subgrade to design dimensions		
Set on blocks to design elevations and plumbed		
Reinforcing bars placed at right angles and projecting into sides of riser		
Concrete poured so as to fill inside of riser to invert of barrel		
B. Pre-cast concrete structure		
Dry and stable subgrade		
Riser base set to design elevation		
If more than one section, no spalling in gasket interface area; gasket or approved caulking material placed securely		
Watertight and structurally sound collar or gasket joint where structure connects to pipe spillway		
C. Poured concrete structure		
Footing excavated or formed on stable subgrade, to design dimensions with reinforcing steel set		
Structure formed to design dimensions, with reinforcing steel set as per plan		
Concrete of an approved mix and vibrated into place (protected from freezing while curing, if necessary)		
Forms stripped & inspected for “honeycomb” prior to backfilling; parge if necessary		

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
5. Embankment Construction		
Fill material		
Compaction		
Embankment		
1. Fill placed in specified lifts and compacted with appropriate equipment		
2. Constructed to design cross-section, side slopes and top width		
3. Constructed to design elevation plus allowance for settlement		
6. Impounded Area Construction		
Excavated / graded to design contours and side slopes		
Inlet pipes have adequate outfall protection		
Forebay(s)		
Pond benches		
7. Earth Emergency Spillway Construction		
Spillway located in cut or structurally stabilized with riprap, gabions, concrete, etc.		
Excavated to proper cross-section, side slopes and bottom width		
Entrance channel, crest, and exit channel constructed to design grades and elevations		

CONSTRUCTION SEQUENCE	SATISFACTORY / UNSATISFACTORY	COMMENTS
8. Outlet Protection		
A. End section		
Securely in place and properly backfilled		
B. Endwall		
Footing excavated or formed on stable subgrade, to design dimensions and reinforcing steel set, if specified		
Endwall formed to design dimensions with reinforcing steel set as per plan		
Concrete of an approved mix and vibrated into place (protected from freezing, if necessary)		
Forms stripped and structure inspected for "honeycomb" prior to backfilling; parge if necessary		
C. Riprap apron / channel		
Apron / channel excavated to design cross-section with proper transition to existing ground		
Filter fabric in place		
Stone sized as per plan and uniformly place at the thickness specified		
9. Vegetative Stabilization		
Approved seed mixture or sod		
Proper surface preparation and required soil amendments		
Excelsior mat or other stabilization, as per plan		

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
10. Miscellaneous		
Drain for ponds having a permanent pool		
Trash rack / anti-vortex device secured to outlet structure		
Trash protection for low flow pipes, orifices, etc.		
Fencing (when required)		
Access road		
Set aside for clean-out maintenance		
11. Stormwater Wetlands		
Adequate water balance		
Variety of depth zones present		
Approved pondscaping plan in place Reinforcement budget for additional plantings		
Plants and materials ordered 6 months prior to construction		
Construction planned to allow for adequate planting and establishment of plant community (April-June planting window)		
Wetland buffer area preserved to maximum extent possible		

Comments:

Actions to be Taken:

Bioretention Construction Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
1. Pre-Construction		
Pre-construction meeting		
Runoff diverted		
Facility area cleared		
If designed as exfilter, soil testing for permeability		
Facility location staked out		
2. Excavation		
Size and location		
Lateral slopes completely level		
If designed as exfilter, ensure that excavation does not compact susoils.		
Longitudinal slopes within design range		

CONSTRUCTION SEQUENCE	SATISFACTORY / UNSATISFACTORY	COMMENTS
3. Structural Components		
Stone diaphragm installed correctly		
Outlets installed correctly		
Underdrain		
Pretreatment devices installed		
Soil bed composition and texture		
4. Vegetation		
Complies with planting specs		
Topsoil adequate in composition and placement		
Adequate erosion control measures in place		
5. Final Inspection		
Dimensions		
Proper stone diaphragm		
Proper outlet		
Soil/ filter bed permeability testing		
Effective stand of vegetation and stabilization		
Construction generated sediments removed		
Contributing watershed stabilized before flow is diverted to the practice		

Comments:

Actions to be Taken:

Open Channel System Construction Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

CONSTRUCTION SEQUENCE	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Pre-Construction		
Pre-construction meeting		
Runoff diverted		
Facility location staked out		
2. Excavation		
Size and location		
Side slope stable		
Soil permeability		
Groundwater / bedrock		
Lateral slopes completely level		
Longitudinal slopes within design range		
Excavation does not compact subsoils		
3. Check dams		
Dimensions		
Spacing		
Materials		

CONSTRUCTION SEQUENCE	SATISFACTORY / UNSATISFACTORY	COMMENTS
4. Structural Components		
Underdrain installed correctly		
Inflow installed correctly		
Pretreatment devices installed		
5. Vegetation		
Complies with planting specifications		
Topsoil adequate in composition and placement		
Adequate erosion control measures in place		
6. Final inspection		
Dimensions		
Check dams		
Proper outlet		
Effective stand of vegetation and stabilization		
Contributing watershed stabilized before flow is routed to the factility		

Comments:

Actions to be Taken:

Appendix G

BMP Long-Term Maintenance and Operation

Stormwater Pond/Wetland Operation, Maintenance and Management Inspection Checklist

Project _____
Location: _____
Site Status: _____

Date: _____
Time: _____

Inspector: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Embankment and emergency spillway (Annual, After Major Storms)		
1. Vegetation and ground cover adequate		
2. Embankment erosion		
3. Animal burrows		
4. Unauthorized planting		
5. Cracking, bulging, or sliding of dam		
a. Upstream face		
b. Downstream face		
c. At or beyond toe		
downstream		
upstream		
d. Emergency spillway		
6.Pond, toe & chimney drains clear and functioning		
7.Seeps/leaks on downstream face		
8.Slope protection or riprap failure		
9. Vertical/horizontal alignment of top of dam “As-Built”		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
10. Emergency spillway clear of obstructions and debris		
11. Other (specify)		
2. Riser and principal spillway (Annual)		
Type: Reinforced concrete _____ Corrugated pipe _____ Masonry _____ 1. Low flow orifice obstructed		
2. Low flow trash rack. a. Debris removal necessary		
b. Corrosion control		
3. Weir trash rack maintenance a. Debris removal necessary		
b. corrosion control		
4. Excessive sediment accumulation insider riser		
5. Concrete/masonry condition riser and barrels a. cracks or displacement		
b. Minor spalling (<1")		
c. Major spalling (rebars exposed)		
d. Joint failures		
e. Water tightness		
6. Metal pipe condition		
7. Control valve a. Operational/exercised		
b. Chained and locked		
8. Pond drain valve a. Operational/exercised		
b. Chained and locked		
9. Outfall channels functioning		
10. Other (specify)		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
3. Permanent Pool (Wet Ponds) (monthly)		
1. Undesirable vegetative growth		
2. Floating or floatable debris removal required		
3. Visible pollution		
4. Shoreline problem		
5. Other (specify)		
4. Sediment Forebays		
1.Sedimentation noted		
2. Sediment cleanout when depth < 50% design depth		
5. Dry Pond Areas		
1. Vegetation adequate		
2. Undesirable vegetative growth		
3. Undesirable woody vegetation		
4. Low flow channels clear of obstructions		
5. Standing water or wet spots		
6. Sediment and / or trash accumulation		
7. Other (specify)		
6. Condition of Outfalls (Annual , After Major Storms)		
1. Riprap failures		
2. Slope erosion		
3. Storm drain pipes		
4.Endwalls / Headwalls		
5. Other (specify)		
7. Other (Monthly)		
1. Encroachment on pond, wetland or easement area		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
2. Complaints from residents		
3.Aesthetics a. Grass growing required		
b. Graffiti removal needed		
c. Other (specify)		
4. Conditions of maintenance access routes.		
5. Signs of hydrocarbon build-up		
6. Any public hazards (specify)		
8. Wetland Vegetation (Annual)		
1. Vegetation healthy and growing Wetland maintaining 50% surface area coverage of wetland plants after the second growing season. (If unsatisfactory, reinforcement plantings needed)		
2. Dominant wetland plants: Survival of desired wetland plant species Distribution according to landscaping plan?		
3. Evidence of invasive species		
4. Maintenance of adequate water depths for desired wetland plant species		
5. Harvesting of emergent plantings needed		
6. Have sediment accumulations reduced pool volume significantly or are plants “choked” with sediment		
7. Eutrophication level of the wetland.		
8. Other (specify)		

Comments:

Actions to be Taken:

Bioretention Operation, Maintenance and Management Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Monthly)		
Bioretention and contributing areas clean of debris		
No dumping of yard wastes into practice		
Litter (branches, etc.) have been removed		
2. Vegetation (Monthly)		
Plant height not less than design water depth		
Fertilized per specifications		
Plant composition according to approved plans		
No placement of inappropriate plants		
Grass height not greater than 6 inches		
No evidence of erosion		
3. Check Dams/Energy Dissipaters/Sumps (Annual, After Major Storms)		
No evidence of sediment buildup		

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
Sumps should not be more than 50% full of sediment		
No evidence of erosion at downstream toe of drop structure		
4. Dewatering (Monthly)		
Dewaters between storms		
No evidence of standing water		
5. Sediment Deposition (Annual)		
Swale clean of sediments		
Sediments should not be > 20% of swale design depth		
6. Outlet/Overflow Spillway (Annual, After Major Storms)		
Good condition, no need for repair		
No evidence of erosion		
No evidence of any blockages		
7. Integrity of Filter Bed (Annual)		
Filter bed has not been blocked or filled inappropriately		

Comments:

Actions to be Taken:

Open Channel Operation, Maintenance, and Management Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY/ UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Monthly)		
Contributing areas clean of debris		
2. Check Dams or Energy Dissipators (Annual, After Major Storms)		
No evidence of flow going around structures		
No evidence of erosion at downstream toe		
Soil permeability		
Groundwater / bedrock		
3. Vegetation (Monthly)		
Mowing done when needed		
Minimum mowing depth not exceeded		
No evidence of erosion		
Fertilized per specification		
4. Dewatering (Monthly)		
Dewaters between storms		

MAINTENANCE ITEM	SATISFACTORY/ UNSATISFACTORY	COMMENTS
5. Sediment deposition (Annual)		
Clean of sediment		
6. Outlet/Overflow Spillway (Annual)		
Good condition, no need for repairs		
No evidence of erosion		

Comments:

Actions to be Taken:

Appendix H

H.1 Water Quality Volume Calculations
H.2 Bioretention Area Calculations
H.3 Soil Survey
H.4 Site Vicinity Map
H.5 HydroCAD Calculations
H.6 Drainage Area Maps

Appendix H.1

Water Quality Volume Calculations
And Runoff Reduction Volume

Version 1.8
Last Updated: 11/09/2015

Total Water Quality Volume Calculation
WQv(acre-feet) = [(P)(Rv)(A)] /12

Is this project subject to Chapter 10 of the NYS Design Manual (i.e. WQv is equal to post-development 1 year runoff volume)?.....	No

Design Point:	Milton	
P=	1.40	*inch*

Manually enter P, Total Area and Impervious Cover.

Breakdown of Subcatchments

Catchment Number	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Rv	WQv *(ft^3)*	Description
1	62.00	2.60	4%	0.09	27,646	
2						
3						
4						
5						
6						
7						
8						
9						
10						
Subtotal (1-30)	62.00	2.60	4%	0.09	**27,646**	**Subtotal 1**
Total	62.00	2.60	4%	0.09	**27,646**	**Initial WQv**

Identify Runoff Reduction Techniques By Area

Technique	Total Contributing Area *(Acre)*	Contributing Impervious Area *(Acre)*	Notes
Conservation of Natural Areas	0.00	0.00	*minimum 10,000 sf*
Riparian Buffers	0.00	0.00	*maximum contributing length 75 feet to 150 feet*
Filter Strips	0.00	0.00	
Tree Planting	0.00	0.00	*Up to 100 sf directly connected impervious area may be subtracted per tree*
Total	**0.00**	**0.00**	

Recalculate WQv after application of Area Reduction Techniques

	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Runoff Coefficient Rv	WQv *(ft^3)*
"<<Initial WQv"	62.00	2.60	4%	0.09	27,646
Subtract Area	0.00	0.00			
WQv adjusted after Area Reductions	**62.00**	**2.60**	4%	0.09	27,646
Disconnection of Rooftops		0.00			
Adjusted WQv after Area Reduction and Rooftop Disconnect	62.00	2.60	4%	0.09	**27,646**

Minimum RRv

Enter the Soils Data for the site		
Soil Group	Acres	S
A	27.90	55%
B	4.30	40%
C	14.90	30%
D	**14.90**	20%
Total Area	62	
Calculate the Minimum RRv		
S =	**0.40**	
Impervious =	2.60	*acre*
Precipitation	1.4	*in*
Rv	0.95	
Minimum RRv	**4,963**	***ft3***
	0.11	af

Appendix H.2

Bioretention Calculations

Total Water Quality Volume Calculation

WQv(acre-feet) = [(P)(Rv)(A)] /12

All Subcatchments						
Catchment	**Total Area** *(Acres)*	**Impervious Cover** *(Acres)*	**Percent Impervious** *%*	**Runoff Coefficient** *Rv*	**WQv** *(ft^3)*	**Description**
1	0.36	0.29	0.81	0.78	1417.88	BIO #1
2	0.43	0.32	0.74	0.72	1,573	BIO #2
3	0.38	0.31	0.82	0.78	1514.44	BIO #3
4	0.30	0.20	0.67	0.65	990.99	BIO #4
5	0.95	0.69	0.73	0.70	3397.32	BIO #5
6	0.35	0.17	0.49	0.49	866.48	BIO #6
7	0.53	0.31	0.58	0.58	1552.55	BIO #7
8	0.55	0.29	0.53	0.52	1466.16	BIO #8
9	1.70	1.00	0.59	0.58	5005.77	BIO #9
10	0.91	0.23	0.25	0.28	1283.21	BIO #10
11	3.61	0.19	0.05	0.10	1786.32	BIO #11
12	0.79	0.18	0.23	0.26	1024.02	BIO #12
13	0.52	0.12	0.23	0.26	680.99	BIO #13
14	0.66	0.13	0.20	0.23	762.30	BIO #14
15	0.56	0.05	0.09	0.13	370.99	DS #1
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

Bioretention Worksheet

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k — The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor &

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
1	0.36	0.29	0.81	0.78	1417.88	1.40	BIO #1
Enter Impervious Area Reduced by Disconnection of Rooftops			81%	0.78	1,418	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Soil Information			
Soil Group	D		
Soil Infiltration Rate	0.40	*in/hour*	*Okay*
Using Underdrains?	Yes	*Okay*	

Calculate the Minimum Filter Area				
		Value	Units	Notes
WQv		1,418	*ft^3*	
Enter Depth of Soil Media	*df*	2.5	*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity	*k*	0.5	*ft/day*	
Enter Average Height of Ponding	*hf*	0.5	*ft*	*6 inches max.*
Enter Filter Time	*tf*	2	*days*	
Required Filter Area	***Af***	**1182**	***ft^2***	

Determine Actual Bio-Retention Area			
Filter Width	9	*ft*	
Filter Length	145	*ft*	
Filter Area	1305	*ft^2*	
Actual Volume Provided	1566	*ft^3*	

Determine Runoff Reduction				
Is the Bioretention contributing flow to another practice?			Select Practice	
RRv	626			
RRv applied	**626**	***ft^3***	***This is 40% of the storage provided or WQv whichever is less.***	
Volume Treated	791	*ft^3*	*This is the portion of the WQv that is not reduced in the practice.*	
Volume Directed	0	*ft^3*	This volume is directed another practice	

Bioretention Worksheet

Sizing √	OK		*Check to be sure Area provided ≥ Af*

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k — The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor & Schueler, 1996)

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
2	0.43	0.32	0.74	0.72	1572.88	1.40	BIO #2
Enter Impervious Area Reduced by Disconnection of Rooftops			74%	0.72	1,573	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Soil Information			
Soil Group	D		
Soil Infiltration Rate	0.40	*in/hour*	*Okay*
Using Underdrains?	Yes	*Okay*	

Calculate the Minimum Filter Area				
		Value	Units	Notes
WQv		1,573	*ft^3*	
Enter Depth of Soil Media	*df*	2.5	*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity	*k*	0.5	*ft/day*	
Enter Average Height of Ponding	*hf*	0.5	*ft*	*6 inches max.*
Enter Filter Time	*tf*	2	*days*	
Required Filter Area	***Af***	**1311**	***ft^2***	

Determine Actual Bio-Retention Area			
Filter Width	9	*ft*	
Filter Length	145	*ft*	
Filter Area	1305	*ft^2*	
Actual Volume Provided	1566	*ft^3*	

Determine Runoff Reduction				
Is the Bioretention contributing flow to another practice?			Select Practice	
RRv	626			
RRv applied	**626**	***ft^3***	***This is 40% of the storage provided or WQv whichever is less.***	
Volume Treated	946	*ft^3*	*This is the portion of the WQv that is not reduced in the practice.*	

Bioretention Worksheet

Volume Directed	0	ft^3	This volume is directed another practice
Sizing √	Error		*Check to be sure Area provided ≥ Af*

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k — The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor &

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
3	0.38	0.31	0.82	0.78	1514.44	1.40	BIO #3
Enter Impervious Area Reduced by Disconnection of Rooftops			82%	0.78	1,514	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Soil Information			
Soil Group	D		
Soil Infiltration Rate	0.40	*in/hour*	*Okay*
Using Underdrains?	Yes	*Okay*	

Calculate the Minimum Filter Area				
		Value	Units	Notes
WQv		1,514	*ft^3*	
Enter Depth of Soil Media	*df*	2.5	*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity	*k*	0.5	*ft/day*	
Enter Average Height of Ponding	*hf*	0.5	*ft*	*6 inches max.*
Enter Filter Time	*tf*	2	*days*	
Required Filter Area	***Af***	**1262**	***ft^2***	

Determine Actual Bio-Retention Area			
Filter Width	9	*ft*	
Filter Length	145	*ft*	
Filter Area	1305	*ft^2*	
Actual Volume Provided	1566	*ft^3*	

Determine Runoff Reduction				
Is the Bioretention contributing flow to another practice?			Select Practice	
RRv	626			
RRv applied	**626**	***ft^3***	***This is 40% of the storage provided or WQv whichever is less.***	

Bioretention Worksheet

Volume Treated	888	ft^3	*This is the portion of the WQv that is not reduced in the practice.*
Volume Directed	0	ft^3	This volume is directed another practice
Sizing √	OK		*Check to be sure Area provided ≥ Af*

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k — The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor &

Design Point: Marborough

Enter Site Data For Drainage Area to be Treated by Practice

Catchment Number	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Rv	WQv *(ft^3)*	Precipitation *(in)*	Description
4	0.30	0.20	0.67	0.65	990.99	1.40	BIO #4
Enter Impervious Area Reduced by Disconnection of Rooftops			67%	0.65	991	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Soil Information

Soil Group	D		
Soil Infiltration Rate	0.40	*in/hour*	*Okay*
Using Underdrains?	Yes	*Okay*	

Calculate the Minimum Filter Area

		Value	Units	Notes
WQv		991	*ft^3*	
Enter Depth of Soil Media	*df*	2.5	*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity	*k*	0.5	*ft/day*	
Enter Average Height of Ponding	*hf*	0.5	*ft*	*6 inches max.*
Enter Filter Time	*tf*	2	*days*	
Required Filter Area	***Af***	**826**	***ft^2***	

Determine Actual Bio-Retention Area

Filter Width	15	*ft*	
Filter Length	65	*ft*	
Filter Area	975	*ft^2*	
Actual Volume Provided	1170	*ft^3*	

Determine Runoff Reduction

Is the Bioretention contributing flow to another practice?		Select Practice	
RRv	468		

Bioretention Worksheet

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k — The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor &

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
5	0.95	0.69	0.73	0.70	3397.32	1.40	BIO #5
Enter Impervious Area Reduced by Disconnection of Rooftops			73%	0.70	3,397	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Soil Information			
Soil Group	D		
Soil Infiltration Rate	0.40	*in/hour*	*Okay*
Using Underdrains?	Yes	*Okay*	

Calculate the Minimum Filter Area				
		Value	Units	Notes
WQv		3,397	*ft^3*	
Enter Depth of Soil Media	*df*	2.5	*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity	*k*	0.5	*ft/day*	
Enter Average Height of Ponding	*hf*	0.5	*ft*	*6 inches max.*
Enter Filter Time	*tf*	2	*days*	
Required Filter Area	***Af***	**2831**	***ft^2***	

Determine Actual Bio-Retention Area			
Filter Width	20	*ft*	
Filter Length	100	*ft*	
Filter Area	2000	*ft^2*	
Actual Volume Provided	2400	*ft^3*	

Determine Runoff Reduction				
Is the Bioretention contributing flow to another practice?			Select Practice	
RRv	960			
RRv applied	**960**	***ft^3***	***This is 40% of the storage provided or WQv whichever is less.***	
Volume Treated	2,437	*ft^3*	*This is the portion of the WQv that is not reduced in the practice.*	
Volume Directed	0	*ft^3*	This volume is directed another practice	

Bioretention Worksheet

Sizing √	Error		*Check to be sure Area provided ≥ Af*

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k — The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor & Schueler, 1996)

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
6	0.35	0.17	0.49	0.49	866.48	1.40	BIO #6
Enter Impervious Area Reduced by Disconnection of Rooftops			49%	0.49	866	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Soil Information			
Soil Group	D		
Soil Infiltration Rate	0.40	*in/hour*	*Okay*
Using Underdrains?	Yes	*Okay*	

Calculate the Minimum Filter Area				
		Value	Units	Notes
WQv		866	*ft^3*	
Enter Depth of Soil Media	*df*	2.5	*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity	*k*	0.5	*ft/day*	
Enter Average Height of Ponding	*hf*	0.5	*ft*	*6 inches max.*
Enter Filter Time	*tf*	2	*days*	
Required Filter Area	***Af***	**722**	***ft^2***	

Determine Actual Bio-Retention Area			
Filter Width	20	*ft*	
Filter Length	40	*ft*	
Filter Area	800	*ft^2*	
Actual Volume Provided	960	*ft^3*	

Determine Runoff Reduction				
Is the Bioretention contributing flow to another practice?			Select Practice	
RRv	384			
RRv applied	**384**	***ft^3***	***This is 40% of the storage provided or WQv whichever is less.***	
Volume Treated	482	*ft^3*	*This is the portion of the WQv that is not reduced in the practice.*	

Bioretention Worksheet

Volume Directed	0	ft^3	This volume is directed another practice
Sizing √	OK		*Check to be sure Area provided ≥ Af*

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k — The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor &

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
7	0.53	0.31	0.58	0.58	1552.55	1.40	BIO #7
Enter Impervious Area Reduced by Disconnection of Rooftops			58%	0.58	1,553	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Soil Information			
Soil Group	C		
Soil Infiltration Rate	0.40	*in/hour*	*Okay*
Using Underdrains?	Yes	*Okay*	

Calculate the Minimum Filter Area				
		Value	Units	Notes
WQv		1,553	*ft^3*	
Enter Depth of Soil Media	*df*	2.5	*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity	*k*	0.5	*ft/day*	
Enter Average Height of Ponding	*hf*	0.5	*ft*	*6 inches max.*
Enter Filter Time	*tf*	2	*days*	
Required Filter Area	***Af***	**1294**	***ft^2***	

Determine Actual Bio-Retention Area			
Filter Width	18	*ft*	
Filter Length	75	*ft*	
Filter Area	1350	*ft^2*	
Actual Volume Provided	1620	*ft^3*	

Determine Runoff Reduction				
Is the Bioretention contributing flow to another practice?			Select Practice	
RRv	648			
RRv applied	**648**	***ft^3***	***This is 40% of the storage provided or WQv whichever is less.***	

Bioretention Worksheet

Volume Treated	905	ft^3	*This is the portion of the WQv that is not reduced in the practice.*
Volume Directed	0	ft^3	This volume is directed another practice
Sizing √	OK		*Check to be sure Area provided ≥ Af*

(For use on HSG C or D Soils with underdrains)

Af=WQv*(df)/[k*(hf+df)(tf)]

Af	Required Surface Area (ft2)
WQv	Water Quality Volume (ft3)
df	Depth of the Soil Medium (feet)
hf	Average height of water above the planter bed
tf	Volume Through the Filter Media (days)

k — The hydraulic conductivity [ft/day], can be varied depending on the properties of the soil media. Some reported conductivity values are: ***Sand*** - 3.5 ft/day (City of Austin 1988); ***Peat*** - 2.0 ft/day (Galli 1990); ***Leaf Compost*** - 8.7 ft/day (Claytor and Schueler, 1996); ***Bioretention Soil*** (0.5 ft/day (Claytor &

Design Point: Marborough

Enter Site Data For Drainage Area to be Treated by Practice

Catchment Number	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Rv	WQv *(ft^3)*	Precipitation *(in)*	Description
8	0.55	0.29	0.53	0.52	1466.16	1.40	BIO #8
Enter Impervious Area Reduced by Disconnection of Rooftops			53%	0.52	1,466	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Soil Information

Soil Group	C		
Soil Infiltration Rate	0.40	*in/hour*	*Okay*
Using Underdrains?	Yes	*Okay*	

Calculate the Minimum Filter Area

		Value	Units	Notes
WQv		1,466	*ft^3*	
Enter Depth of Soil Media	*df*	2.5	*ft*	*2.5-4 ft*
Enter Hydraulic Conductivity	*k*	0.5	*ft/day*	
Enter Average Height of Ponding	*hf*	0.5	*ft*	*6 inches max.*
Enter Filter Time	*tf*	2	*days*	
Required Filter Area	***Af***	**1222**	***ft^2***	

Determine Actual Bio-Retention Area

Filter Width	18	*ft*	
Filter Length	75	*ft*	
Filter Area	1350	*ft^2*	
Actual Volume Provided	1620	*ft^3*	

Determine Runoff Reduction

Is the Bioretention contributing flow to another practice?		Select Practice	
RRv	648		

Infiltrating Bioretention Worksheet

(For use on HSG A or B Soils without underdrains)

WQv ≤ VSM + VDL + (DP x ARG)

VSM = ARG x DSM x nSM

VDL (optional) = ARG x DDL x nDL

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
9	1.70	1.00	0.59	0.58	5005.77	1.40	BIO #9
Enter Impervious Area Reduced by Disconnection of Rooftops			59%	0.58	5,006	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Infiltrating Bioretention Parameters				
Treatment Volume	WQv	5,006	*ft^3*	
Enter depth of soil Media	DSM	4.00	*ft*	*2.5 - 4 ft*
Enter depth of drainage	DDL	0.50	*ft*	*≥ 0.5 ft*
Enter ponding depth above surface	DP	0.5	*ft*	*≤ 0.5*
Enter porosity of Soil Media	nSM	0.20		*≥20%*
Enter porosity of Drainage	nDL	0.40		*≥ 40%*
Required Bioretention Area	ARG	3337	*sf*	
Bioretention Area Provided		3400	*ft2*	
Native Soil Infiltration Rate		2.00	*in/hr*	*Okay*
Are you using underdrains?		No		
Total Volume Provided		5,100	*ft^3*	*Sum of storage Volume Provided in each layer*

Determine Runoff Reduction			
Runoff Reduction	**4,080**	***ft^3***	***This is 80% of storage volume provided or WQv whichever is less***
Volume Treated	926	*ft^3*	*This is the portion of the WQv that is not reduced in the practice*
Sizing √	*OK*		*Check to be sure Area provided ≥ Af*

Infiltrating Bioretention Worksheet

(For use on HSG A or B Soils without underdrains)

WQv ≤ VSM + VDL + (DP x ARG)

VSM = ARG x DSM x nSM

VDL (optional) = ARG x DDL x nDL

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
10	0.91	0.23	0.25	0.28	1283.21	1.40	BIO #10
Enter Impervious Area Reduced by Disconnection of Rooftops			25%	0.28	1,283	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Infiltrating Bioretention Parameters				
Treatment Volume	WQv	1,283	*ft^3*	
Enter depth of soil Media	DSM	2.50	*ft*	*2.5 - 4 ft*
Enter depth of drainage	DDL	0.5	*ft*	*≥ 0.5 ft*
Enter ponding depth above	DP	0.5	*ft*	*≤ 0.5*
Enter porosity of Soil Media	nSM	0.20		*≥20%*
Enter porosity of Drainage	nDL	0.40		*≥ 40%*
Required Bioretention Area	ARG	1069	*sf*	
Bioretention Area Provided		1100	*ft2*	
Native Soil Infiltration Rate		2.00	*in/hr*	*Okay*
Are you using underdrains?		No		
Total Volume Provided		1,320	*ft^3*	*Sum of storage Volume Provided in each layer*

Determine Runoff Reduction			
Runoff Reduction	**1,056**	***ft^3***	***This is 80% of storage volume provided or WQv whichever is less***
Volume Treated	227	*ft^3*	*This is the portion of the WQv that is not reduced in the practice*
Sizing √	*OK*		*Check to be sure Area provided ≥ Af*

Infiltrating Bioretention Worksheet

(For use on HSG A or B Soils without underdrains)

WQv ≤ VSM + VDL + (DP x ARG)

VSM = ARG x DSM x nSM

VDL (optional) = ARG x DDL x nDL

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
11	3.61	0.19	0.05	0.10	1786.32	1.40	BIO #11
Enter Impervious Area Reduced by Disconnection of Rooftops			5%	0.10	1,786	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Infiltrating Bioretention Parameters				
Treatment Volume	WQv	1,786	*ft^3*	
Enter depth of soil Media	DSM	2.50	*ft*	*2.5 - 4 ft*
Enter depth of drainage	DDL	0.5	*ft*	*≥ 0.5 ft*
Enter ponding depth above	DP	0.5	*ft*	*≤ 0.5*
Enter porosity of Soil Media	nSM	0.20		*≥20%*
Enter porosity of Drainage	nDL	0.40		*≥ 40%*
Required Bioretention Area	ARG	1489	*sf*	
Bioretention Area Provided		1500	*ft2*	
Native Soil Infiltration Rate		2.00	*in/hr*	*Okay*
Are you using underdrains?		No		
Total Volume Provided		1,800	*ft^3*	*Sum of storage Volume Provided in each layer*

Determine Runoff Reduction			
Runoff Reduction	**1,440**	***ft^3***	***This is 80% of storage volume provided or WQv whichever is less***
Volume Treated	346	*ft^3*	*This is the portion of the WQv that is not reduced in the practice*
Sizing √	*OK*		*Check to be sure Area provided ≥ Af*

Infiltrating Bioretention Worksheet

(For use on HSG A or B Soils without underdrains)

WQv ≤ VSM + VDL + (DP x ARG)

VSM = ARG x DSM x nSM

VDL (optional) = ARG x DDL x nDL

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
12	0.79	0.18	0.23	0.26	1024.02	1.40	BIO #12
Enter Impervious Area Reduced by Disconnection of Rooftops			23%	0.26	1,024	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Infiltrating Bioretention Parameters				
Treatment Volume	WQv	1,024	*ft^3*	
Enter depth of soil Media	DSM	2.50	*ft*	*2.5 - 4 ft*
Enter depth of drainage	DDL	0.5	*ft*	*≥ 0.5 ft*
Enter ponding depth above	DP	0.5	*ft*	*≤ 0.5*
Enter porosity of Soil Media	nSM	0.20		*≥20%*
Enter porosity of Drainage	nDL	0.40		*≥ 40%*
Required Bioretention Area	ARG	853	*sf*	
Bioretention Area Provided		900	*ft2*	
Native Soil Infiltration Rate		2.00	*in/hr*	*Okay*
Are you using underdrains?		No		
Total Volume Provided		1,080	*ft^3*	*Sum of storage Volume Provided in each layer*

Determine Runoff Reduction			
Runoff Reduction	**864**	***ft^3***	***This is 80% of storage volume provided or WQv whichever is less***
Volume Treated	160	*ft^3*	*This is the portion of the WQv that is not reduced in the practice*
Sizing √	*OK*		*Check to be sure Area provided ≥ Af*

Infiltrating Bioretention Worksheet

(For use on HSG A or B Soils without underdrains)

WQv ≤ VSM + VDL + (DP x ARG)

VSM = ARG x DSM x nSM

VDL (optional) = ARG x DDL x nDL

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
13	0.52	0.12	0.23	0.26	680.99	1.40	BIO #13
Enter Impervious Area Reduced by Disconnection of Rooftops			23%	0.26	681	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Infiltrating Bioretention Parameters				
Treatment Volume	WQv	681	*ft^3*	
Enter depth of soil Media	DSM	4.00	*ft*	*2.5 - 4 ft*
Enter depth of drainage	DDL	0.50	*ft*	*≥ 0.5 ft*
Enter ponding depth above surface	DP	0.5	*ft*	*≤ 0.5*
Enter porosity of Soil Media	nSM	0.20		*≥20%*
Enter porosity of Drainage	nDL	0.40		*≥ 40%*
Required Bioretention Area	ARG	454	*sf*	
Bioretention Area Provided		500	*ft2*	
Native Soil Infiltration Rate		2.00	*in/hr*	*Okay*
Are you using underdrains?		No		
Total Volume Provided		750	*ft^3*	*Sum of storage Volume Provided in each layer*

Determine Runoff Reduction			
Runoff Reduction	**600**	***ft^3***	***This is 80% of storage volume provided or WQv whichever is less***
Volume Treated	81	*ft^3*	*This is the portion of the WQv that is not reduced in the practice*
Sizing √	*OK*		*Check to be sure Area provided ≥ Af*

Infiltrating Bioretention Worksheet

(For use on HSG A or B Soils without underdrains)

WQv ≤ VSM + VDL + (DP x ARG)

VSM = ARG x DSM x nSM

VDL (optional) = ARG x DDL x nDL

Design Point:	**Marborough**

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
14	0.66	0.13	0.20	0.23	762.30	1.40	BIO #14
Enter Impervious Area Reduced by Disconnection of Rooftops			20%	0.23	762	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Infiltrating Bioretention Parameters				
Treatment Volume	WQv	762	*ft^3*	
Enter depth of soil Media	DSM	2.50	*ft*	*2.5 - 4 ft*
Enter depth of drainage	DDL	0.5	*ft*	*≥ 0.5 ft*
Enter ponding depth above	DP	0.5	*ft*	*≤ 0.5*
Enter porosity of Soil Media	nSM	0.20		*≥20%*
Enter porosity of Drainage	nDL	0.40		*≥ 40%*
Required Bioretention Area	ARG	635	*sf*	
Bioretention Area Provided		650	*ft2*	
Native Soil Infiltration Rate		2.00	*in/hr*	*Okay*
Are you using underdrains?		No		
Total Volume Provided		780	*ft^3*	*Sum of storage Volume Provided in each layer*

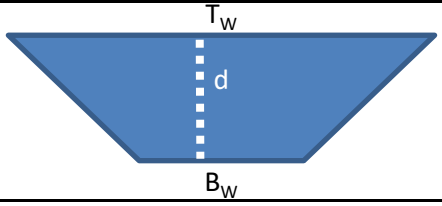
Determine Runoff Reduction			
Runoff Reduction	**624**	***ft^3***	***This is 80% of storage volume provided or WQv whichever is less***
Volume Treated	138	*ft^3*	*This is the portion of the WQv that is not reduced in the practice*
Sizing √	*OK*		*Check to be sure Area provided ≥ Af*

Dry Swale Worksheet

Design Point:	Marborough

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
15	0.56	0.05	0.09	0.13	370.99	1.40	DS #1
Enter Impervious Area Reduced by Disconnection of Rooftops			9%	0.13	371	<<WQv after adjusting for Disconnected Rooftops	

Pretreatment Provided			Pretreatment Technique
Pretreatment (10% of WQv)	37	*ft^3*	

Calculate Available Storage Capacity			
Bottom Width	4	*ft*	Design with a bottom width no greater than eight feet to avoid potential gullying and channel braiding, but no less than two feet
Side Slope (X:1)	2	*Okay*	Channels shall be designed with moderate side slopes (flatter than 3:1) for most conditions. 2:1 is the absolute maximum side slope
Longitudinal Slope	2%	*Okay*	*Maximum longitudinal slope shall be 4%*
Flow Depth	1	*ft*	*Maximum ponding depth of one foot at the mid-point of the channel, and a maximum depth of 18" at the end point of the channel (for storage of the WQv)*
Top Width	8	*ft*	
Area	6.00	*sf*	
Minimum Length	56	*ft*	
Actual Length	60	*ft*	
End Point Depth check	1.00	*Okay*	*A maximum depth of 18" at the end point of the channel (for storage of the WQv)*
Storage Capacity	397	*ft^3*	
Soil Group (HSG)		A	

Runoff Reduction				
Is the Dry Swale contributing flow to another practice?			Select Practice	
RRv	**159**	***ft^3***	**Runnoff Reduction equals 40% in HSG A and B and 20% in HSG C and D up to the WQv**	
Volume Treated	212	*ft^3*	This is the difference between the WQv calculated and the runoff reduction achieved in the swale	
Volume Directed	0	*ft^3*	This volume is directed another practice	
Volume √	*Okay*		Check to be sure that channel is long enough to store WQv	

Appendix H.3

Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Ulster County, New York

Robert Pollock

June 27, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

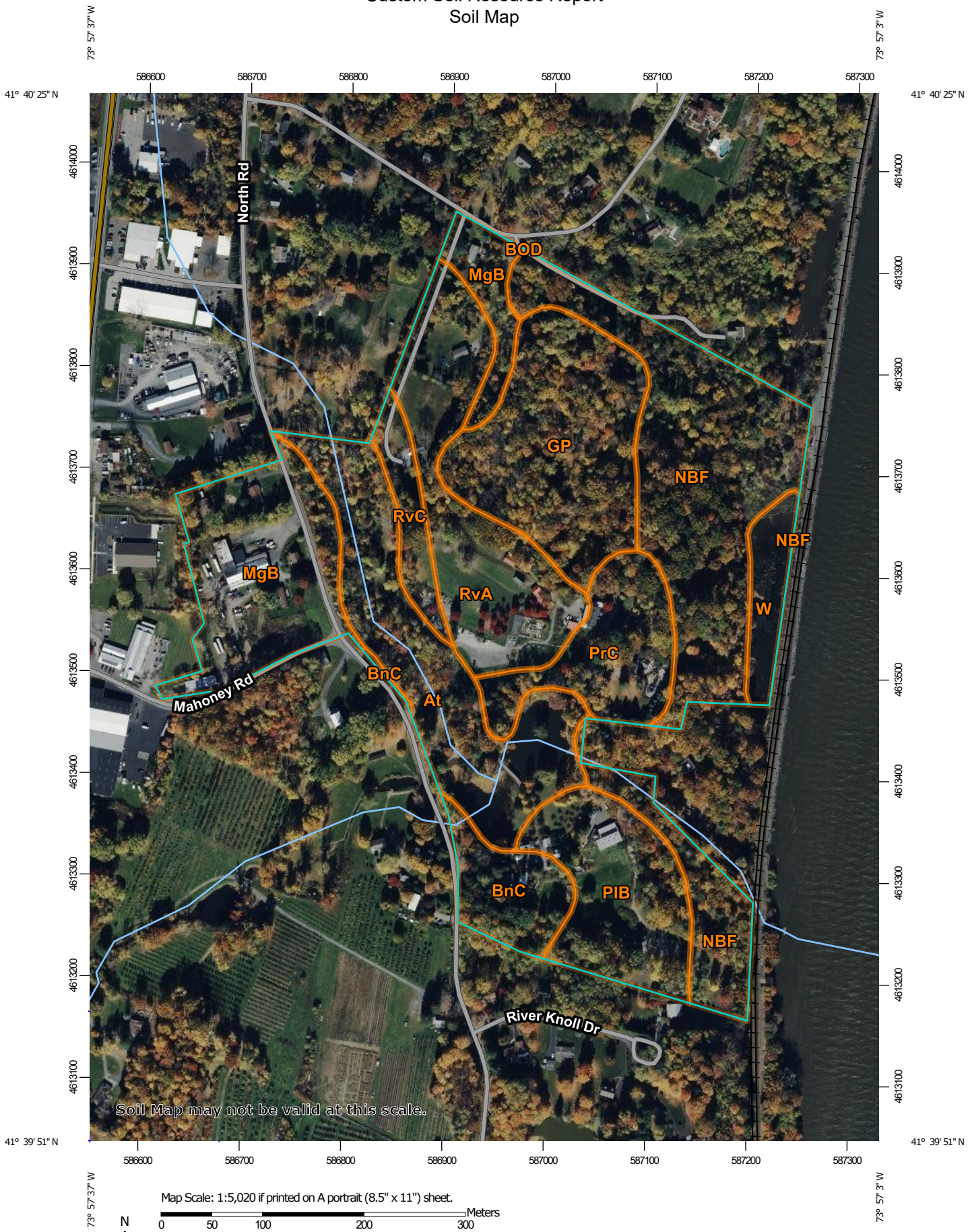
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



Map Scale: 1:5,020 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: Ulster County, New York
Survey Area Data: Version 21, Sep 10, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 21, 2022—Oct 27, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
At	Atherton silt loam	8.7	13.5%
BnC	Bath-Nassau complex, 8 to 25 percent slopes	2.7	4.2%
BOD	Bath-Nassau-Rock outcrop complex, hilly	0.0	0.0%
GP	Gravel pit	8.7	13.5%
MgB	Mardin-Nassau complex, 3 to 8 percent slopes	9.0	13.9%
NBF	Nassau-Bath-Rock outcrop complex, very steep	14.5	22.3%
PlB	Plainfield loamy sand, 0 to 8 percent slopes	5.7	8.7%
PrC	Plainfield-Rock outcrop complex, rolling	4.4	6.8%
RvA	Riverhead fine sandy loam, 0 to 3 percent slopes	7.8	12.0%
RvC	Riverhead fine sandy loam, 8 to 15 percent slopes	1.7	2.6%
W	Water	1.7	2.6%
Totals for Area of Interest		**64.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties

and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Ulster County, New York

At—Atherton silt loam

Map Unit Setting

National map unit symbol: 9xfl
Elevation: 50 to 1,500 feet
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Atherton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Atherton

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy glaciofluvial deposits over stratified deposits

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 19 inches: silt loam
H3 - 19 to 34 inches: gravelly loam
H4 - 34 to 65 inches: stratified very gravelly sandy loam to sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Occasional
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Ecological site: F140XY016NY - Mineral Wetlands
Hydric soil rating: Yes

Minor Components

Canandaigua

Percent of map unit: 5 percent

Landform: Depressions
Hydric soil rating: Yes

Red hook
Percent of map unit: 5 percent
Hydric soil rating: No

Raynham
Percent of map unit: 5 percent
Hydric soil rating: No

Lamson
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

BnC—Bath-Nassau complex, 8 to 25 percent slopes

Map Unit Setting
National map unit symbol: 9xft
Elevation: 600 to 1,800 feet
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition
Bath and similar soils: 50 percent
Nassau and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bath

Setting
Landform: Till plains, hills, drumlinoid ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived mainly from gray and brown siltstone, sandstone, and shale

Typical profile
H1 - 0 to 6 inches: gravelly silt loam
H2 - 6 to 28 inches: gravelly loam
H3 - 28 to 48 inches: very gravelly loam
H4 - 48 to 52 inches: bedrock

Properties and qualities
Slope: 8 to 25 percent

Depth to restrictive feature: 26 to 38 inches to fragipan; 40 to 80 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F140XY030NY - Well Drained Dense Till
Hydric soil rating: No

Description of Nassau

Setting

Landform: Till plains, ridges, benches
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Channery loamy till derived mainly from local slate or shale

Typical profile

H1 - 0 to 6 inches: channery silt loam
H2 - 6 to 16 inches: very channery silt loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 25 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Minor Components

Hudson

Percent of map unit: 5 percent
Hydric soil rating: No

Cambridge

Percent of map unit: 5 percent

Hydric soil rating: No

Volusia

Percent of map unit: 5 percent
Hydric soil rating: No

Manlius

Percent of map unit: 5 percent
Hydric soil rating: No

BOD—Bath-Nassau-Rock outcrop complex, hilly

Map Unit Setting

National map unit symbol: 9xfv
Elevation: 600 to 1,800 feet
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Bath and similar soils: 40 percent
Nassau and similar soils: 25 percent
Rock outcrop: 15 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bath

Setting

Landform: Till plains, hills, drumlinoid ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived mainly from gray and brown siltstone, sandstone, and shale

Typical profile

H1 - 0 to 6 inches: gravelly silt loam
H2 - 6 to 28 inches: gravelly loam
H3 - 28 to 48 inches: very gravelly loam
H4 - 48 to 52 inches: bedrock

Properties and qualities

Slope: 10 to 25 percent
Depth to restrictive feature: 26 to 38 inches to fragipan; 40 to 80 inches to lithic bedrock
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F140XY030NY - Well Drained Dense Till
Hydric soil rating: No

Description of Nassau

Setting

Landform: Till plains, ridges, benches
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Channery loamy till derived mainly from local slate or shale

Typical profile

H1 - 0 to 6 inches: channery silt loam
H2 - 6 to 16 inches: very channery silt loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 10 to 25 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 10 to 25 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydric soil rating: Unranked

Minor Components

Manlius

Percent of map unit: 5 percent
Hydric soil rating: No

Mardin

Percent of map unit: 5 percent
Hydric soil rating: No

Hudson

Percent of map unit: 5 percent
Hydric soil rating: No

Volusia

Percent of map unit: 5 percent
Hydric soil rating: No

GP—Gravel pit

Map Unit Setting

National map unit symbol: 9xgh
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Gravel pit: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gravel Pit

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: 40 to 80 inches to lithic bedrock
Drainage class: Somewhat excessively drained

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydric soil rating: Unranked

Minor Components

Pompton
Percent of map unit: 5 percent
Hydric soil rating: No

Atherton
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Hoosic
Percent of map unit: 5 percent
Hydric soil rating: No

Chenango
Percent of map unit: 5 percent
Hydric soil rating: No

MgB—Mardin-Nassau complex, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2v30k
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Mardin and similar soils: 55 percent
Nassau and similar soils: 25 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mardin

Setting
Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till

Typical profile
Ap - 0 to 8 inches: gravelly silt loam
Bw - 8 to 15 inches: gravelly silt loam
E - 15 to 20 inches: gravelly silt loam
Bx - 20 to 72 inches: gravelly silt loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 14 to 26 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Nassau

Setting

Landform: Till plains, ridges, benches
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, concave
Across-slope shape: Convex, linear
Parent material: Channery loamy till derived mainly from local slate or shale

Typical profile

H1 - 0 to 6 inches: channery silt loam
H2 - 6 to 16 inches: very channery silt loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Minor Components

Manlius

Percent of map unit: 5 percent
Landform: Till plains, ridges, benches

Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, concave
Across-slope shape: Convex, linear
Hydric soil rating: No

Volusia

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Churchville

Percent of map unit: 5 percent
Landform: Till plains, lake plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, base slope, tread
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Schoharie

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Concave
Across-slope shape: Convex, linear
Hydric soil rating: No

NBF—Nassau-Bath-Rock outcrop complex, very steep

Map Unit Setting

National map unit symbol: 9xhh
Elevation: 600 to 1,800 feet
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Nassau and similar soils: 35 percent
Bath and similar soils: 25 percent
Rock outcrop: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nassau

Setting

Landform: Till plains, ridges, benches
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Channery loamy till derived mainly from local slate or shale

Typical profile

H1 - 0 to 6 inches: channery silt loam
H2 - 6 to 16 inches: very channery silt loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 65 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Bath

Setting

Landform: Till plains, hills, drumlinoid ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till derived mainly from gray and brown siltstone, sandstone, and shale

Typical profile

H1 - 0 to 6 inches: gravelly silt loam
H2 - 6 to 28 inches: gravelly loam
H3 - 28 to 48 inches: very gravelly loam
H4 - 48 to 52 inches: bedrock

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: 26 to 38 inches to fragipan; 40 to 80 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 24 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F140XY030NY - Well Drained Dense Till
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydric soil rating: Unranked

Minor Components

Hoosic

Percent of map unit: 5 percent
Hydric soil rating: No

Valois

Percent of map unit: 5 percent
Hydric soil rating: No

Arnot

Percent of map unit: 5 percent
Hydric soil rating: No

Manlius

Percent of map unit: 5 percent
Hydric soil rating: No

PlB—Plainfield loamy sand, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9xhw

Elevation: 720 to 1,150 feet
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Plainfield

Setting

Landform: Terraces, outwash plains, deltas
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy glaciofluvial or deltaic deposits

Typical profile

H1 - 0 to 9 inches: loamy sand
H2 - 9 to 32 inches: loamy sand
H3 - 32 to 65 inches: coarse sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F140XY021NY - Dry Outwash
Hydric soil rating: No

Minor Components

Hoosic

Percent of map unit: 5 percent
Hydric soil rating: No

Pompton

Percent of map unit: 5 percent
Hydric soil rating: No

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

PrC—Plainfield-Rock outcrop complex, rolling

Map Unit Setting

National map unit symbol: 9xj0
Elevation: 720 to 1,150 feet
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Plainfield and similar soils: 65 percent
Rock outcrop: 15 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Plainfield

Setting

Landform: Terraces, outwash plains, deltas
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy glaciofluvial or deltaic deposits

Typical profile

H1 - 0 to 9 inches: loamy sand
H2 - 9 to 32 inches: loamy sand
H3 - 32 to 65 inches: coarse sand

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydric soil rating: Unranked

Minor Components

Stockbridge

Percent of map unit: 5 percent
Hydric soil rating: No

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

Walpole

Percent of map unit: 5 percent
Hydric soil rating: No

Pompton

Percent of map unit: 5 percent
Hydric soil rating: No

RvA—Riverhead fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 9xj7
Elevation: 590 to 1,970 feet
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Riverhead and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Riverhead

Setting

Landform: Terraces, deltas
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits overlying stratified sand and gravel

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 26 inches: sandy loam
H3 - 26 to 49 inches: loamy sand
H4 - 49 to 62 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F144AY023CT - Well Drained Outwash
Hydric soil rating: No

Minor Components

Plainfield

Percent of map unit: 5 percent
Hydric soil rating: No

Hoosic

Percent of map unit: 5 percent
Hydric soil rating: No

Walpole

Percent of map unit: 5 percent
Hydric soil rating: No

Pompton

Percent of map unit: 5 percent
Hydric soil rating: No

RvC—Riverhead fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9xj9
Elevation: 590 to 1,970 feet
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Riverhead

Setting

Landform: Terraces, deltas
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits overlying stratified sand and gravel

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 26 inches: sandy loam
H3 - 26 to 49 inches: loamy sand
H4 - 49 to 62 inches: sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F140XY021NY - Dry Outwash
Hydric soil rating: No

Minor Components

Hoosic
Percent of map unit: 5 percent
Hydric soil rating: No

Pompton
Percent of map unit: 5 percent
Hydric soil rating: No

Plainfield
Percent of map unit: 5 percent
Hydric soil rating: No

W—Water

Map Unit Setting
National map unit symbol: 9xk9
Mean annual precipitation: 41 to 62 inches
Mean annual air temperature: 41 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

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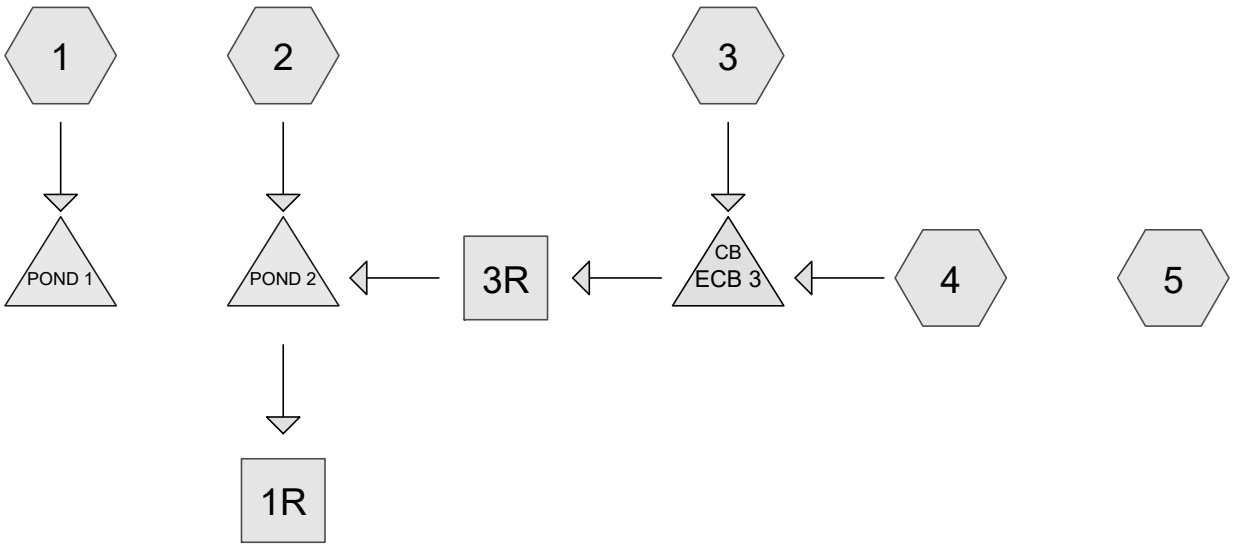
Appendix H.4

Site Vicinity Map

Appendix H.5 & H.6

HydroCAD Calculations
And Drainage Area Maps



Subcat Reach Pond Link

Routing Diagram for 2024 06 E18 105 Pollock PRE
Prepared by Medenbach & Eggers, Printed 6/28/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
7.850	39	>75% Grass cover, Good, HSG A (1)
3.466	77	Brush, Fair, HSG D (3)
9.039	49	Pasture/grassland/range, Fair, HSG A (2)
11.630	98	Paved parking & roofs (1, 2, 3, 4, 5)
5.401	98	Water Surface (1, 2, 5)
3.329	60	Woods, Fair, HSG B (2)
8.700	30	Woods, Good, HSG A (1)
13.162	70	Woods, Good, HSG C (1)
13.292	77	Woods, Good, HSG D (2, 4, 5)
3.113	43	Woods/grass comb., Fair, HSG A (5)
0.838	76	Woods/grass comb., Fair, HSG C (5)
1.540	79	Woods/grass comb., Good, HSG D (1)
81.361	**66**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Pre-development area-1 Runoff Area=36.252 ac 13.79% Impervious Runoff Depth=0.24"
Flow Length=1,440' Tc=25.3 min CN=58 Runoff=2.98 cfs 0.732 af

Subcatchment 2: Pre-development area Runoff Area=1,168,040 sf 23.82% Impervious Runoff Depth=0.66"
Flow Length=2,105' Tc=66.6 min CN=70 Runoff=6.50 cfs 1.474 af

Subcatchment 3: Pre-development area 3 Runoff Area=317,000 sf 52.37% Impervious Runoff Depth=1.73"
Flow Length=775' Tc=24.2 min CN=88 Runoff=9.19 cfs 1.049 af

Subcatchment 4: Pre-development 4 Runoff Area=97,000 sf 7.22% Impervious Runoff Depth=1.12"
Flow Length=530' Tc=18.8 min CN=79 Runoff=1.95 cfs 0.207 af

Subcatchment 5: Pre-Dev area 5 (Design Runoff Area=382,900 sf 19.01% Impervious Runoff Depth=0.62"
Flow Length=850' Tc=23.5 min CN=69 Runoff=3.33 cfs 0.452 af

Reach 1R: Steep stream channel Avg. Flow Depth=0.11' Max Vel=5.88 fps Inflow=6.45 cfs 2.512 af
n=0.025 L=700.0' S=0.1971 '/' Capacity=958.84 cfs Outflow=6.45 cfs 2.512 af

Reach 3R: Stream Channel Avg. Flow Depth=0.36' Max Vel=2.84 fps Inflow=11.05 cfs 1.256 af
n=0.025 L=700.0' S=0.0100 '/' Capacity=215.95 cfs Outflow=10.82 cfs 1.256 af

Pond ECB 3: Existing Catch Basin #3 Peak Elev=165.19' Inflow=11.05 cfs 1.256 af
12.0" Round Culvert n=0.013 L=40.0' S=0.0223 '/' Outflow=11.05 cfs 1.256 af

Pond POND 1: Existing Pond #1 (Design Peak Elev=1.23' Storage=391,214 cf Inflow=2.98 cfs 0.732 af
18.0" Round Culvert n=0.013 L=60.0' S=0.0167 '/' Outflow=0.28 cfs 0.474 af

Pond POND 2: Stormwater Pond Peak Elev=139.40' Storage=595,317 cf Inflow=13.34 cfs 2.729 af
Outflow=6.45 cfs 2.512 af

Total Runoff Area = 81.361 ac Runoff Volume = 3.914 af Average Runoff Depth = 0.58"
79.07% Pervious = 64.330 ac 20.93% Impervious = 17.031 ac

Summary for Subcatchment 1: Pre-development area-1

Runoff = 2.98 cfs @ 12.61 hrs, Volume= 0.732 af, Depth= 0.24"
Routed to Pond POND 1 : Existing Pond #1 (Design Point #1)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (ac)	CN	Description
*	2.500	98	Paved parking & roofs
	8.700	30	Woods, Good, HSG A
	7.850	39	>75% Grass cover, Good, HSG A
	1.540	79	Woods/grass comb., Good, HSG D
	13.162	70	Woods, Good, HSG C
*	2.500	98	Water Surface
	36.252	58	Weighted Average
	31.252		86.21% Pervious Area
	5.000		13.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	150	0.0130	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
2.4	300	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.1	40	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
7.9	950	0.1600	2.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.3	1,440	Total			

Summary for Subcatchment 2: Pre-development area 2

Runoff = 6.50 cfs @ 13.02 hrs, Volume= 1.474 af, Depth= 0.66"
Routed to Pond POND 2 : Stormwater Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
	393,760	49	Pasture/grassland/range, Fair, HSG A
	145,000	60	Woods, Fair, HSG B
	351,000	77	Woods, Good, HSG D
*	169,600	98	Paved parking & roofs
*	108,680	98	Water Surface
	1,168,040	70	Weighted Average
	889,760		76.18% Pervious Area
	278,280		23.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	150	0.0130	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
25.5	640	0.0070	0.42		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	65	0.2100	2.29		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	1,250	0.0080	2.60	14.30	**Trap/Vee/Rect Channel Flow,** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.030 Stream, clean & straight
66.6	2,105	Total			

Summary for Subcatchment 3: Pre-development area 3

Runoff = 9.19 cfs @ 12.34 hrs, Volume= 1.049 af, Depth= 1.73"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
	151,000	77	Brush, Fair, HSG D
*	166,000	98	Paved parking & roofs
	317,000	88	Weighted Average
	151,000		47.63% Pervious Area
	166,000		52.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	150	0.0200	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.75"
4.1	275	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.6	315	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	35	0.0690	1.84		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.2	775	Total			

Summary for Subcatchment 4: Pre-development 4

Runoff = 1.95 cfs @ 12.27 hrs, Volume= 0.207 af, Depth= 1.12"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
	90,000	77	Woods, Good, HSG D
*	7,000	98	Paved parking & roofs
	97,000	79	Weighted Average
	90,000		92.78% Pervious Area
	7,000		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	150	0.1000	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
4.4	380	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	530	Total			

Summary for Subcatchment 5: Pre-Dev area 5 (Design Point #3)

Runoff = 3.33 cfs @ 12.40 hrs, Volume= 0.452 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
	135,600	43	Woods/grass comb., Fair, HSG A
	36,500	76	Woods/grass comb., Fair, HSG C
	138,000	77	Woods, Good, HSG D
*	55,100	98	Paved parking & roofs
*	17,700	98	Water Surface
	382,900	69	Weighted Average
	310,100		80.99% Pervious Area
	72,800		19.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	150	0.0660	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
2.7	200	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.0	350	0.3257	2.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	150	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
23.5	850	Total			

Summary for Reach 1R: Steep stream channel (Design Point #2)

Inflow Area = 36.319 ac, 28.53% Impervious, Inflow Depth = 0.83" for 1 Year event
Inflow = 6.45 cfs @ 13.50 hrs, Volume= 2.512 af
Outflow = 6.45 cfs @ 13.56 hrs, Volume= 2.512 af, Atten= 0%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.88 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 2.67 fps, Avg. Travel Time= 4.4 min

Peak Storage= 767 cf @ 13.52 hrs
Average Depth at Peak Storage= 0.11' , Surface Width= 10.43'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 958.84 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.1971 '/'
Inlet Invert= 138.00', Outlet Invert= 0.00'

‡

Summary for Reach 3R: Stream Channel

Inflow Area = 9.504 ac, 41.79% Impervious, Inflow Depth = 1.59" for 1 Year event
Inflow = 11.05 cfs @ 12.32 hrs, Volume= 1.256 af
Outflow = 10.82 cfs @ 12.44 hrs, Volume= 1.256 af, Atten= 2%, Lag= 6.9 min
Routed to Pond POND 2 : Stormwater Pond

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.84 fps, Min. Travel Time= 4.1 min
Avg. Velocity = 0.83 fps, Avg. Travel Time= 14.1 min

Peak Storage= 2,672 cf @ 12.37 hrs
Average Depth at Peak Storage= 0.36' , Surface Width= 11.43'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 215.95 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.0100 '/'
Inlet Invert= 147.00', Outlet Invert= 140.00'

‡

Summary for Pond ECB 3: Existing Catch Basin #3

Inflow Area = 9.504 ac, 41.79% Impervious, Inflow Depth = 1.59" for 1 Year event
Inflow = 11.05 cfs @ 12.32 hrs, Volume= 1.256 af
Outflow = 11.05 cfs @ 12.32 hrs, Volume= 1.256 af, Atten= 0%, Lag= 0.0 min
Primary = 11.05 cfs @ 12.32 hrs, Volume= 1.256 af
Routed to Reach 3R : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 165.19' @ 12.32 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	156.15'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.15' / 155.26' S= 0.0223 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=11.05 cfs @ 12.32 hrs HW=165.19' (Free Discharge)
1=Culvert (Inlet Controls 11.05 cfs @ 14.07 fps)

Summary for Pond POND 1: Existing Pond #1 (Design Point #1)

Inflow Area = 36.252 ac, 13.79% Impervious, Inflow Depth = 0.24" for 1 Year event
Inflow = 2.98 cfs @ 12.61 hrs, Volume= 0.732 af
Outflow = 0.28 cfs @ 24.11 hrs, Volume= 0.474 af, Atten= 91%, Lag= 689.8 min
Primary = 0.28 cfs @ 24.11 hrs, Volume= 0.474 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf
Peak Elev= 1.23' @ 24.11 hrs Surf.Area= 103,671 sf Storage= 391,214 cf (23,395 cf above start)
Flood Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 706.3 min (1,674.7 - 968.4)

Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	1,005,110 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
-4.00	30,000	0	0	30,000
-2.00	70,000	97,217	97,217	70,030
0.00	100,000	169,111	266,328	100,101
2.00	106,020	205,991	472,319	106,536
4.00	133,250	238,752	711,070	133,876
6.00	161,234	294,040	1,005,110	161,992

Device	Routing	Invert	Outlet Devices
#1	Primary	1.00'	**18.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1.00' / 0.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=0.27 cfs @ 24.11 hrs HW=1.23' TW=0.23' (TW follows 1.00' below HW)
↑—**1=Culvert** (Inlet Controls 0.27 cfs @ 1.62 fps)

Summary for Pond POND 2: Stormwater Pond

Inflow Area = 36.319 ac, 28.53% Impervious, Inflow Depth = 0.90" for 1 Year event
Inflow = 13.34 cfs @ 12.50 hrs, Volume= 2.729 af
Outflow = 6.45 cfs @ 13.50 hrs, Volume= 2.512 af, Atten= 52%, Lag= 59.9 min
Primary = 6.45 cfs @ 13.50 hrs, Volume= 2.512 af
Routed to Reach 1R : Steep stream channel (Design Point #2)

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 139.00' Surf.Area= 94,243 sf Storage= 557,219 cf
Peak Elev= 139.40' @ 13.50 hrs Surf.Area= 97,013 sf Storage= 595,317 cf (38,098 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 117.5 min (1,017.5 - 900.0)

Volume	Invert	Avail.Storage	Storage Description
#1	130.00'	654,954 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
130.00	39,400	0	0	39,400
132.00	47,600	86,871	86,871	47,732
134.00	56,600	104,070	190,941	56,876
136.00	66,000	122,480	313,421	66,438
138.00	87,467	152,964	466,385	87,994
140.00	101,271	188,570	654,954	101,969

Device	Routing	Invert	Outlet Devices
#1	Primary	139.10'	**13.5' long + 5.0 '/' SideZ x 23.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=6.44 cfs @ 13.50 hrs HW=139.40' TW=138.40' (TW follows 1.00' below HW)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 6.44 cfs @ 1.44 fps)

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Pre-development area-1 Runoff Area=36.252 ac 13.79% Impervious Runoff Depth=1.03"
Flow Length=1,440' Tc=25.3 min CN=58 Runoff=22.55 cfs 3.124 af

Subcatchment 2: Pre-development area Runoff Area=1,168,040 sf 23.82% Impervious Runoff Depth=1.85"
Flow Length=2,105' Tc=66.6 min CN=70 Runoff=20.89 cfs 4.140 af

Subcatchment 3: Pre-development area 3 Runoff Area=317,000 sf 52.37% Impervious Runoff Depth=3.43"
Flow Length=775' Tc=24.2 min CN=88 Runoff=17.92 cfs 2.081 af

Subcatchment 4: Pre-development 4 Runoff Area=97,000 sf 7.22% Impervious Runoff Depth=2.59"
Flow Length=530' Tc=18.8 min CN=79 Runoff=4.68 cfs 0.480 af

Subcatchment 5: Pre-Dev area 5 (Design Runoff Area=382,900 sf 19.01% Impervious Runoff Depth=1.78"
Flow Length=850' Tc=23.5 min CN=69 Runoff=11.16 cfs 1.302 af

Reach 1R: Steep stream channel Avg. Flow Depth=0.23' Max Vel=9.60 fps Inflow=23.20 cfs 6.485 af
n=0.025 L=700.0' S=0.1971 '/' Capacity=958.84 cfs Outflow=23.20 cfs 6.485 af

Reach 3R: Stream Channel Avg. Flow Depth=0.54' Max Vel=3.67 fps Inflow=22.40 cfs 2.562 af
n=0.025 L=700.0' S=0.0100 '/' Capacity=215.95 cfs Outflow=22.10 cfs 2.562 af

Pond ECB 3: Existing Catch Basin #3 Peak Elev=191.72' Inflow=22.40 cfs 2.562 af
12.0" Round Culvert n=0.013 L=40.0' S=0.0223 '/' Outflow=22.40 cfs 2.562 af

Pond POND 1: Existing Pond #1 (Design Peak Elev=1.71' Storage=441,446 cf Inflow=22.55 cfs 3.124 af
18.0" Round Culvert n=0.013 L=60.0' S=0.0167 '/' Outflow=2.35 cfs 2.746 af

Pond POND 2: Stormwater Pond Peak Elev=139.76' Storage=630,728 cf Inflow=32.57 cfs 6.702 af
Outflow=23.20 cfs 6.485 af

Total Runoff Area = 81.361 ac Runoff Volume = 11.128 af Average Runoff Depth = 1.64"
79.07% Pervious = 64.330 ac 20.93% Impervious = 17.031 ac

Summary for Subcatchment 1: Pre-development area-1

Runoff = 22.55 cfs @ 12.42 hrs, Volume= 3.124 af, Depth= 1.03"
Routed to Pond POND 1 : Existing Pond #1 (Design Point #1)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.75"

	Area (ac)	CN	Description
*	2.500	98	Paved parking & roofs
	8.700	30	Woods, Good, HSG A
	7.850	39	>75% Grass cover, Good, HSG A
	1.540	79	Woods/grass comb., Good, HSG D
	13.162	70	Woods, Good, HSG C
*	2.500	98	Water Surface
	36.252	58	Weighted Average
	31.252		86.21% Pervious Area
	5.000		13.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	150	0.0130	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
2.4	300	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.1	40	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
7.9	950	0.1600	2.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.3	1,440	Total			

Summary for Subcatchment 2: Pre-development area 2

Runoff = 20.89 cfs @ 12.95 hrs, Volume= 4.140 af, Depth= 1.85"
Routed to Pond POND 2 : Stormwater Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.75"

	Area (sf)	CN	Description
	393,760	49	Pasture/grassland/range, Fair, HSG A
	145,000	60	Woods, Fair, HSG B
	351,000	77	Woods, Good, HSG D
*	169,600	98	Paved parking & roofs
*	108,680	98	Water Surface
	1,168,040	70	Weighted Average
	889,760		76.18% Pervious Area
	278,280		23.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	150	0.0130	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
25.5	640	0.0070	0.42		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	65	0.2100	2.29		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	1,250	0.0080	2.60	14.30	**Trap/Vee/Rect Channel Flow,** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.030 Stream, clean & straight
66.6	2,105	Total			

Summary for Subcatchment 3: Pre-development area 3

Runoff = 17.92 cfs @ 12.33 hrs, Volume= 2.081 af, Depth= 3.43"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.75"

	Area (sf)	CN	Description
	151,000	77	Brush, Fair, HSG D
*	166,000	98	Paved parking & roofs
	317,000	88	Weighted Average
	151,000		47.63% Pervious Area
	166,000		52.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	150	0.0200	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.75"
4.1	275	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.6	315	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	35	0.0690	1.84		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.2	775	Total			

Summary for Subcatchment 4: Pre-development 4

Runoff = 4.68 cfs @ 12.26 hrs, Volume= 0.480 af, Depth= 2.59"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.75"

	Area (sf)	CN	Description
	90,000	77	Woods, Good, HSG D
*	7,000	98	Paved parking & roofs
	97,000	79	Weighted Average
	90,000		92.78% Pervious Area
	7,000		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	150	0.1000	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
4.4	380	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	530	Total			

Summary for Subcatchment 5: Pre-Dev area 5 (Design Point #3)

Runoff = 11.16 cfs @ 12.35 hrs, Volume= 1.302 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 Year Rainfall=4.75"

	Area (sf)	CN	Description
	135,600	43	Woods/grass comb., Fair, HSG A
	36,500	76	Woods/grass comb., Fair, HSG C
	138,000	77	Woods, Good, HSG D
*	55,100	98	Paved parking & roofs
*	17,700	98	Water Surface
	382,900	69	Weighted Average
	310,100		80.99% Pervious Area
	72,800		19.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	150	0.0660	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
2.7	200	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.0	350	0.3257	2.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	150	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
23.5	850	Total			

Summary for Reach 1R: Steep stream channel (Design Point #2)

Inflow Area = 36.319 ac, 28.53% Impervious, Inflow Depth = 2.14" for 10 Year event
Inflow = 23.20 cfs @ 13.18 hrs, Volume= 6.485 af
Outflow = 23.20 cfs @ 13.22 hrs, Volume= 6.485 af, Atten= 0%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 9.60 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 3.21 fps, Avg. Travel Time= 3.6 min

Peak Storage= 1,692 cf @ 13.20 hrs
Average Depth at Peak Storage= 0.23' , Surface Width= 10.92'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 958.84 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.1971 '/'
Inlet Invert= 138.00', Outlet Invert= 0.00'

‡

Summary for Reach 3R: Stream Channel

Inflow Area = 9.504 ac, 41.79% Impervious, Inflow Depth = 3.23" for 10 Year event
Inflow = 22.40 cfs @ 12.31 hrs, Volume= 2.562 af
Outflow = 22.10 cfs @ 12.40 hrs, Volume= 2.562 af, Atten= 1%, Lag= 5.6 min
Routed to Pond POND 2 : Stormwater Pond

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.67 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 1.01 fps, Avg. Travel Time= 11.6 min

Peak Storage= 4,219 cf @ 12.35 hrs
Average Depth at Peak Storage= 0.54' , Surface Width= 12.17'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 215.95 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.0100 '/'
Inlet Invert= 147.00', Outlet Invert= 140.00'

‡

Summary for Pond ECB 3: Existing Catch Basin #3

Inflow Area = 9.504 ac, 41.79% Impervious, Inflow Depth = 3.23" for 10 Year event
Inflow = 22.40 cfs @ 12.31 hrs, Volume= 2.562 af
Outflow = 22.40 cfs @ 12.31 hrs, Volume= 2.562 af, Atten= 0%, Lag= 0.0 min
Primary = 22.40 cfs @ 12.31 hrs, Volume= 2.562 af
Routed to Reach 3R : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 191.72' @ 12.31 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	156.15'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.15' / 155.26' S= 0.0223 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=22.39 cfs @ 12.31 hrs HW=191.71' (Free Discharge)
1=Culvert (Inlet Controls 22.39 cfs @ 28.51 fps)

Summary for Pond POND 1: Existing Pond #1 (Design Point #1)

Inflow Area = 36.252 ac, 13.79% Impervious, Inflow Depth = 1.03" for 10 Year event
Inflow = 22.55 cfs @ 12.42 hrs, Volume= 3.124 af
Outflow = 2.35 cfs @ 16.16 hrs, Volume= 2.746 af, Atten= 90%, Lag= 224.7 min
Primary = 2.35 cfs @ 16.16 hrs, Volume= 2.746 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf
Peak Elev= 1.71' @ 16.16 hrs Surf.Area= 105,129 sf Storage= 441,446 cf (73,628 cf above start)
Flood Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 457.7 min (1,361.8 - 904.1)

Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	1,005,110 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
-4.00	30,000	0	0	30,000
-2.00	70,000	97,217	97,217	70,030
0.00	100,000	169,111	266,328	100,101
2.00	106,020	205,991	472,319	106,536
4.00	133,250	238,752	711,070	133,876
6.00	161,234	294,040	1,005,110	161,992

Device	Routing	Invert	Outlet Devices
#1	Primary	1.00'	**18.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1.00' / 0.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=2.35 cfs @ 16.16 hrs HW=1.71' TW=0.71' (TW follows 1.00' below HW)
↑—**1=Culvert** (Inlet Controls 2.35 cfs @ 2.86 fps)

Summary for Pond POND 2: Stormwater Pond

Inflow Area = 36.319 ac, 28.53% Impervious, Inflow Depth = 2.21" for 10 Year event
Inflow = 32.57 cfs @ 12.52 hrs, Volume= 6.702 af
Outflow = 23.20 cfs @ 13.18 hrs, Volume= 6.485 af, Atten= 29%, Lag= 40.0 min
Primary = 23.20 cfs @ 13.18 hrs, Volume= 6.485 af
Routed to Reach 1R : Steep stream channel (Design Point #2)

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 139.00' Surf.Area= 94,243 sf Storage= 557,219 cf
Peak Elev= 139.76' @ 13.18 hrs Surf.Area= 99,552 sf Storage= 630,728 cf (73,510 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 80.4 min (958.1 - 877.7)

Volume	Invert	Avail.Storage	Storage Description
#1	130.00'	654,954 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
130.00	39,400	0	0	39,400
132.00	47,600	86,871	86,871	47,732
134.00	56,600	104,070	190,941	56,876
136.00	66,000	122,480	313,421	66,438
138.00	87,467	152,964	466,385	87,994
140.00	101,271	188,570	654,954	101,969

Device	Routing	Invert	Outlet Devices
#1	Primary	139.10'	**13.5' long + 5.0 '/' SideZ x 23.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=23.14 cfs @ 13.18 hrs HW=139.76' TW=138.76' (TW follows 1.00' below HW)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 23.14 cfs @ 2.09 fps)

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Pre-development area-1 Runoff Area=36.252 ac 13.79% Impervious Runoff Depth=3.67"
Flow Length=1,440' Tc=25.3 min CN=58 Runoff=93.28 cfs 11.075 af

Subcatchment 2: Pre-development area Runoff Area=1,168,040 sf 23.82% Impervious Runoff Depth=5.12"
Flow Length=2,105' Tc=66.6 min CN=70 Runoff=59.33 cfs 11.430 af

Subcatchment 3: Pre-development area 3 Runoff Area=317,000 sf 52.37% Impervious Runoff Depth=7.30"
Flow Length=775' Tc=24.2 min CN=88 Runoff=36.83 cfs 4.429 af

Subcatchment 4: Pre-development 4 Runoff Area=97,000 sf 7.22% Impervious Runoff Depth=6.21"
Flow Length=530' Tc=18.8 min CN=79 Runoff=11.08 cfs 1.152 af

Subcatchment 5: Pre-Dev area 5 (Design Runoff Area=382,900 sf 19.01% Impervious Runoff Depth=4.99"
Flow Length=850' Tc=23.5 min CN=69 Runoff=32.39 cfs 3.658 af

Reach 1R: Steep stream channel Avg. Flow Depth=0.48' Max Vel=15.20 fps Inflow=116.45 cfs 16.794 af
n=0.025 L=700.0' S=0.1971 '/' Capacity=958.84 cfs Outflow=80.89 cfs 16.794 af

Reach 3R: Stream Channel Avg. Flow Depth=0.84' Max Vel=4.76 fps Inflow=47.45 cfs 5.581 af
n=0.025 L=700.0' S=0.0100 '/' Capacity=215.95 cfs Outflow=47.00 cfs 5.581 af

Pond ECB 3: Existing Catch Basin #3 Peak Elev=314.10' Inflow=47.45 cfs 5.581 af
12.0" Round Culvert n=0.013 L=40.0' S=0.0223 '/' Outflow=47.45 cfs 5.581 af

Pond POND 1: Existing Pond #1 (Design Peak Elev=3.40' Storage=633,932 cf Inflow=93.28 cfs 11.075 af
18.0" Round Culvert n=0.013 L=60.0' S=0.0167 '/' Outflow=8.51 cfs 10.595 af

Pond POND 2: Stormwater Pond Peak Elev=140.88' Storage=654,954 cf Inflow=80.91 cfs 17.011 af
Outflow=116.45 cfs 16.794 af

Total Runoff Area = 81.361 ac Runoff Volume = 31.744 af Average Runoff Depth = 4.68"
79.07% Pervious = 64.330 ac 20.93% Impervious = 17.031 ac

Summary for Subcatchment 1: Pre-development area-1

Runoff = 93.28 cfs @ 12.37 hrs, Volume= 11.075 af, Depth= 3.67"
Routed to Pond POND 1 : Existing Pond #1 (Design Point #1)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (ac)	CN	Description
*	2.500	98	Paved parking & roofs
	8.700	30	Woods, Good, HSG A
	7.850	39	>75% Grass cover, Good, HSG A
	1.540	79	Woods/grass comb., Good, HSG D
	13.162	70	Woods, Good, HSG C
*	2.500	98	Water Surface
	36.252	58	Weighted Average
	31.252		86.21% Pervious Area
	5.000		13.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	150	0.0130	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
2.4	300	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.1	40	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
7.9	950	0.1600	2.00		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.3	1,440	Total			

Summary for Subcatchment 2: Pre-development area 2

Runoff = 59.33 cfs @ 12.88 hrs, Volume= 11.430 af, Depth= 5.12"
Routed to Pond POND 2 : Stormwater Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
	393,760	49	Pasture/grassland/range, Fair, HSG A
	145,000	60	Woods, Fair, HSG B
	351,000	77	Woods, Good, HSG D
*	169,600	98	Paved parking & roofs
*	108,680	98	Water Surface
	1,168,040	70	Weighted Average
	889,760		76.18% Pervious Area
	278,280		23.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	150	0.0130	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
25.5	640	0.0070	0.42		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	65	0.2100	2.29		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	1,250	0.0080	2.60	14.30	**Trap/Vee/Rect Channel Flow,** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.030 Stream, clean & straight
66.6	2,105	Total			

Summary for Subcatchment 3: Pre-development area 3

Runoff = 36.83 cfs @ 12.32 hrs, Volume= 4.429 af, Depth= 7.30"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
	151,000	77	Brush, Fair, HSG D
*	166,000	98	Paved parking & roofs
	317,000	88	Weighted Average
	151,000		47.63% Pervious Area
	166,000		52.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	150	0.0200	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.75"
4.1	275	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.6	315	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	35	0.0690	1.84		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
24.2	775	Total			

Summary for Subcatchment 4: Pre-development 4

Runoff = 11.08 cfs @ 12.26 hrs, Volume= 1.152 af, Depth= 6.21"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
	90,000	77	Woods, Good, HSG D
*	7,000	98	Paved parking & roofs
	97,000	79	Weighted Average
	90,000		92.78% Pervious Area
	7,000		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	150	0.1000	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
4.4	380	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	530	Total			

Summary for Subcatchment 5: Pre-Dev area 5 (Design Point #3)

Runoff = 32.39 cfs @ 12.32 hrs, Volume= 3.658 af, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
	135,600	43	Woods/grass comb., Fair, HSG A
	36,500	76	Woods/grass comb., Fair, HSG C
	138,000	77	Woods, Good, HSG D
*	55,100	98	Paved parking & roofs
*	17,700	98	Water Surface
	382,900	69	Weighted Average
	310,100		80.99% Pervious Area
	72,800		19.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	150	0.0660	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
2.7	200	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.0	350	0.3257	2.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	150	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
23.5	850	Total			

Summary for Reach 1R: Steep stream channel (Design Point #2)

Inflow Area = 36.319 ac, 28.53% Impervious, Inflow Depth = 5.55" for 100 Year event
Inflow = 116.45 cfs @ 12.58 hrs, Volume= 16.794 af
Outflow = 80.89 cfs @ 12.61 hrs, Volume= 16.794 af, Atten= 31%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.20 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.98 fps, Avg. Travel Time= 2.9 min

Peak Storage= 3,724 cf @ 12.59 hrs
Average Depth at Peak Storage= 0.48' , Surface Width= 11.94'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 958.84 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.1971 '/'
Inlet Invert= 138.00', Outlet Invert= 0.00'

‡

Summary for Reach 3R: Stream Channel

Inflow Area = 9.504 ac, 41.79% Impervious, Inflow Depth = 7.05" for 100 Year event
Inflow = 47.45 cfs @ 12.29 hrs, Volume= 5.581 af
Outflow = 47.00 cfs @ 12.37 hrs, Volume= 5.581 af, Atten= 1%, Lag= 4.5 min
Routed to Pond POND 2 : Stormwater Pond

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.76 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 1.28 fps, Avg. Travel Time= 9.1 min

Peak Storage= 6,912 cf @ 12.33 hrs
Average Depth at Peak Storage= 0.84' , Surface Width= 13.38'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 215.95 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.0100 '/'
Inlet Invert= 147.00', Outlet Invert= 140.00'

‡

Summary for Pond ECB 3: Existing Catch Basin #3

Inflow Area = 9.504 ac, 41.79% Impervious, Inflow Depth = 7.05" for 100 Year event
Inflow = 47.45 cfs @ 12.29 hrs, Volume= 5.581 af
Outflow = 47.45 cfs @ 12.29 hrs, Volume= 5.581 af, Atten= 0%, Lag= 0.0 min
Primary = 47.45 cfs @ 12.29 hrs, Volume= 5.581 af
Routed to Reach 3R : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 314.10' @ 12.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	156.15'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.15' / 155.26' S= 0.0223 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=47.42 cfs @ 12.29 hrs HW=313.91' (Free Discharge)
1=Culvert (Inlet Controls 47.42 cfs @ 60.38 fps)

Summary for Pond POND 1: Existing Pond #1 (Design Point #1)

Inflow Area = 36.252 ac, 13.79% Impervious, Inflow Depth = 3.67" for 100 Year event
Inflow = 93.28 cfs @ 12.37 hrs, Volume= 11.075 af
Outflow = 8.51 cfs @ 12.70 hrs, Volume= 10.595 af, Atten= 91%, Lag= 20.0 min
Primary = 8.51 cfs @ 12.70 hrs, Volume= 10.595 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf
Peak Elev= 3.40' @ 15.35 hrs Surf.Area= 124,782 sf Storage= 633,932 cf (266,114 cf above start)
Flood Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf

Plug-Flow detention time= 1,146.5 min calculated for 2.151 af (19% of inflow)
Center-of-Mass det. time= 394.3 min (1,258.0 - 863.7)

Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	1,005,110 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
-4.00	30,000	0	0	30,000
-2.00	70,000	97,217	97,217	70,030
0.00	100,000	169,111	266,328	100,101
2.00	106,020	205,991	472,319	106,536
4.00	133,250	238,752	711,070	133,876
6.00	161,234	294,040	1,005,110	161,992

Device	Routing	Invert	Outlet Devices
#1	Primary	1.00'	**18.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1.00' / 0.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=8.51 cfs @ 12.70 hrs HW=2.81' TW=1.81' (TW follows 1.00' below HW)
↑—**1=Culvert** (Inlet Controls 8.51 cfs @ 4.81 fps)

Summary for Pond POND 2: Stormwater Pond

Inflow Area = 36.319 ac, 28.53% Impervious, Inflow Depth = 5.62" for 100 Year event
Inflow = 80.91 cfs @ 12.58 hrs, Volume= 17.011 af
Outflow = 116.45 cfs @ 12.58 hrs, Volume= 16.794 af, Atten= 0%, Lag= 0.0 min
Primary = 116.45 cfs @ 12.58 hrs, Volume= 16.794 af
Routed to Reach 1R : Steep stream channel (Design Point #2)

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 139.00' Surf.Area= 94,243 sf Storage= 557,219 cf
Peak Elev= 140.88' @ 12.58 hrs Surf.Area= 101,271 sf Storage= 654,954 cf (97,736 cf above start)

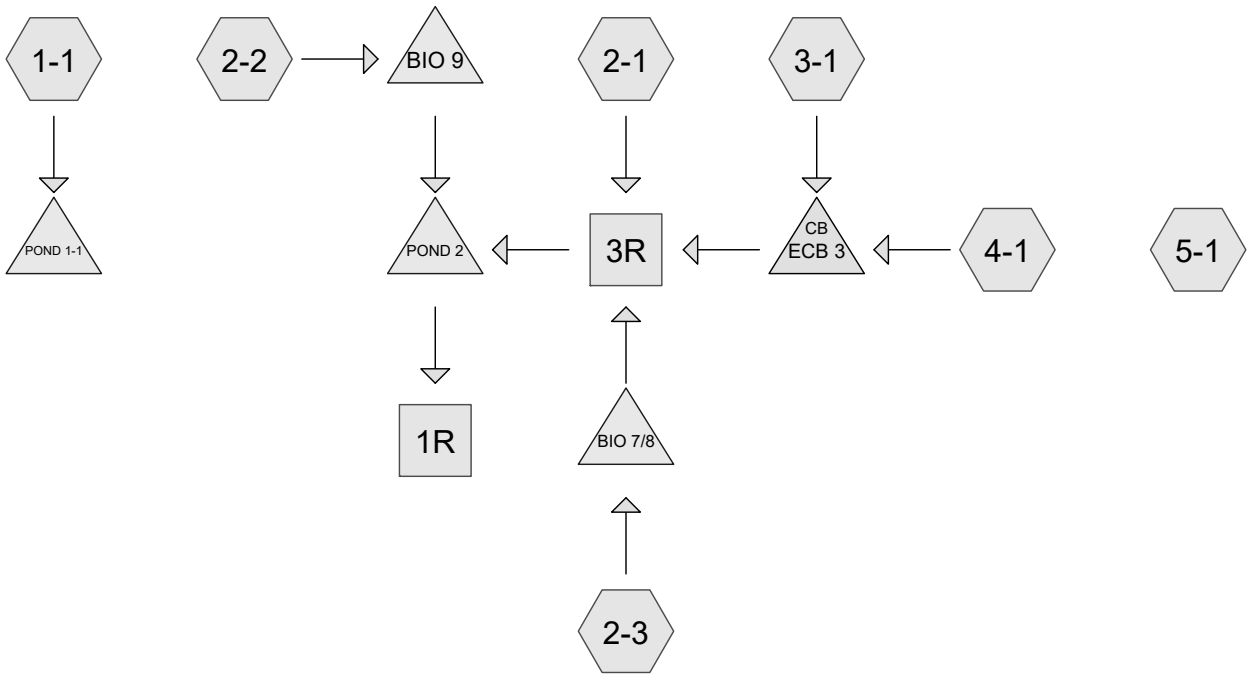
Plug-Flow detention time= 533.8 min calculated for 4.002 af (24% of inflow)
Center-of-Mass det. time= 53.1 min (907.4 - 854.3)

Volume	Invert	Avail.Storage	Storage Description
#1	130.00'	654,954 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
130.00	39,400	0	0	39,400
132.00	47,600	86,871	86,871	47,732
134.00	56,600	104,070	190,941	56,876
136.00	66,000	122,480	313,421	66,438
138.00	87,467	152,964	466,385	87,994
140.00	101,271	188,570	654,954	101,969

Device	Routing	Invert	Outlet Devices
#1	Primary	139.10'	**13.5' long + 5.0 '/' SideZ x 23.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=116.40 cfs @ 12.58 hrs HW=140.88' TW=139.88' (TW follows 1.00' below HW)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 116.40 cfs @ 2.91 fps)



Subcat Reach Pond Link

Routing Diagram for 2024 06 E18 105 Pollock POST
Prepared by Medenbach & Eggers, Printed 6/28/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
7.850	39	>75% Grass cover, Good, HSG A (1-1)
3.306	77	Brush, Fair, HSG D (3-1)
9.614	49	Pasture/grassland/range, Fair, HSG A (2-1, 2-2)
14.165	98	Paved parking (1-1, 2-1, 2-2, 2-3, 3-1, 4-1, 5-1)
5.399	98	Water Surface (1-1, 2-1, 5-1)
3.579	60	Woods, Fair, HSG B (2-1, 2-3)
6.240	30	Woods, Good, HSG A (1-1)
13.270	70	Woods, Good, HSG C (1-1)
12.466	77	Woods, Good, HSG D (2-1, 4-1, 5-1)
3.113	43	Woods/grass comb., Fair, HSG A (5-1)
0.838	76	Woods/grass comb., Fair, HSG C (5-1)
1.500	79	Woods/grass comb., Good, HSG D (1-1)
81.340	**68**	**TOTAL AREA**

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1-1: 1-1 Runoff Area=35.010 ac 17.57% Impervious Runoff Depth=0.33"
Flow Length=1,440' Tc=25.4 min CN=61 Runoff=4.85 cfs 0.957 af

Subcatchment 2-1: Post-development Runoff Area=1,114,600 sf 23.56% Impervious Runoff Depth=0.66"
Flow Length=2,105' Tc=66.6 min CN=70 Runoff=6.20 cfs 1.406 af

Subcatchment 2-2: Post-development area Runoff Area=60,385 sf 72.20% Impervious Runoff Depth=1.43"
Flow Length=160' Tc=12.5 min CN=84 Runoff=1.88 cfs 0.166 af

Subcatchment 2-3: Post-development area Runoff Area=47,240 sf 55.78% Impervious Runoff Depth=1.24"
Flow Length=185' Tc=6.7 min CN=81 Runoff=1.52 cfs 0.112 af

Subcatchment 3-1: Post-development Runoff Area=316,000 sf 54.43% Impervious Runoff Depth=1.73"
Flow Length=860' Tc=23.3 min CN=88 Runoff=9.29 cfs 1.046 af

Subcatchment 4-1: Post-Development 4 Runoff Area=97,000 sf 7.22% Impervious Runoff Depth=1.12"
Flow Length=530' Tc=18.8 min CN=79 Runoff=1.95 cfs 0.207 af

Subcatchment 5-1: Post-Dev area 5 Runoff Area=382,900 sf 19.01% Impervious Runoff Depth=0.62"
Flow Length=850' Tc=23.5 min CN=69 Runoff=3.33 cfs 0.452 af

Reach 1R: Steep stream channel Avg. Flow Depth=0.10' Max Vel=5.77 fps Inflow=6.14 cfs 2.456 af
n=0.025 L=700.0' S=0.1971 '/' Capacity=958.84 cfs Outflow=6.14 cfs 2.456 af

Reach 3R: Stream Channel Avg. Flow Depth=0.38' Max Vel=2.96 fps Inflow=12.41 cfs 2.659 af
n=0.025 L=700.0' S=0.0100 '/' Capacity=215.95 cfs Outflow=12.22 cfs 2.659 af

Pond BIO 7/8: Bio-Retention Zone #7 AND Peak Elev=155.07' Storage=2,037 cf Inflow=1.52 cfs 0.112 af
Discarded=0.13 cfs 0.112 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.112 af

Pond BIO 9: Bio-Retention Zone #9 INF Peak Elev=164.53' Storage=2,898 cf Inflow=1.88 cfs 0.166 af
Discarded=0.14 cfs 0.152 af Primary=0.24 cfs 0.014 af Outflow=0.38 cfs 0.166 af

Pond ECB 3: Existing Catch Basin #3 Peak Elev=165.44' Inflow=11.21 cfs 1.253 af
12.0" Round Culvert n=0.013 L=40.0' S=0.0223 '/' Outflow=11.21 cfs 1.253 af

Pond POND 1-1: Stormwater Pond (Design Peak Elev=1.27' Storage=396,133 cf Inflow=4.85 cfs 0.957 af
18.0" Round Culvert n=0.013 L=60.0' S=0.0167 '/' Outflow=0.40 cfs 0.675 af

Pond POND 2: Stormwater Pond Peak Elev=139.39' Storage=594,353 cf Inflow=12.22 cfs 2.673 af
Outflow=6.14 cfs 2.456 af

Total Runoff Area = 81.340 ac Runoff Volume = 4.345 af Average Runoff Depth = 0.64"
75.95% Pervious = 61.775 ac 24.05% Impervious = 19.565 ac

Summary for Subcatchment 1-1: 1-1

Runoff = 4.85 cfs @ 12.53 hrs, Volume= 0.957 af, Depth= 0.33"
Routed to Pond POND 1-1 : Stormwater Pond (Design Point #1)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (ac)	CN	Description
*	3.650	98	Paved parking
	6.240	30	Woods, Good, HSG A
	7.850	39	>75% Grass cover, Good, HSG A
	1.500	79	Woods/grass comb., Good, HSG D
	13.270	70	Woods, Good, HSG C
*	2.500	98	Water Surface
	35.010	61	Weighted Average
	28.860		82.43% Pervious Area
	6.150		17.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	150	0.0130	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
2.4	300	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.1	40	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
8.0	950	0.1560	1.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.4	1,440	Total			

Summary for Subcatchment 2-1: Post-development area 2-1

Runoff = 6.20 cfs @ 13.02 hrs, Volume= 1.406 af, Depth= 0.66"
Routed to Reach 3R : Stream Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
	402,000	49	Pasture/grassland/range, Fair, HSG A
	135,000	60	Woods, Fair, HSG B
	315,000	77	Woods, Good, HSG D
*	154,000	98	Paved parking
*	108,600	98	Water Surface
	1,114,600	70	Weighted Average
	852,000		76.44% Pervious Area
	262,600		23.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	150	0.0130	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
25.5	640	0.0070	0.42		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	65	0.2100	2.29		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	1,250	0.0080	2.60	14.30	**Trap/Vee/Rect Channel Flow,** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.030 Stream, clean & straight
66.6	2,105	Total			

Summary for Subcatchment 2-2: Post-development area 2-2

Runoff = 1.88 cfs @ 12.18 hrs, Volume= 0.166 af, Depth= 1.43"
Routed to Pond BIO 9 : Bio-Retention Zone #9 INF

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
*	43,600	98	Paved parking
	16,785	49	Pasture/grassland/range, Fair, HSG A
	60,385	84	Weighted Average
	16,785		27.80% Pervious Area
	43,600		72.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0100	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
0.1	20	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	40	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.5	160	Total			

Summary for Subcatchment 2-3: Post-development area 2-3

Runoff = 1.52 cfs @ 12.10 hrs, Volume= 0.112 af, Depth= 1.24"
Routed to Pond BIO 7/8 : Bio-Retention Zone #7 AND #8 INF

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
*	26,350	98	Paved parking
	20,890	60	Woods, Fair, HSG B
	47,240	81	Weighted Average
	20,890		44.22% Pervious Area
	26,350		55.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	73	0.0400	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
0.3	27	0.0300	1.35		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.75"
0.6	40	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	45	0.0450	1.48		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.7	185	Total			

Summary for Subcatchment 3-1: Post-development area 3

Runoff = 9.29 cfs @ 12.32 hrs, Volume= 1.046 af, Depth= 1.73"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
	144,000	77	Brush, Fair, HSG D
*	172,000	98	Paved parking
	316,000	88	Weighted Average
	144,000		45.57% Pervious Area
	172,000		54.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	150	0.0200	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.75"
4.1	275	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	25	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	375	0.0270	8.65	10.61	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
0.2	35	0.0400	3.00		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.3	860	Total			

Summary for Subcatchment 4-1: Post-Development 4

Runoff = 1.95 cfs @ 12.27 hrs, Volume= 0.207 af, Depth= 1.12"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
	90,000	77	Woods, Good, HSG D
*	7,000	98	Paved parking
	97,000	79	Weighted Average
	90,000		92.78% Pervious Area
	7,000		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	150	0.1000	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
4.4	380	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	530	Total			

Summary for Subcatchment 5-1: Post-Dev area 5 (Design Point #3)

Runoff = 3.33 cfs @ 12.40 hrs, Volume= 0.452 af, Depth= 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 Year Rainfall=2.90"

	Area (sf)	CN	Description
	135,600	43	Woods/grass comb., Fair, HSG A
	36,500	76	Woods/grass comb., Fair, HSG C
	138,000	77	Woods, Good, HSG D
*	55,100	98	Paved parking
*	17,700	98	Water Surface
	382,900	69	Weighted Average
	310,100		80.99% Pervious Area
	72,800		19.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	150	0.0660	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
2.7	200	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.0	350	0.3257	2.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	150	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
23.5	850	Total			

Summary for Reach 1R: Steep stream channel (Design Point #2)

Inflow Area = 37.540 ac, 31.28% Impervious, Inflow Depth = 0.79" for 1 Year event
Inflow = 6.14 cfs @ 13.61 hrs, Volume= 2.456 af
Outflow = 6.14 cfs @ 13.67 hrs, Volume= 2.456 af, Atten= 0%, Lag= 3.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.77 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 2.65 fps, Avg. Travel Time= 4.4 min

Peak Storage= 745 cf @ 13.63 hrs
Average Depth at Peak Storage= 0.10' , Surface Width= 10.42'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 958.84 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.1971 '/'
Inlet Invert= 138.00', Outlet Invert= 0.00'

‡

Summary for Reach 3R: Stream Channel

Inflow Area = 36.153 ac, 29.71% Impervious, Inflow Depth = 0.88" for 1 Year event
Inflow = 12.41 cfs @ 12.35 hrs, Volume= 2.659 af
Outflow = 12.22 cfs @ 12.46 hrs, Volume= 2.659 af, Atten= 1%, Lag= 7.0 min
Routed to Pond POND 2 : Stormwater Pond

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.96 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 1.07 fps, Avg. Travel Time= 10.9 min

Peak Storage= 2,887 cf @ 12.40 hrs
Average Depth at Peak Storage= 0.38' , Surface Width= 11.53'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 215.95 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.0100 '/'
Inlet Invert= 147.00', Outlet Invert= 140.00'

‡

Summary for Pond BIO 7/8: Bio-Retention Zone #7 AND #8 INF

Inflow Area = 1.084 ac, 55.78% Impervious, Inflow Depth = 1.24" for 1 Year event
Inflow = 1.52 cfs @ 12.10 hrs, Volume= 0.112 af
Outflow = 0.13 cfs @ 13.66 hrs, Volume= 0.112 af, Atten= 91%, Lag= 93.4 min
Discarded = 0.13 cfs @ 13.66 hrs, Volume= 0.112 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 3R : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 155.07' @ 13.66 hrs Surf.Area= 2,787 sf Storage= 2,037 cf

Plug-Flow detention time= 176.7 min calculated for 0.112 af (100% of inflow)
Center-of-Mass det. time= 176.7 min (1,021.9 - 845.2)

Volume	Invert	Avail.Storage	Storage Description
#1	151.74'	7,988 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
151.74	2,100	0.0	0	0
151.75	2,100	40.0	8	8
152.25	2,100	20.0	210	218
154.75	2,100	20.0	1,050	1,268
154.76	2,100	100.0	21	1,289
155.25	3,200	100.0	1,299	2,588
156.75	4,000	100.0	5,400	7,988

Device	Routing	Invert	Outlet Devices
#1	Discarded	151.74'	**2.000 in/hr Soil Exfiltration over Surface area**
#2	Primary	155.25'	**20.0' long + 3.0 '/' SideZ x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.13 cfs @ 13.66 hrs HW=155.07' (Free Discharge)
1=Soil Exfiltration (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=151.74' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond BIO 9: Bio-Retention Zone #9 INF

Inflow Area = 1.386 ac, 72.20% Impervious, Inflow Depth = 1.43" for 1 Year event
Inflow = 1.88 cfs @ 12.18 hrs, Volume= 0.166 af
Outflow = 0.38 cfs @ 12.74 hrs, Volume= 0.166 af, Atten= 80%, Lag= 33.6 min
Discarded = 0.14 cfs @ 12.74 hrs, Volume= 0.152 af
Primary = 0.24 cfs @ 12.74 hrs, Volume= 0.014 af
Routed to Pond POND 2 : Stormwater Pond

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 164.53' @ 12.74 hrs Surf.Area= 3,023 sf Storage= 2,898 cf

Plug-Flow detention time= 205.1 min calculated for 0.166 af (100% of inflow)
Center-of-Mass det. time= 205.1 min (1,045.2 - 840.2)

Volume	Invert	Avail.Storage	Storage Description
#1	160.99'	8,047 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
160.99	2,400	0.0	0	0
161.00	2,400	40.0	10	10
161.50	2,400	20.0	240	250
164.00	2,400	20.0	1,200	1,450
164.01	2,400	100.0	24	1,474
164.50	3,000	100.0	1,323	2,797
166.00	4,000	100.0	5,250	8,047

Device	Routing	Invert	Outlet Devices
#1	Discarded	160.99'	**2.000 in/hr Soil Exfiltration over Surface area**
#2	Primary	161.50'	**15.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 161.50' / 156.00' S= 0.0846 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#3	Device 2	164.50'	**30.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.14 cfs @ 12.74 hrs HW=164.53' (Free Discharge)
↑—**1=Soil Exfiltration** (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.20 cfs @ 12.74 hrs HW=164.53' (Free Discharge)
↑—**2=Culvert** (Passes 0.20 cfs of 9.17 cfs potential flow)
↑—**3=Orifice/Grate** (Weir Controls 0.20 cfs @ 0.60 fps)

Summary for Pond ECB 3: Existing Catch Basin #3

Inflow Area = 9.481 ac, 43.34% Impervious, Inflow Depth = 1.59" for 1 Year event
Inflow = 11.21 cfs @ 12.30 hrs, Volume= 1.253 af
Outflow = 11.21 cfs @ 12.30 hrs, Volume= 1.253 af, Atten= 0%, Lag= 0.0 min
Primary = 11.21 cfs @ 12.30 hrs, Volume= 1.253 af
Routed to Reach 3R : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 165.44' @ 12.30 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	156.15'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.15' / 155.26' S= 0.0223 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=11.20 cfs @ 12.30 hrs HW=165.43' (Free Discharge)
1=Culvert (Inlet Controls 11.20 cfs @ 14.26 fps)

Summary for Pond POND 1-1: Stormwater Pond (Design Point #1)

Inflow Area = 35.010 ac, 17.57% Impervious, Inflow Depth = 0.33" for 1 Year event
Inflow = 4.85 cfs @ 12.53 hrs, Volume= 0.957 af
Outflow = 0.40 cfs @ 22.05 hrs, Volume= 0.675 af, Atten= 92%, Lag= 571.1 min
Primary = 0.40 cfs @ 22.05 hrs, Volume= 0.675 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf
Peak Elev= 1.27' @ 22.05 hrs Surf.Area= 103,814 sf Storage= 396,133 cf (28,314 cf above start)
Flood Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 664.5 min (1,611.2 - 946.7)

Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	1,005,110 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
-4.00	30,000	0	0	30,000
-2.00	70,000	97,217	97,217	70,030
0.00	100,000	169,111	266,328	100,101
2.00	106,020	205,991	472,319	106,536
4.00	133,250	238,752	711,070	133,876
6.00	161,234	294,040	1,005,110	161,992

Device	Routing	Invert	Outlet Devices
#1	Primary	1.00'	**18.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1.00' / 0.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=0.39 cfs @ 22.05 hrs HW=1.27' TW=0.27' (TW follows 1.00' below HW)
↑—**1=Culvert** (Inlet Controls 0.39 cfs @ 1.78 fps)

Summary for Pond POND 2: Stormwater Pond

Inflow Area = 37.540 ac, 31.28% Impervious, Inflow Depth = 0.85" for 1 Year event
Inflow = 12.22 cfs @ 12.46 hrs, Volume= 2.673 af
Outflow = 6.14 cfs @ 13.61 hrs, Volume= 2.456 af, Atten= 50%, Lag= 68.9 min
Primary = 6.14 cfs @ 13.61 hrs, Volume= 2.456 af
Routed to Reach 1R : Steep stream channel (Design Point #2)

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 139.00' Surf.Area= 94,243 sf Storage= 557,219 cf
Peak Elev= 139.39' @ 13.61 hrs Surf.Area= 96,943 sf Storage= 594,353 cf (37,134 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 119.1 min (1,022.0 - 902.9)

Volume	Invert	Avail.Storage	Storage Description
#1	130.00'	654,954 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
130.00	39,400	0	0	39,400
132.00	47,600	86,871	86,871	47,732
134.00	56,600	104,070	190,941	56,876
136.00	66,000	122,480	313,421	66,438
138.00	87,467	152,964	466,385	87,994
140.00	101,271	188,570	654,954	101,969

Device	Routing	Invert	Outlet Devices
#1	Primary	139.10'	**13.5' long + 5.0 '/' SideZ x 23.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=6.10 cfs @ 13.61 hrs HW=139.39' TW=138.39' (TW follows 1.00' below HW)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 6.10 cfs @ 1.42 fps)

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1-1: 1-1 Runoff Area=35.010 ac 17.57% Impervious Runoff Depth=1.89"
Flow Length=1,440' Tc=25.4 min CN=61 Runoff=44.68 cfs 5.522 af

Subcatchment 2-1: Post-development Runoff Area=1,114,600 sf 23.56% Impervious Runoff Depth=2.67"
Flow Length=2,105' Tc=66.6 min CN=70 Runoff=29.27 cfs 5.695 af

Subcatchment 2-2: Post-development area Runoff Area=60,385 sf 72.20% Impervious Runoff Depth=4.04"
Flow Length=160' Tc=12.5 min CN=84 Runoff=5.25 cfs 0.466 af

Subcatchment 2-3: Post-development area Runoff Area=47,240 sf 55.78% Impervious Runoff Depth=3.73"
Flow Length=185' Tc=6.7 min CN=81 Runoff=4.60 cfs 0.337 af

Subcatchment 3-1: Post-development Runoff Area=316,000 sf 54.43% Impervious Runoff Depth=4.46"
Flow Length=860' Tc=23.3 min CN=88 Runoff=23.40 cfs 2.698 af

Subcatchment 4-1: Post-Development 4 Runoff Area=97,000 sf 7.22% Impervious Runoff Depth=3.53"
Flow Length=530' Tc=18.8 min CN=79 Runoff=6.38 cfs 0.655 af

Subcatchment 5-1: Post-Dev area 5 Runoff Area=382,900 sf 19.01% Impervious Runoff Depth=2.58"
Flow Length=850' Tc=23.5 min CN=69 Runoff=16.53 cfs 1.890 af

Reach 1R: Steep stream channel Avg. Flow Depth=0.29' Max Vel=11.12 fps Inflow=34.38 cfs 9.226 af
n=0.025 L=700.0' S=0.1971 '/' Capacity=958.84 cfs Outflow=34.37 cfs 9.226 af

Reach 3R: Stream Channel Avg. Flow Depth=0.79' Max Vel=4.59 fps Inflow=42.29 cfs 9.194 af
n=0.025 L=700.0' S=0.0100 '/' Capacity=215.95 cfs Outflow=42.14 cfs 9.194 af

Pond BIO 7/8: Bio-Retention Zone #7 AND Peak Elev=155.44' Storage=3,213 cf Inflow=4.60 cfs 0.337 af
Discarded=0.15 cfs 0.191 af Primary=4.05 cfs 0.146 af Outflow=4.20 cfs 0.337 af

Pond BIO 9: Bio-Retention Zone #9 INF Peak Elev=164.78' Storage=3,668 cf Inflow=5.25 cfs 0.466 af
Discarded=0.15 cfs 0.217 af Primary=4.90 cfs 0.249 af Outflow=5.05 cfs 0.466 af

Pond ECB 3: Existing Catch Basin #3 Peak Elev=217.89' Inflow=29.59 cfs 3.352 af
12.0" Round Culvert n=0.013 L=40.0' S=0.0223 '/' Outflow=29.59 cfs 3.352 af

Pond POND 1-1: Stormwater Pond (Design Peak Elev=2.16' Storage=489,463 cf Inflow=44.68 cfs 5.522 af
18.0" Round Culvert n=0.013 L=60.0' S=0.0167 '/' Outflow=5.38 cfs 5.111 af

Pond POND 2: Stormwater Pond Peak Elev=139.94' Storage=648,982 cf Inflow=44.96 cfs 9.443 af
Outflow=34.38 cfs 9.226 af

Total Runoff Area = 81.340 ac Runoff Volume = 17.263 af Average Runoff Depth = 2.55"
75.95% Pervious = 61.775 ac 24.05% Impervious = 19.565 ac

Summary for Subcatchment 1-1: 1-1

Runoff = 44.68 cfs @ 12.39 hrs, Volume= 5.522 af, Depth= 1.89"
Routed to Pond POND 1-1 : Stormwater Pond (Design Point #1)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=5.83"

	Area (ac)	CN	Description
*	3.650	98	Paved parking
	6.240	30	Woods, Good, HSG A
	7.850	39	>75% Grass cover, Good, HSG A
	1.500	79	Woods/grass comb., Good, HSG D
	13.270	70	Woods, Good, HSG C
*	2.500	98	Water Surface
	35.010	61	Weighted Average
	28.860		82.43% Pervious Area
	6.150		17.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	150	0.0130	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
2.4	300	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.1	40	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
8.0	950	0.1560	1.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.4	1,440	Total			

Summary for Subcatchment 2-1: Post-development area 2-1

Runoff = 29.27 cfs @ 12.95 hrs, Volume= 5.695 af, Depth= 2.67"
Routed to Reach 3R : Stream Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=5.83"

	Area (sf)	CN	Description
	402,000	49	Pasture/grassland/range, Fair, HSG A
	135,000	60	Woods, Fair, HSG B
	315,000	77	Woods, Good, HSG D
*	154,000	98	Paved parking
*	108,600	98	Water Surface
	1,114,600	70	Weighted Average
	852,000		76.44% Pervious Area
	262,600		23.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	150	0.0130	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
25.5	640	0.0070	0.42		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	65	0.2100	2.29		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	1,250	0.0080	2.60	14.30	**Trap/Vee/Rect Channel Flow,** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.030 Stream, clean & straight
66.6	2,105	Total			

Summary for Subcatchment 2-2: Post-development area 2-2

Runoff = 5.25 cfs @ 12.17 hrs, Volume= 0.466 af, Depth= 4.04"
Routed to Pond BIO 9 : Bio-Retention Zone #9 INF

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=5.83"

	Area (sf)	CN	Description
*	43,600	98	Paved parking
	16,785	49	Pasture/grassland/range, Fair, HSG A
	60,385	84	Weighted Average
	16,785		27.80% Pervious Area
	43,600		72.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0100	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
0.1	20	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	40	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.5	160	Total			

Summary for Subcatchment 2-3: Post-development area 2-3

Runoff = 4.60 cfs @ 12.10 hrs, Volume= 0.337 af, Depth= 3.73"
Routed to Pond BIO 7/8 : Bio-Retention Zone #7 AND #8 INF

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=5.83"

	Area (sf)	CN	Description
*	26,350	98	Paved parking
	20,890	60	Woods, Fair, HSG B
	47,240	81	Weighted Average
	20,890		44.22% Pervious Area
	26,350		55.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	73	0.0400	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
0.3	27	0.0300	1.35		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.75"
0.6	40	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	45	0.0450	1.48		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.7	185	Total			

Summary for Subcatchment 3-1: Post-development area 3

Runoff = 23.40 cfs @ 12.30 hrs, Volume= 2.698 af, Depth= 4.46"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=5.83"

	Area (sf)	CN	Description
	144,000	77	Brush, Fair, HSG D
*	172,000	98	Paved parking
	316,000	88	Weighted Average
	144,000		45.57% Pervious Area
	172,000		54.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	150	0.0200	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.75"
4.1	275	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	25	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	375	0.0270	8.65	10.61	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
0.2	35	0.0400	3.00		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.3	860	Total			

Summary for Subcatchment 4-1: Post-Development 4

Runoff = 6.38 cfs @ 12.26 hrs, Volume= 0.655 af, Depth= 3.53"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=5.83"

	Area (sf)	CN	Description
	90,000	77	Woods, Good, HSG D
*	7,000	98	Paved parking
	97,000	79	Weighted Average
	90,000		92.78% Pervious Area
	7,000		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	150	0.1000	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
4.4	380	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	530	Total			

Summary for Subcatchment 5-1: Post-Dev area 5 (Design Point #3)

Runoff = 16.53 cfs @ 12.35 hrs, Volume= 1.890 af, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 Year Rainfall=5.83"

	Area (sf)	CN	Description
	135,600	43	Woods/grass comb., Fair, HSG A
	36,500	76	Woods/grass comb., Fair, HSG C
	138,000	77	Woods, Good, HSG D
*	55,100	98	Paved parking
*	17,700	98	Water Surface
	382,900	69	Weighted Average
	310,100		80.99% Pervious Area
	72,800		19.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	150	0.0660	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
2.7	200	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.0	350	0.3257	2.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	150	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
23.5	850	Total			

Summary for Reach 1R: Steep stream channel (Design Point #2)

Inflow Area = 37.540 ac, 31.28% Impervious, Inflow Depth = 2.95" for 25 Year event
Inflow = 34.38 cfs @ 13.14 hrs, Volume= 9.226 af
Outflow = 34.37 cfs @ 13.17 hrs, Volume= 9.226 af, Atten= 0%, Lag= 1.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.12 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 3.45 fps, Avg. Travel Time= 3.4 min

Peak Storage= 2,163 cf @ 13.15 hrs
Average Depth at Peak Storage= 0.29' , Surface Width= 11.17'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 958.84 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.1971 '/'
Inlet Invert= 138.00', Outlet Invert= 0.00'

‡

Summary for Reach 3R: Stream Channel

Inflow Area = 36.153 ac, 29.71% Impervious, Inflow Depth = 3.05" for 25 Year event
Inflow = 42.29 cfs @ 12.35 hrs, Volume= 9.194 af
Outflow = 42.14 cfs @ 12.44 hrs, Volume= 9.194 af, Atten= 0%, Lag= 5.2 min
Routed to Pond POND 2 : Stormwater Pond

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.59 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 1.49 fps, Avg. Travel Time= 7.8 min

Peak Storage= 6,429 cf @ 12.40 hrs
Average Depth at Peak Storage= 0.79' , Surface Width= 13.17'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 215.95 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.0100 '/'
Inlet Invert= 147.00', Outlet Invert= 140.00'

‡

Summary for Pond BIO 7/8: Bio-Retention Zone #7 AND #8 INF

Inflow Area = 1.084 ac, 55.78% Impervious, Inflow Depth = 3.73" for 25 Year event
Inflow = 4.60 cfs @ 12.10 hrs, Volume= 0.337 af
Outflow = 4.20 cfs @ 12.13 hrs, Volume= 0.337 af, Atten= 9%, Lag= 2.3 min
Discarded = 0.15 cfs @ 12.13 hrs, Volume= 0.191 af
Primary = 4.05 cfs @ 12.13 hrs, Volume= 0.146 af
Routed to Reach 3R : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 155.44' @ 12.13 hrs Surf.Area= 3,303 sf Storage= 3,213 cf

Plug-Flow detention time= 124.0 min calculated for 0.337 af (100% of inflow)
Center-of-Mass det. time= 124.0 min (937.3 - 813.4)

Volume	Invert	Avail.Storage	Storage Description
#1	151.74'	7,988 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
151.74	2,100	0.0	0	0
151.75	2,100	40.0	8	8
152.25	2,100	20.0	210	218
154.75	2,100	20.0	1,050	1,268
154.76	2,100	100.0	21	1,289
155.25	3,200	100.0	1,299	2,588
156.75	4,000	100.0	5,400	7,988

Device	Routing	Invert	Outlet Devices
#1	Discarded	151.74'	**2.000 in/hr Soil Exfiltration over Surface area**
#2	Primary	155.25'	**20.0' long + 3.0 '/' SideZ x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.15 cfs @ 12.13 hrs HW=155.44' (Free Discharge)
1=Soil Exfiltration (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=4.03 cfs @ 12.13 hrs HW=155.44' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 4.03 cfs @ 1.02 fps)

Summary for Pond BIO 9: Bio-Retention Zone #9 INF

Inflow Area = 1.386 ac, 72.20% Impervious, Inflow Depth = 4.04" for 25 Year event
Inflow = 5.25 cfs @ 12.17 hrs, Volume= 0.466 af
Outflow = 5.05 cfs @ 12.20 hrs, Volume= 0.466 af, Atten= 4%, Lag= 2.1 min
Discarded = 0.15 cfs @ 12.20 hrs, Volume= 0.217 af
Primary = 4.90 cfs @ 12.20 hrs, Volume= 0.249 af
Routed to Pond POND 2 : Stormwater Pond

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 164.78' @ 12.20 hrs Surf.Area= 3,188 sf Storage= 3,668 cf

Plug-Flow detention time= 114.0 min calculated for 0.466 af (100% of inflow)
Center-of-Mass det. time= 114.1 min (924.6 - 810.6)

Volume	Invert	Avail.Storage	Storage Description
#1	160.99'	8,047 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
160.99	2,400	0.0	0	0
161.00	2,400	40.0	10	10
161.50	2,400	20.0	240	250
164.00	2,400	20.0	1,200	1,450
164.01	2,400	100.0	24	1,474
164.50	3,000	100.0	1,323	2,797
166.00	4,000	100.0	5,250	8,047

Device	Routing	Invert	Outlet Devices
#1	Discarded	160.99'	**2.000 in/hr Soil Exfiltration over Surface area**
#2	Primary	161.50'	**15.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 161.50' / 156.00' S= 0.0846 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#3	Device 2	164.50'	**30.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.15 cfs @ 12.20 hrs HW=164.78' (Free Discharge)
↑—**1=Soil Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=4.89 cfs @ 12.20 hrs HW=164.78' (Free Discharge)
↑—**2=Culvert** (Passes 4.89 cfs of 9.63 cfs potential flow)
↑—**3=Orifice/Grate** (Weir Controls 4.89 cfs @ 1.74 fps)

Summary for Pond ECB 3: Existing Catch Basin #3

Inflow Area = 9.481 ac, 43.34% Impervious, Inflow Depth = 4.24" for 25 Year event
Inflow = 29.59 cfs @ 12.30 hrs, Volume= 3.352 af
Outflow = 29.59 cfs @ 12.30 hrs, Volume= 3.352 af, Atten= 0%, Lag= 0.0 min
Primary = 29.59 cfs @ 12.30 hrs, Volume= 3.352 af
Routed to Reach 3R : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 217.89' @ 12.30 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	156.15'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.15' / 155.26' S= 0.0223 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=29.58 cfs @ 12.30 hrs HW=217.84' (Free Discharge)
1=Culvert (Inlet Controls 29.58 cfs @ 37.66 fps)

Summary for Pond POND 1-1: Stormwater Pond (Design Point #1)

Inflow Area = 35.010 ac, 17.57% Impervious, Inflow Depth = 1.89" for 25 Year event
Inflow = 44.68 cfs @ 12.39 hrs, Volume= 5.522 af
Outflow = 5.38 cfs @ 14.79 hrs, Volume= 5.111 af, Atten= 88%, Lag= 144.0 min
Primary = 5.38 cfs @ 14.79 hrs, Volume= 5.111 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf
Peak Elev= 2.16' @ 14.79 hrs Surf.Area= 108,086 sf Storage= 489,463 cf (121,645 cf above start)
Flood Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 375.3 min (1,255.3 - 880.0)

Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	1,005,110 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
-4.00	30,000	0	0	30,000
-2.00	70,000	97,217	97,217	70,030
0.00	100,000	169,111	266,328	100,101
2.00	106,020	205,991	472,319	106,536
4.00	133,250	238,752	711,070	133,876
6.00	161,234	294,040	1,005,110	161,992

Device	Routing	Invert	Outlet Devices
#1	Primary	1.00'	**18.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1.00' / 0.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=5.38 cfs @ 14.79 hrs HW=2.16' TW=1.16' (TW follows 1.00' below HW)
↑—**1=Culvert** (Inlet Controls 5.38 cfs @ 3.67 fps)

Summary for Pond POND 2: Stormwater Pond

Inflow Area = 37.540 ac, 31.28% Impervious, Inflow Depth = 3.02" for 25 Year event
Inflow = 44.96 cfs @ 12.41 hrs, Volume= 9.443 af
Outflow = 34.38 cfs @ 13.14 hrs, Volume= 9.226 af, Atten= 24%, Lag= 44.1 min
Primary = 34.38 cfs @ 13.14 hrs, Volume= 9.226 af
Routed to Reach 1R : Steep stream channel (Design Point #2)

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 139.00' Surf.Area= 94,243 sf Storage= 557,219 cf
Peak Elev= 139.94' @ 13.14 hrs Surf.Area= 100,849 sf Storage= 648,982 cf (91,763 cf above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 70.1 min (937.8 - 867.7)

Volume	Invert	Avail.Storage	Storage Description
#1	130.00'	654,954 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
130.00	39,400	0	0	39,400
132.00	47,600	86,871	86,871	47,732
134.00	56,600	104,070	190,941	56,876
136.00	66,000	122,480	313,421	66,438
138.00	87,467	152,964	466,385	87,994
140.00	101,271	188,570	654,954	101,969

Device	Routing	Invert	Outlet Devices
#1	Primary	139.10'	**13.5' long + 5.0 '/' SideZ x 23.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=34.30 cfs @ 13.14 hrs HW=139.94' TW=138.94' (TW follows 1.00' below HW)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 34.30 cfs @ 2.30 fps)

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1-1: 1-1 Runoff Area=35.010 ac 17.57% Impervious Runoff Depth=4.03"
Flow Length=1,440' Tc=25.4 min CN=61 Runoff=99.64 cfs 11.746 af

Subcatchment 2-1: Post-development Runoff Area=1,114,600 sf 23.56% Impervious Runoff Depth=5.12"
Flow Length=2,105' Tc=66.6 min CN=70 Runoff=56.61 cfs 10.907 af

Subcatchment 2-2: Post-development area Runoff Area=60,385 sf 72.20% Impervious Runoff Depth=6.82"
Flow Length=160' Tc=12.5 min CN=84 Runoff=8.68 cfs 0.788 af

Subcatchment 2-3: Post-development area Runoff Area=47,240 sf 55.78% Impervious Runoff Depth=6.45"
Flow Length=185' Tc=6.7 min CN=81 Runoff=7.81 cfs 0.583 af

Subcatchment 3-1: Post-development Runoff Area=316,000 sf 54.43% Impervious Runoff Depth=7.30"
Flow Length=860' Tc=23.3 min CN=88 Runoff=37.39 cfs 4.415 af

Subcatchment 4-1: Post-Development 4 Runoff Area=97,000 sf 7.22% Impervious Runoff Depth=6.21"
Flow Length=530' Tc=18.8 min CN=79 Runoff=11.08 cfs 1.152 af

Subcatchment 5-1: Post-Dev area 5 Runoff Area=382,900 sf 19.01% Impervious Runoff Depth=4.99"
Flow Length=850' Tc=23.5 min CN=69 Runoff=32.39 cfs 3.658 af

Reach 1R: Steep stream channel Avg. Flow Depth=0.48' Max Vel=15.11 fps Inflow=99.53 cfs 17.142 af
n=0.025 L=700.0' S=0.1971 '/' Capacity=958.84 cfs Outflow=79.44 cfs 17.142 af

Reach 3R: Stream Channel Avg. Flow Depth=1.11' Max Vel=5.55 fps Inflow=75.07 cfs 16.826 af
n=0.025 L=700.0' S=0.0100 '/' Capacity=215.95 cfs Outflow=74.97 cfs 16.826 af

Pond BIO 7/8: Bio-Retention Zone #7 AND Peak Elev=155.53' Storage=3,507 cf Inflow=7.81 cfs 0.583 af
Discarded=0.16 cfs 0.231 af Primary=7.42 cfs 0.352 af Outflow=7.57 cfs 0.583 af

Pond BIO 9: Bio-Retention Zone #9 INF Peak Elev=164.90' Storage=4,052 cf Inflow=8.68 cfs 0.788 af
Discarded=0.15 cfs 0.255 af Primary=8.29 cfs 0.533 af Outflow=8.44 cfs 0.788 af

Pond ECB 3: Existing Catch Basin #3 Peak Elev=318.49' Inflow=48.11 cfs 5.567 af
12.0" Round Culvert n=0.013 L=40.0' S=0.0223 '/' Outflow=48.11 cfs 5.567 af

Pond POND 1-1: Stormwater Pond Peak Elev=3.60' Storage=659,249 cf Inflow=99.64 cfs 11.746 af
18.0" Round Culvert n=0.013 L=60.0' S=0.0167 '/' Outflow=8.51 cfs 11.252 af

Pond POND 2: Stormwater Pond Peak Elev=140.72' Storage=654,954 cf Inflow=79.48 cfs 17.359 af
Outflow=99.53 cfs 17.142 af

Total Runoff Area = 81.340 ac Runoff Volume = 33.249 af Average Runoff Depth = 4.91"
75.95% Pervious = 61.775 ac 24.05% Impervious = 19.565 ac

Summary for Subcatchment 1-1: 1-1

Runoff = 99.64 cfs @ 12.36 hrs, Volume= 11.746 af, Depth= 4.03"
Routed to Pond POND 1-1 : Stormwater Pond (Design Point #1)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (ac)	CN	Description
*	3.650	98	Paved parking
	6.240	30	Woods, Good, HSG A
	7.850	39	>75% Grass cover, Good, HSG A
	1.500	79	Woods/grass comb., Good, HSG D
	13.270	70	Woods, Good, HSG C
*	2.500	98	Water Surface
	35.010	61	Weighted Average
	28.860		82.43% Pervious Area
	6.150		17.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	150	0.0130	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
2.4	300	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.1	40	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Corrugated PP, smooth interior
8.0	950	0.1560	1.97		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.4	1,440	Total			

Summary for Subcatchment 2-1: Post-development area 2-1

Runoff = 56.61 cfs @ 12.88 hrs, Volume= 10.907 af, Depth= 5.12"
Routed to Reach 3R : Stream Channel

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
	402,000	49	Pasture/grassland/range, Fair, HSG A
	135,000	60	Woods, Fair, HSG B
	315,000	77	Woods, Good, HSG D
*	154,000	98	Paved parking
*	108,600	98	Water Surface
	1,114,600	70	Weighted Average
	852,000		76.44% Pervious Area
	262,600		23.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
32.6	150	0.0130	0.08		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
25.5	640	0.0070	0.42		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	65	0.2100	2.29		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
8.0	1,250	0.0080	2.60	14.30	**Trap/Vee/Rect Channel Flow,** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.030 Stream, clean & straight
66.6	2,105	Total			

Summary for Subcatchment 2-2: Post-development area 2-2

Runoff = 8.68 cfs @ 12.17 hrs, Volume= 0.788 af, Depth= 6.82"
Routed to Pond BIO 9 : Bio-Retention Zone #9 INF

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
*	43,600	98	Paved parking
	16,785	49	Pasture/grassland/range, Fair, HSG A
	60,385	84	Weighted Average
	16,785		27.80% Pervious Area
	43,600		72.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.9	100	0.0100	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
0.1	20	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	40	0.0400	1.40		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
12.5	160	Total			

Summary for Subcatchment 2-3: Post-development area 2-3

Runoff = 7.81 cfs @ 12.09 hrs, Volume= 0.583 af, Depth= 6.45"
Routed to Pond BIO 7/8 : Bio-Retention Zone #7 AND #8 INF

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
*	26,350	98	Paved parking
	20,890	60	Woods, Fair, HSG B
	47,240	81	Weighted Average
	20,890		44.22% Pervious Area
	26,350		55.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.3	73	0.0400	0.23		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.75"
0.3	27	0.0300	1.35		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.75"
0.6	40	0.0030	1.11		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.5	45	0.0450	1.48		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
6.7	185	Total			

Summary for Subcatchment 3-1: Post-development area 3

Runoff = 37.39 cfs @ 12.30 hrs, Volume= 4.415 af, Depth= 7.30"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
	144,000	77	Brush, Fair, HSG D
*	172,000	98	Paved parking
	316,000	88	Weighted Average
	144,000		45.57% Pervious Area
	172,000		54.43% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.2	150	0.0200	0.14		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.75"
4.1	275	0.0260	1.13		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	25	0.0400	3.22		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.7	375	0.0270	8.65	10.61	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
0.2	35	0.0400	3.00		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
23.3	860	Total			

Summary for Subcatchment 4-1: Post-Development 4

Runoff = 11.08 cfs @ 12.26 hrs, Volume= 1.152 af, Depth= 6.21"
Routed to Pond ECB 3 : Existing Catch Basin #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
	90,000	77	Woods, Good, HSG D
*	7,000	98	Paved parking
	97,000	79	Weighted Average
	90,000		92.78% Pervious Area
	7,000		7.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.4	150	0.1000	0.17		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
4.4	380	0.0840	1.45		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	530	Total			

Summary for Subcatchment 5-1: Post-Dev area 5 (Design Point #3)

Runoff = 32.39 cfs @ 12.32 hrs, Volume= 3.658 af, Depth= 4.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 Year Rainfall=8.75"

	Area (sf)	CN	Description
	135,600	43	Woods/grass comb., Fair, HSG A
	36,500	76	Woods/grass comb., Fair, HSG C
	138,000	77	Woods, Good, HSG D
*	55,100	98	Paved parking
*	17,700	98	Water Surface
	382,900	69	Weighted Average
	310,100		80.99% Pervious Area
	72,800		19.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	150	0.0660	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.75"
2.7	200	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
2.0	350	0.3257	2.85		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.8	150	0.0800	1.41		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
23.5	850	Total			

Summary for Reach 1R: Steep stream channel (Design Point #2)

Inflow Area = 37.540 ac, 31.28% Impervious, Inflow Depth = 5.48" for 100 Year event
Inflow = 99.53 cfs @ 12.41 hrs, Volume= 17.142 af
Outflow = 79.44 cfs @ 12.44 hrs, Volume= 17.142 af, Atten= 20%, Lag= 1.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.11 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.99 fps, Avg. Travel Time= 2.9 min

Peak Storage= 3,682 cf @ 12.42 hrs
Average Depth at Peak Storage= 0.48' , Surface Width= 11.92'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 958.84 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.1971 '/'
Inlet Invert= 138.00', Outlet Invert= 0.00'

‡

Summary for Reach 3R: Stream Channel

Inflow Area = 36.153 ac, 29.71% Impervious, Inflow Depth = 5.59" for 100 Year event
Inflow = 75.07 cfs @ 12.39 hrs, Volume= 16.826 af
Outflow = 74.97 cfs @ 12.45 hrs, Volume= 16.826 af, Atten= 0%, Lag= 3.2 min
Routed to Pond POND 2 : Stormwater Pond

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.55 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 1.79 fps, Avg. Travel Time= 6.5 min

Peak Storage= 9,449 cf @ 12.41 hrs
Average Depth at Peak Storage= 1.11' , Surface Width= 14.42'
Bank-Full Depth= 2.00' Flow Area= 28.0 sf, Capacity= 215.95 cfs

10.00' x 2.00' deep channel, n= 0.025 Stream, clean & straight
Side Slope Z-value= 2.0 '/' Top Width= 18.00'
Length= 700.0' Slope= 0.0100 '/'
Inlet Invert= 147.00', Outlet Invert= 140.00'

‡

Summary for Pond BIO 7/8: Bio-Retention Zone #7 AND #8 INF

Inflow Area = 1.084 ac, 55.78% Impervious, Inflow Depth = 6.45" for 100 Year event
Inflow = 7.81 cfs @ 12.09 hrs, Volume= 0.583 af
Outflow = 7.57 cfs @ 12.12 hrs, Volume= 0.583 af, Atten= 3%, Lag= 1.3 min
Discarded = 0.16 cfs @ 12.12 hrs, Volume= 0.231 af
Primary = 7.42 cfs @ 12.12 hrs, Volume= 0.352 af
Routed to Reach 3R : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 155.53' @ 12.12 hrs Surf.Area= 3,350 sf Storage= 3,507 cf

Plug-Flow detention time= 91.4 min calculated for 0.583 af (100% of inflow)
Center-of-Mass det. time= 91.5 min (889.4 - 797.9)

Volume	Invert	Avail.Storage	Storage Description
#1	151.74'	7,988 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
151.74	2,100	0.0	0	0
151.75	2,100	40.0	8	8
152.25	2,100	20.0	210	218
154.75	2,100	20.0	1,050	1,268
154.76	2,100	100.0	21	1,289
155.25	3,200	100.0	1,299	2,588
156.75	4,000	100.0	5,400	7,988

Device	Routing	Invert	Outlet Devices
#1	Discarded	151.74'	**2.000 in/hr Soil Exfiltration over Surface area**
#2	Primary	155.25'	**20.0' long + 3.0 '/' SideZ x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.16 cfs @ 12.12 hrs HW=155.53' (Free Discharge)
↑—**1=Soil Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=7.37 cfs @ 12.12 hrs HW=155.53' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 7.37 cfs @ 1.26 fps)

Summary for Pond BIO 9: Bio-Retention Zone #9 INF

Inflow Area = 1.386 ac, 72.20% Impervious, Inflow Depth = 6.82" for 100 Year event
Inflow = 8.68 cfs @ 12.17 hrs, Volume= 0.788 af
Outflow = 8.44 cfs @ 12.20 hrs, Volume= 0.788 af, Atten= 3%, Lag= 1.8 min
Discarded = 0.15 cfs @ 12.20 hrs, Volume= 0.255 af
Primary = 8.29 cfs @ 12.20 hrs, Volume= 0.533 af
Routed to Pond POND 2 : Stormwater Pond

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 164.90' @ 12.20 hrs Surf.Area= 3,267 sf Storage= 4,052 cf

Plug-Flow detention time= 84.0 min calculated for 0.787 af (100% of inflow)
Center-of-Mass det. time= 84.1 min (880.1 - 796.1)

Volume	Invert	Avail.Storage	Storage Description
#1	160.99'	8,047 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
160.99	2,400	0.0	0	0
161.00	2,400	40.0	10	10
161.50	2,400	20.0	240	250
164.00	2,400	20.0	1,200	1,450
164.01	2,400	100.0	24	1,474
164.50	3,000	100.0	1,323	2,797
166.00	4,000	100.0	5,250	8,047

Device	Routing	Invert	Outlet Devices
#1	Discarded	160.99'	**2.000 in/hr Soil Exfiltration over Surface area**
#2	Primary	161.50'	**15.0" Round Culvert** L= 65.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 161.50' / 156.00' S= 0.0846 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#3	Device 2	164.50'	**30.0" x 30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.15 cfs @ 12.20 hrs HW=164.90' (Free Discharge)
↑—**1=Soil Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=8.28 cfs @ 12.20 hrs HW=164.90' (Free Discharge)
↑—**2=Culvert** (Passes 8.28 cfs of 9.84 cfs potential flow)
↑—**3=Orifice/Grate** (Weir Controls 8.28 cfs @ 2.07 fps)

Summary for Pond ECB 3: Existing Catch Basin #3

Inflow Area = 9.481 ac, 43.34% Impervious, Inflow Depth = 7.05" for 100 Year event
Inflow = 48.11 cfs @ 12.30 hrs, Volume= 5.567 af
Outflow = 48.11 cfs @ 12.30 hrs, Volume= 5.567 af, Atten= 0%, Lag= 0.0 min
Primary = 48.11 cfs @ 12.30 hrs, Volume= 5.567 af
Routed to Reach 3R : Stream Channel

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 318.49' @ 12.30 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	156.15'	**12.0" Round Culvert** L= 40.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 156.15' / 155.26' S= 0.0223 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=48.08 cfs @ 12.30 hrs HW=318.29' (Free Discharge)
1=Culvert (Inlet Controls 48.08 cfs @ 61.22 fps)

Summary for Pond POND 1-1: Stormwater Pond (Design Point #1)

Inflow Area = 35.010 ac, 17.57% Impervious, Inflow Depth = 4.03" for 100 Year event
Inflow = 99.64 cfs @ 12.36 hrs, Volume= 11.746 af
Outflow = 8.51 cfs @ 12.60 hrs, Volume= 11.252 af, Atten= 91%, Lag= 14.3 min
Primary = 8.51 cfs @ 12.60 hrs, Volume= 11.252 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf
Peak Elev= 3.60' @ 15.43 hrs Surf.Area= 127,592 sf Storage= 659,249 cf (291,431 cf above start)
Flood Elev= 1.00' Surf.Area= 102,988 sf Storage= 367,818 cf

Plug-Flow detention time= 1,092.9 min calculated for 2.807 af (24% of inflow)
Center-of-Mass det. time= 417.2 min (1,274.5 - 857.4)

Volume	Invert	Avail.Storage	Storage Description
#1	-4.00'	1,005,110 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
-4.00	30,000	0	0	30,000
-2.00	70,000	97,217	97,217	70,030
0.00	100,000	169,111	266,328	100,101
2.00	106,020	205,991	472,319	106,536
4.00	133,250	238,752	711,070	133,876
6.00	161,234	294,040	1,005,110	161,992

Device	Routing	Invert	Outlet Devices
#1	Primary	1.00'	**18.0" Round Culvert** L= 60.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1.00' / 0.00' S= 0.0167 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=8.51 cfs @ 12.60 hrs HW=2.80' TW=1.80' (TW follows 1.00' below HW)
↑—**1=Culvert** (Inlet Controls 8.51 cfs @ 4.81 fps)

Summary for Pond POND 2: Stormwater Pond

Inflow Area = 37.540 ac, 31.28% Impervious, Inflow Depth = 5.55" for 100 Year event
Inflow = 79.48 cfs @ 12.41 hrs, Volume= 17.359 af
Outflow = 99.53 cfs @ 12.41 hrs, Volume= 17.142 af, Atten= 0%, Lag= 0.1 min
Primary = 99.53 cfs @ 12.41 hrs, Volume= 17.142 af
Routed to Reach 1R : Steep stream channel (Design Point #2)

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 139.00' Surf.Area= 94,243 sf Storage= 557,219 cf
Peak Elev= 140.72' @ 12.41 hrs Surf.Area= 101,271 sf Storage= 654,954 cf (97,736 cf above start)

Plug-Flow detention time= 507.6 min calculated for 4.349 af (25% of inflow)
Center-of-Mass det. time= 52.3 min (904.4 - 852.1)

Volume	Invert	Avail.Storage	Storage Description
#1	130.00'	654,954 cf	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
130.00	39,400	0	0	39,400
132.00	47,600	86,871	86,871	47,732
134.00	56,600	104,070	190,941	56,876
136.00	66,000	122,480	313,421	66,438
138.00	87,467	152,964	466,385	87,994
140.00	101,271	188,570	654,954	101,969

Device	Routing	Invert	Outlet Devices
#1	Primary	139.10'	**13.5' long + 5.0 '/' SideZ x 23.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=99.50 cfs @ 12.41 hrs HW=140.72' TW=139.72' (TW follows 1.00' below HW)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 99.50 cfs @ 2.85 fps)

GRID NORTH
NEW YORK EAST ZONE 1983

N/F: West Jericho Turnpike LLC, 380
SBL: 103.1–2–74.100

N/F
GELA GROUP LLC
SBL:103.1–2–66
L.6103 ~ P.018

N/F: Ticcony, Matthew
SBL: 103.1–2–1.100

N/F: White Wolf Holdings Inc
SBL: 103.1–2–81

N/F
Milton 2002 LLC
SBL: 103.1–2–78.100

N/F
SEED LANDSCAPE DESIGN INC.
SBL:103.1–2–79 TOP

N/F
SONO–TEK INDUSTRIAL PARK LLC
SBL:103.1–2–80

N/F
TICCONY & McPECK
SBL:103.1–2–1.200

N/F: Haywood
SBL: 96.3–2–

MAHONEY ROAD

NORTH ROAD

LANDS OF
ROBERT POLLOCK
SBL:103.1–2–2
L.6480 ~ P.185

LANDS OF
MILTON REALTY LLC
SBL:103.1–2–9.2
L.3173 ~ P.206

N/F
MILTON REALTY LLC
SBL:103.1–2–9.1
L.3173 ~ P.206

N/F
WILLIAM M BEDNARSKI JR
SBL:103.1–2–5
2639 ~ P.039

LANDS OF
ROBERT POLLOCK
SBL:103.1–2–4
L.5704 ~ P.319

LANDS OF
ROBERT POLLOCK
SBL:103.1–2–3
L.5476 ~ P.257

N/F: Dauenheimer, Glenn H
SBL: 96.3–2–14

N/F
AMG MILTON LLC
SBL:103.1–2–70
L.6157 ~ P.342

N/F:
BANAJA, HATIM D
SBL: 103.1–2–9.400

N/F
JOHN W & LINDA McELRATH
SBL:103.1–2–6
L.6545 ~ P.154

N/F
JOHN W. TOTTEN
SBL:103.1–2–69
L.2133 ~ P.213

LANDS OF
MILTON REALTY LLC
SBL:103.1–2–9.3
L.3173 ~ P.206

N/F
PHYLLIS A SPOTO
IRREVOCABLE TRUST
SBL:103.1–2–7
L.6246 ~ P.311

STREAM

POPOSED
NEW
EASEMENT
FOR ACCESS
TO SBL
103.1-2-12.100

LANDS OF
ROBERT POLLOCK
SBL:103.1–2–8
L.6782 ~ P.251

N/F
JAMES D KENT
SBL:103.1–2–67
L.5034 ~ P.081

N/F
TIMOTHY R BOZIDAJ
SBL:103.1–2–68
L.5923 ~ P.195

N/F
PETER A. RUOLOTO
SBL:103.1–2–14
L.2122 ~ P.350

POND

LANDS OF
ROBERT POLLOCK
SBL:103.1–2–15
L.5666 ~ P.039

LANDS OF
ROBERT POLLOCK
SBL:103.1–2–16
L.4121 ~ P.150

CEMETERY

LANDS OF
ROBERT POLLOCK
SBL:103.1–2–17
L.4121 ~ P.150

N/F: Manning, James A
SBL: 96.3–3–2

N/F: Saychek, Toni A
SBL: 96.3–3–1.111

N/F: Murphy, Brian W
SBL: 96.3–3–3

N/F: Ward, Michael P
SBL: 96.3–3–6.100

N/F: JAMAL, AHMAD I
SBL: 96.3–3–6.200

N/F
JANET ECKERSON
SBL:96.3–3–7

N/F: Indigo, Kyle E
SBL: 96.3–2–1.300

CASSEL ROAD

VAN ORDEN ROAD

PROPOSED
PROPERTY
LINE
ADJUSTMENT
±11,600 SF
±0.27 AC

EXISTING POND

RAIL ROAD
TO POUGHKEEPSIE/NYC =>
<= TO ALBANY

N/F
CSX TRANSPORTATION INC
SBL:109.1–2–7
L.3070 ~ P.005

N/F: 220 North Road Realty LLC
SBL: 103.1–2–13

TOWN OF MARLBOROUGH
TOWN OF LLOYD

HUDSON RIVER

BOD
BnC
At
RvC
RvA
GP
PrC
PtB
NBF
W
FW
MgB

1
2
3
4
5

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PROPERTIES UNDER CONSIDERATION

SBL	OWNER	ADDRESS	TOWN	TYPE	ACREAGE
*103.1-2-12.100	Robert Pollock	238-244 North Rd	Marlboro	1 Family Res	±0.3 AC *
103.1-2-12.200	Robert Pollock	238-244 North Rd	Marlboro	Res Multiple	±39.7 AC
103.1-2-13	220 North Road Realty LLC	220-236 North Rd	Marlboro	Inn/lodge	±11.0 AC
103.1-2-11.200	99 S. Elliott Place LLC	26 Van Orden Rd	Marlboro	1 Family Res	±1.3 AC
103.1-2-10	Robert Pollock	20 Van Orden Rd	Marlboro	2 Family Res	±2.5 AC
103.1-2-11.100	22 Van Ordon LLC	22 Van Orden Rd	Marlboro	1 Family Res	±1.2 AC
103.1-2-75	99 S Elliott Place LLC	257 North Rd	Marlboro	1 Family Res	±1.4 AC
103.1-2-71	99 S. Elliot Place LLC	249-251 North Rd	Marlboro	Other Storage	±3.8 AC
103.1-2-72	Chernobyl Power & Light	8 Mahoney Rd	Marlboro	Auto body	±0.8 AC
				TOTAL	±62.0 AC

*±0.3 AC of 103.1-2-12.100 to be added to 103.1-2-200 in a lot line adjustment

PRE-DEVELOPMENT DRAINAGE AREAS
FOR
BUTTERMILK FALLS

TOWN OF MARLBOROUGH
ULSTER COUNTY ~ NEW YORK

100 0 100 200 300

Scale: 1" = 100'

JUNE 28, 2024

MEDENBACH & EGGERS
CIVIL ENGINEERING & LAND SURVEYING, P.C.
STONE RIDGE, NEW YORK (845) 687-0047

PRE
E18 105

GRID NORTH
NEW YORK EAST ZONE 1983

3-1
2-3
2-1
2-1
2-2
5-1
1-1

BIO #1
BIO #2
BIO #3
BIO #4
BIO #5
BIO #6
BIO #7
BIO #8
BIO #9
BIO #10
BIO #11
BIO #12
BIO #13
BIO #14
DS #1

PROPOSED PROPERTY LINE ADJUSTMENT
±11,600 SF
±0.27 AC

HUDSON RIVER

CEMETERY

STREAM CROSSING UNDER CONSTRUCTION
UNDER CONSTRUCTION: 30LF 3x12 CONCRETE CULVERT

(2)-CULV

EXISTING WELL

EXISTING SEPTIC TANK AND WOOD CRIBBING

SIGN & LP

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Certified on 2019 to:

1. Joe & Jane Client
2. Bank, its successors and/or assigns
3. Title Insurance Company

I HEREBY CERTIFY that this map is a true representation of a survey performed by this office in the field on In accordance with the existing code of practice for land surveys as adopted by the New York State Association of Professional Land Surveyors. Further use of this document by others not a party to this agreement be certified.

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ULSTER COUNTY ~ NEW YORK

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Scale: 1" = 100'

JUNE 28, 2024

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POST
E18 105

Appendix I

Stormwater maintenance Agreement

Appendix J

Site Plans