



July 11, 2023

Mr. Gregory Rondeau, Chairman  
Franklin Planning Board  
355 East Central Street  
Franklin, MA 02038

**Re: Proposed Solar Array, Parcel 1, 160 Maple Street, Bellingham, Norfolk County, MA  
Site Plan Peer Review**

Dear Mr. Rondeau:

BETA Group, Inc. is pleased to continue our engineering peer review services for the proposed project entitled ***Proposed Solar Array, Parcel 1, 160 Maple Street, Bellingham, Norfolk County, MA*** in Franklin, Massachusetts. This letter is provided to outline findings, comments, and recommendations on the revised documents submitted in response to our initial review of the project.

### **BASIS OF REVIEW**

The following documents were received by BETA and formed the basis of the review:

- Comment Response Letter, addressed to Mr. Gregory Rondeau, Chairman Franklin Planning board, ***RE: Proposed Solar array, Parcel 1, 160 Maple Street, Bellingham, Norfolk County, MA Site Plan Peer Review.***, dated July 10, 2023 from Bohler.
- Plans (48 sheets) entitled: ***Proposed Site Plan Documents for Nextgrid Mescalbean LLC, Bellingham & Franklin, Norfolk County, MA*** dated April 13, 2023, revised July 10, 2023, prepared by Bohler, stamped by John Kucich, PE No. 41530.

Review by BETA will include the above items along with the following, as applicable:

- ***Zoning Chapter 185 From the Code of the Town of Franklin***, current through March 01, 2016
- ***Zoning Map of the Town of Franklin, Massachusetts***, amended July 13, 2016
- ***Stormwater Management Chapter 153 From the Code of the Town of Franklin***, Adopted May 02, 2007
- ***Wetlands Protection Chapter 181 From the Code of the Town of Franklin***, current through August 20, 1997
- ***Subdivision Regulations Chapter 300 From the Code of the Town of Franklin***, current through January 01, 2016
- MassDEP Wetlands Program Policy 17-1: Photovoltaic System Solar Array Review, dated September 23, 2017

### **INTRODUCTION**

The project site is the former Maplegate Country Club which is a total lot area of 144.6± acres. Access to the site will come from the existing driveway to the golf course clubhouse from Maple Street in Bellingham. The site development associated with this proposal will be limited to Parcel 1 which is approximately 69.5± acres. The proposed development is a 5,000-kW ground mounted Photovoltaic

Power System. The limit of work for this system will be approximately 44.0 acres within parcel 1. The existing site improvements within the limits of the development include a club house, paved driveway, parking areas, gravel and paved cart paths, golf greens, driving range, landscaping, resource areas, and wooded areas. The site is surrounded by wooded land to the north, wooded land and Mine Brook to the east, Route 495 to the south, and commercial businesses, a solar field, and Maple Street to the west. Drainage patterns at the site vary but generally flow from west to east across the site to Mine Brook. The site is located within the Industrial Zoning District. The land west, north and south of the parcel are all within the same Industrial District. The parcels east of Mine Brook are located within the Single-Family III zone.

The project is partially within Water Resource District (MassDEP Zone II) along the eastern border adjacent to Mine Brook. The site is not in proximity to estimated habitat of rare or endangered species but is adjacent to NHESP Potential Vernal Pools to the North and South. The project is partially within a Zone AE FEMA mapped flood zone (area of 1% chance flood) along the eastern boundary of the site with variable elevations determined by a detailed analysis of Mine Brook. NRCS soil maps indicate the soils at the site are of Montauk fine sandy loam, and Scituate fine sandy loam. Each are rated in Hydrologic Soil Group (HSG) C (low infiltration potential).

The project proposes to develop the site with approximately 44 acres of ground mounted solar modules, 2 separate equipment areas composed of inverters, cabinets and transformers, security fencing, 20' wide gravel access driveway from the existing paved driveway into the clubhouse through the entire site with access to future development at the southern end of the array.

The proposed development will reduce the overall impervious surface area on site. Proposed impervious surfaces include the concrete pads for solar equipment and gravel access driveways. Stormwater management will deal primarily with conformance with Standard 2 for peak flow rate attenuation. Stormwater management features proposed include the construction of a stormwater detention basin along the easterly edge of the development. The project as currently depicted will disturb in excess of one acre of land and is required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and file a Notice of Intent with EPA. As currently shown, the project area will be located within the limits of the buffers to the existing wetland resource areas on site. A Notice of Intent has been filed with the Franklin Conservation Commission.

## FINDINGS, COMMENTS, AND RECOMMENDATIONS

To assist with the review, the response to comments from Bohler to the 2<sup>nd</sup> round of BETA comments are highlighted in yellow (**Bohler2: ...**) and the response by BETA will be noted as **BETA3**. Those comments that were addressed in prior reviews are noted but no further action will be taken on these responses.

### GENERAL

- G1. Recommend increasing text size of callouts to improve legibility, particularly on enlarged plans.

**Bohler:** Notes have been enlarged on the Overall Sheets to provide more clarity.

**BETA2:** Text size remains unchanged on enlarged plans. Additionally, the details provided on Sheets C-906 and C-907 are illegible.

**Bohler2:** Comment acknowledged. The intent of the overall sheets is to be referenced as a key map only. All text within the individual sheets is plotted at a legible size. Additionally, the details provided on Sheet C-906 and C-907 have been updated per new images received from the manufacture of the equipment.

**BETA3: No further comments**

- G2. Revise plans to include any utility poles, overhead wires, or electrical conduit to be used for interconnection, as applicable.

*Bohler: The utility poles proposed at the end of the existing access road for the interconnect and the additional poles proposed to bring the overhead wiring up the access road to the solar field entrance gates have been added to the plans.*

*BETA2: Plans have been revised showing 15 utility poles and overhead wire connecting to an existing utility pole along Maple Street. Comment addressed.*

- G3. Provide proposed contours for red-shaded areas to be re-graded to determine accurate limits of work, especially in those areas around the flagged wetlands where it appears that the only option available to reduce the grade is to fill the wetlands.

*Bohler: The areas of red highlighted slope is intended to provide distinction for the racking installer to utilize extended mounting legs. We are not intending to regrade those areas, instead we will work around steeper slopes by elevating the racking accordingly. Notes have been revised on the grading plan to clarify this direction.*

*BETA2: Comment addressed.*

- G4. BETA recommends that the shaded areas, which identify areas where the existing grade exceeds 15%, be eliminated from the drawings outside the limits of work to avoid confusion.

*Bohler: Acknowledged, we have removed the red hatching in areas that are outside our limit of work.*

*BETA2: Comment addressed.*

- G5. BETA recommends a condition that no earth material be removed from the Site except for unsuitable construction and demolition debris.

*Bohler: Acknowledged, the earth material will remain on site to be reused. Only unsuitable construction demolition debris, asphalt material or building material will be removed from the site.*

*BETA2: BETA defers to the Town regarding the proposed condition. Comment addressed.*

**ZONING**

The Site is located within the industrial (I) Zoning District. The proposed use is a Large-Scale Ground-Mounted Solar Energy System, which is permitted within this district following Planning Board Site Plan Review.

**SCHEDULE OF LOT, AREA, FRONTAGE, YARD, AND HEIGHT REQUIREMENTS (§185 ATTACHMENT 9)**

As shown on the schedule on the Zoning table on Sheet C-301 of the set, the Site meets the requirements for lot area, depth, frontage, width, yard widths, building height, and impervious area coverage.

**PARKING, LOADING AND DRIVEWAY REQUIREMENTS (§185-21)**

The project proposes to retain approximately 1,100 feet of an existing paved driveway which connects to Maple Street in the Town of Bellingham. Proposed 18' or 20' wide gravel driveways will connect to this existing driveway to provide access to equipment areas and the southern end of the solar array. Notes on the plan indicate that the gravel driveway will also provide access to future development to the south.

The project does not propose a residential or nonresidential building; therefore, no parking is required. BETA anticipates that there is adequate space along at turnaround areas for maintenance vehicles to temporarily park without disrupting access.

- P1. BETA defers to the Town regarding the extent of the proposed access road. BETA recommends the Applicant consult with the Town of Franklin Fire Department to determine required driveway widths and the potential need for driveways around the array perimeter.

**Bohler:** *The layout has been shared with the Town of Franklin Fire Department and the layout depicts their suggestions for turnaround areas and access points to the equipment pads.*

**BETA2:** *BETA defers to the Town of Franklin Fire Department.*

**Bohler2:** *Comment acknowledged.*

- P2. Provide plan depicting turning moments along the access roads. Confirm that the turning radius at curves and at turnaround areas is sufficient for a Town of Franklin Fire Apparatus.

**Bohler:** *Truck turning plan has been added to the set which depicts the Fire truck access through the site.*

**BETA2:** *The truck turning movements are not visible or labeled. Comment remains.*

**Bohler2:** *Truck turning movements have been turned on, and the truck turning plan has been added to the set.*

**BETA3:** *Truck turning plan is now included in the drawing set. As shown, there are a few locations where the outside travel edge does extend beyond the edge of gravel. If these areas are maintained as a grass shoulder, there should be no issues. BETA recommends that a 2' wide grass lined shoulder be identified on the construction detail on Sheet C-902*

- P3. Review width of existing access road to determine if two fire trucks could drive side-by-side and pass one-another if needed. This access route is fairly long and backing up to allow a vehicle to pass may be unsafe.

**Bohler:** *Existing access road is approximately 20' wide. This road has serviced the active use of the golf course for many years, which currently has significantly more vehicle activity than what a solar field will experience. We have depicted two fire trucks passing on this existing drive. The space is tight as noted, however we do not believe this warrants the need to widen the existing access road to account for two vehicles passing on a road that will rarely be accessed. Truck turning plan has been added to the set which depicts the Fire truck access through the site.*

**BETA2:** *Providing the hammerhead turn around at the end of the entrance driveway and maintaining the first gravel access driveway into the parking lot will alleviate the issues associated with the driveway width. No further comment.*

- P4. The proposed access gate is located at the end of an 1100+ foot long driveway with little opportunity for turnaround; therefore, a vehicle which cannot access this gate will have difficulty backing out of the Site. BETA recommends providing a turnaround area near the gate or moving the gate to allow the use of the driveway as a hammerhead.

**Bohler:** We have revised the gate location and provided two gates so that the access drive itself adjacent to the primary equipment pad can accommodate an ability to turn around.

**BETA2:** Comment addressed; gate added to provide a hammerhead turn around at the end of the access road.

- P5. Coordinate with Town Fire Department to determine means of emergency access through front gate, such as a knox box.

**Bohler:** We have added notes to the gates to provide knox box accommodations for all access gate locations.

**BETA2:** Comment addressed.

### **INDUSTRIAL DISTRICT PERFORMANCE CONTROLS (§185-22)**

The project is located within an Industrial District and therefore must conform to these requirements. Given the nature of the project, BETA does not anticipate vibration, odor, or flashing related impacts.

11. As noted at the hearing, the inverter noise levels will be approximately 65 decibels. Based upon their proximity to the adjacent industrial building, BETA recommends that the applicant review the abatement provided by the limited vegetation remaining and if necessary, provide a barrier around these units to maintain a level of 10 decibels at the property line. (See I2)

**Bohler:** The closest equipment pad is located approximately 564' feet away from the closest property that is not an adjacent solar field. The noise generation levels will not have impacts on the adjacent properties.

**BETA2:** The distance noted is correct; however, there is little vegetation that will remain between the noise generation and the abutting structure. BETA's review of the noise level at the abutting structure shows a level of 35db at the structure. Comment remains.

**Bohler2:** The closest equipment pad is located approximately 564' feet away from the closest Residential property line, the residential building is 696' away from the pad. There is existing vegetation and a commercial logging/mulching business located between the residence and the equipment pad. Note the adjacent solar facility has similar equipment at a similar distance without noise attenuating fencing. We do not foresee impacts that would be perceived by the adjacent residence per this use; however, the applicant is willing to work with the board post construction if there is an issue with noise to supplement fencing if there is a perceived noise generation concern.

**BETA3:** In accordance with §185-22.

- A. Disturbances. No sound, noise, vibration, odor or flashing (except for warning devices, temporary construction or maintenance work, parades, agricultural activities or other special circumstances) shall be perceptible without instruments more than 400 feet from the boundaries of the originating premises within an Industrial District or more than 200 feet inside the boundaries of a commercial or business district or more than 100 feet inside the boundaries of a residential district.**

**Based on the proximity of the invertors to the property line, the noise from the invertors will be heard within 400' of the parcel boundaries. BETA recommends that a noise barrier be installed between the invertors and the property line.**

12. Provide data on anticipated sound levels for transformer and related equipment (§185-22.A) and an analysis to ensure that remnant sound levels at adjacent receptors are below ambient levels.

**Bohler:** *Based on the response above, we believe the concern of impact to neighbors is remedied by the significant distance to the adjacent properties. We do not feel a noise analysis is warranted in this condition.*

**BETA2:** *See comment above.*

**Bohler2:** *There is existing vegetation along the property boundary that will remain. Note that there is also a commercial property that contains heavy equipment, and mulching activities that exists between the solar boundary and the residential properties. These activities would generate higher decibel levels than what we are proposing from the transformers. We do not foresee impacts that would be perceived by the adjacent residence per this use; however, the applicant is willing to work with the board post construction if there is an issue with noise to supplement fencing if there is a perceived noise generation concern.*

**BETA3:** *The bylaw does not qualify the impacts solely to the adjacent residential uses. Without a noise analysis at the adjacent industrial parcel, we cannot confirm that the ambient noise levels would exceed the noise levels generated by the transformers. Thus, BETA recommends that a noise attenuation barrier be provided between the transformers and the property line.*

#### **EARTH REMOVAL REGULATIONS (§185-23)**

The project includes significant disturbance which may result in earth removal greater than 15 cubic yards.

- E1. Indicate approximate earth removal volume to determine compliance with this section.

**Bohler:** *We have added notes on the plans regarding maintaining the soil removal or disturbed top soil onsite for re-use. We are not exporting soil from the site.*

**BETA2:** *No further comments.*

#### **FLOODPLAIN DISTRICT (§185-24)**

A FEMA-mapped 100-year floodzone (Zone AE) is located along the northern and eastern limits of the Site (Approx. elevation 183' to 184'). No work is proposed within this area, and all proposed grading is well above the flood elevation.

#### **SIDEWALKS (§185-28) AND CURBING (§185-29)**

No sidewalks or curbing are proposed under this project. As a solar facility, pedestrian access to the Site is not required. The project proposes to retain the existing driveway entrance, located in the Town of Bellingham, and therefore no new curbing is provided within the area 10' from the street lot line as required per §185-29.

#### **SITE PLAN AND DESIGN REVIEW (§185-31)**

The project has been submitted for Site Plan Review and is required to conform to the requirements of this section. The submitted plan set appears to be in compliance with all drawing requirements and review criteria, pending further review by the Fire Department to determine access requirements.

### **WATER RESOURCES DISTRICT (§185-40)**

The Site is partially located within the Town of Franklin Water Resources District and a Zone II Wellhead Protection Area. Proposed work in this area includes tree clearing, grading, construction of a small section of solar panels and fencing, and construction of an infiltration basin. The project does not include any use that would be prohibited in this district. Impervious surfaces proposed within the district are limited only to the footprint of the array racking footings.

- W1. Identify safeguards which will be implemented to protect against any accidental hazardous material release from the solar panels or ancillary equipment (§185-40.E.1).

**Bohler:** *The panels and equipment pads do not contain hazardous material that warrants additional protection. The transformer is noted to have bio-degradable fluid. The energy storage inverters are also self-contained.*

**BETA2:** *No further comments.*

### **STORMWATER MANAGEMENT**

The stormwater management design proposes a detention basin to capture stormwater runoff from the northeastern portion of the array. Two outfalls from this basin are proposed to convey captured stormwater runoff to the east. The remainder of the Site will generally follow pre-development flow patterns with no stormwater BMPs proposed.

### **STORMWATER MANAGEMENT REGULATIONS (CHAPTER 153)**

The project proposes to disturb land in excess of one acre within the Town of Franklin. It is therefore subject to the Stormwater Management Regulations. The project is also required to comply with the Town of Franklin Best Development Practices Guidebook (BDPG). Compliance with these regulations is outlined below and throughout the following sections.

- SW1. Provide test pit data in the area of the proposed basin to determine Estimated Seasonal High Groundwater levels (§153-15.A(9)).

**Bohler:** *Four (4) test pits are being schedule and will be conducted within the limits of the proposed stormwater management basin. The results of the testing will be shared with the Board and BETA upon completion.*

**BETA2:** *No further comments until test pit results are available.*

**Bohler2:** *As discussed during the last planning board meeting, we are requesting to schedule the test pits prior to construction so that we do not disturb the current activity of the golf course in this location. The proposed basin is located where a current fairway and green is today. The basin bottom will be aligned with the current lower surface elevations of the course, so we will not be proposing a deep cut or have concerns of high groundwater in this location.*

**BETA3:** *As discussed, there are several areas where test pits could be implemented without disturbing the existing recreational use of the parcel by the golfing community. BETA recommends that a minimum of 2 shallow test pits be implemented now with a condition of 2 more prior to construction.*

- SW2. Indicate composition of proposed “meadow seed mix.” Proposed seed mix should include native vegetation to the extent practicable (BDPG Pg 6).

**Bohler:** Refer to the seed mix specifications provided on Detail Sheet C-902 for the associated seed mixes proposed onsite.

**BETA2:** No further comments.

### **SUBDIVISION REGULATIONS - STORMWATER MANAGEMENT REGULATIONS (§300-11)**

Additional requirements for stormwater management are outlined in §300-11 of the Town of Franklin Subdivision Regulations.

SW3. Revise proposed drainage pipe to be reinforced concrete or request waiver (§300-11.B(2.a)).

**Bohler:** Drainage piping has been revised to concrete pipe. Refer to the revised civil plans.

**BETA2: No further Comments.**

### **MASSDEP STORMWATER STANDARDS**

The project is subject to the Massachusetts Stormwater Standards as outlined by MassDEP. Compliance with these standards is outlined below:

**NO UNTREATED STORMWATER (STANDARD NUMBER 1):** No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. The project proposes two new outfalls from the detention basin. Each outfall will discharge onto a new riprap apron. The northern outfall is within the 100-foot wetland buffer zone, while the southern outfall is outside all buffer zones.

SW4. Provide callouts for riprap aprons on the plans. Revise dimensions of riprap aprons in plan view to be consistent with the details.

**Bohler:** Rip rap aprons have been revised and labeled on the revised civil plans.

**BETA2:** No further comments.

**POST-DEVELOPMENT PEAK DISCHARGE RATES (STANDARD NUMBER 2):** Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. The project proposes changes to site hydrology and ground cover which will impact stormwater flow to the one analyzed design point. Stormwater runoff will be mitigated via a net decrease in impervious area as well as a detention basin BMP. Calculations indicate a decrease in peak discharge rate and runoff volume to the design point.

SW5. Depict existing treeline to remain and proposed limits of clearing on the post-development watershed plan.

**Bohler:** The existing treeline to remain has been added to the Proposed Conditions Drainage Area Map (A). The proposed limits of clearing are shown on the Demolition Plans that will be removed within the limit of work line.

**BETA2:** Comment addressed.

SW6. Revise post-development hydroCAD model to utilize a cover type of “>75% grass cover” for the array area. The establishment of meadow-like conditions in this area will be hampered by shading from the panels and length of time needed for vegetation to grow.

**Bohler:** The proposed HydroCAD model has been updated accordingly.

**BETA2:** Comment addressed.



- SW7. Revise cover type for gravel driveways to be “Gravel Surface” with CN 96. The “Gravel Roads” cover type assumes a grassed shoulder is included in the contributing area.

**Bohler:** *The existing and proposed HydroCAD models have been updated accordingly.*

**BETA2:** *Comment addressed.*

- SW8. Review cover type area attributed to “paved parking” for subcatchment P1a; the area used is inconsistent with the area depicted on the plans, based on the portions of the access driveway and cart paths designated to remain.

**Bohler:** *Onsite cart paths are proposed to be removed within the limit of work except for those located at wetland crossings. The civil plans have been revised to reflect this work.*

**BETA2:** *The demolition plans depict several cart paths to remain which do not appear to have been accounted for in the model. Confirm accuracy of demolition plans, clearly depict any cart paths to remain on the watershed plans, and revise model as necessary.*

**Bohler2:** *The civil plans and stormwater models have been revised to accurately depict the extent of the proposed work and have been updated to show consistent data.*

**BETA3:** *In accordance with the plans, the paved areas that will remain in subcatchment P1a is greater than 0.61 acres. It appears that the existing cart paths that are scheduled to remain in place have not been accounted for. Comment remains.*

- SW9. Review cover type area attributed to “gravel” for subcatchment P1a; the area used is inconsistent with the gravel driveway depicted on the plans.

**Bohler:** *Onsite cart paths are proposed to be removed within the limit of work except for those located at wetland crossings. The civil plans have been revised to reflect this work.*

**BETA2:** *The demolition plans depict gravel areas to remain in the western portion of the Site outside the limits of work, which do not appear to have been accounted for in the model. Confirm accuracy of demolition plans, clearly depict any gravel areas to remain on the watershed plans, and revise model as necessary.*

**Bohler2:** *The demolition plans have been updated to be consistent with the stormwater model data.*

**BETA3:** *The drainage analysis does not account for that portion of the gravel parking lot outside the limit of work within subcatchment P1a scheduled to remain. Comment remains.*

- SW10. There are no proposed changes to the site north of the pond located northeast of the proposed entrance gate and a portion of this area will flow west towards Maple Street. BETA recommends that the drainage analysis be restricted to the area south of the northern wetlands which are impacted by the development.

**Bohler:** *The Project proposes to remove cart paths in the northern portion of the site therefore it has been included in the analysis area.*

**BETA2:** *Although it is noted on the demolition plans, the limit of work as identified on the plans does not include these areas. There are no notes in the Erosion and sediment control plan either relative to this demolition and restoration either. BETA recommends that a construction detail with notes relative to time requirements for both demolition and restoration be provided on the plans.*

**Bohler2:** *The Project proposes to remove cart paths in the northern portion of the site therefore it has been included in the analysis area. Additionally, this area has been noted on the erosion and sediment control plans.*

**BETA3:** *Because these areas will be located outside the primary limit of work associated with the panels, timing for this activity will be critical. Although there are general notes on the erosion control plan that discuss the issue of restoration of disturbed areas, BETA recommends that more specific notes relative to the demolition and restoration of these cart paths be added to the layout Sheets C302-303 rather than the general note currently shown. In addition, BETA recommends that this demolition and restoration be restricted to either the spring or fall growing seasons.*

**RECHARGE TO GROUNDWATER (STANDARD NUMBER 3):** *Loss of annual recharge to groundwater should be minimized through the use of infiltration measures to maximum extent practicable. NRCS soil maps indicate the soils at the site are of Montauk fine sandy loam, and Scituate fine sandy loam. Each are rated in Hydrologic Soil Group (HSG) C (low infiltration potential). A portion of the analysis area is mapped as Freetown Muck with HSG B/D (very low infiltration potential when saturated).*

Soil testing has not been conducted at the Site. The project narrative indicate that this will be completed prior to construction.

The project proposes a net decrease in impervious area; therefore, post-development annual recharge is anticipated to be an improvement compared to existing conditions.

SW11. Based on the size of the basin and proximity to wetlands, BETA recommends that soil testing be conducted in the footprint of the basin prior to approval.

**Bohler:** *Four (4) test pits are being scheduled and will be conducted within the limits of the proposed stormwater management basin. The results of the testing will be shared with the Board and BETA upon completion.*

**BETA2:** *No further comments until test pit results are available.*

**Bohler2:** *As discussed during the last planning board meeting, we are requesting to schedule the test pits prior to construction so that we do not disturb the current activity of the golf course in this location. The proposed basin is located where a current fairway and green is today. The basin bottom will be aligned with the current lower surface elevations of the course, so we will not be proposing a deep cut or have concerns of high groundwater in this location.*

**BETA3:** *See comment SW1 above*

SW12. Revise detention basin detail to remove erroneous reference to Landscape Plan and to exclude aspects which do not pertain to the project, e.g. flared end, riprap pad, and HDPE inlet pipe.

**Bohler:** *The detention basin detail has been revised.*

**BETA2:** *Comment addressed.*

SW13. Provide a minimum of 4 test pits in the area of the proposed detention basin to establish Estimated Seasonal High Groundwater.

**Bohler:** Four (4) test pits are being scheduled and will be conducted within the limits of the proposed stormwater management basin. The results of the testing will be shared with the Board and BETA upon completion.

**BETA2:** No further comments until test pit results are available.

**Bohler2:** As discussed during the last planning board meeting, we are requesting to schedule the test pits prior to construction so that we do not disturb the current activity of the golf course in this location. The proposed basin is located where a current fairway and green is today. The basin bottom will be aligned with the current lower surface elevations of the course, so we will not be proposing a deep cut or have concerns of high groundwater in this location.

**BETA3:** See comment SW1 above.

**TOTAL SUSPENDED SOLIDS (STANDARD NUMBER 4):** For new development, stormwater management systems must be designed to remove 80% (90% per Town Bylaw) of the annual load of Total Suspended Solids (TSS). No stormwater BMPs have been proposed with the capability of TSS removal. As noted in the project narrative, proposed impervious areas are limited to gravel drives and existing paved roadways which will see only minimal vehicle traffic for maintenance. TSS removal will also be achieved via impervious area disconnection.

The project is required to treat the 0.8-inch water quality volume per Town Bylaws. No infiltration or treatment BMPs are proposed to meet this requirement.

SW14. For a redevelopment Site, meet one of the following criteria (§153-16.B(2))

- a. Retain the volume of runoff equivalent to, or greater than, 0.8 inch multiplied by the total post-construction impervious surface area on the Site; and/or
- b. Remove 80% of the average annual post-construction load of TSS and 50% of the average annual load of total phosphorus.

**Bohler:** The detention basin and associated outlet control structures have been modified to retain and infiltrate more than the required water quality volume for impervious areas on site. Refer to the calculations provided in the revised drainage report.

**BETA2:** The use of the basin as an infiltration basin will be dependent on the test pit results. The detail on sheet C-902 should also be modified to show the actual outlet configuration and elevations. No further comments until test pit results are available.

**Bohler2:** The detention basin and associated outlet control structures have been modified to retain and infiltrate more than the required water quality volume for impervious areas on site. Additionally, the details have been revised to show the actual outlet configuration. Refer to updated calculations attached within this response letter.

**BETA3:** The Typical Surface Basin Outlet Control Structure Detail, on sheet C-902 should reflect the design rather than a reference to the calculations especially since the note (Note #6) on the detail does not reference the calculations.

- SW15. Provide means of sediment control, such as a swale or berm, in areas where the proposed gravel road or paved driveway is in close proximity to wetlands (e.g. WF #285-#292, WF #181 - #191, #M Series, and #N Series).

**Bohler:** Swales and stone check dams have been added along the proposed gravel road adjacent to wetland WF #285-292. Refer to the revised civil plans. Existing gravel and/or paved areas draining to wetlands WF#181-191, #M Series, and #N Series are located outside of the proposed development limits and are expected to remain untouched. Vegetation within these areas appears well established and provides a natural buffer to the wetlands. It is our belief that impacts proposed to these areas would not be beneficial to the wetlands or their associated buffers and that these areas should remain. In addition, a reduction in sediment is anticipated since vehicular access to the site will be limited due to the proposed use.

**BETA2:** Provide detail of proposed level spreader and review proposed top elevation for consistency with proposed grading. Provide detail for proposed earthen berm.

**Bohler2:** Details for the proposed level spreader and earthen berms have been added to the plan set. Additionally, the grading plans have been updated to reflect a top elevation that is consistent with the proposed grading.

**BETA3:** The Level Spreader detail does not fit the plan view on Sheet C-405. In addition, the label "Top Elevation 204.0" is confusing since the roadway elevation is 218 and the toe of slope is 213±. Provide further detail and explanation.

- SW16. Unless required for access, consider removing existing cart paths within the western portion of the property to mitigate impacts to water quality.

**Bohler:** Onsite cart paths are proposed to be removed within the limit of work except for those located at wetland crossings. The civil plans have been revised to reflect this work.

**BETA2:** The demolition plans have been modified to reflect the existing cart path removal. However, the existing paved cart paths adjacent to wetland flags 284-294 are scheduled to remain. Based upon the level of construction proposed in this area, extending the erosion control to include these areas should be considered.

**Bohler2:** Onsite cart paths are proposed to be removed within the limit of work except for those located at wetland crossings. The paved cart path adjacent to wetland flags 284-294 have also been modified to be removed. The erosion control measures have been updated to reflect this change. The civil plans have been revised to reflect this work.

**BETA3:** The cart paths in this area are still noted on the demolition plans to remain. No further comments. (See SW 8 above)

**HIGHER POTENTIAL POLLUTANT LOADS (STANDARD NUMBER 5):** Stormwater discharges from Land Uses with Higher Potential Pollutant Loads (LUHPPLs) require the use of specific stormwater management BMPs. The project is not considered a LUHPPL – **not applicable**.

**CRITICAL AREAS (STANDARD NUMBER 6):** Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas. The project includes stormwater discharges to a Zone II Wellhead protection area located along the eastern perimeter of the Site which is a critical area. In addition, the WF #186 – WF #203 wetlands include a vernal pool which is considered a critical area. Detention Basins are not considered recommended BMPs for use in these critical areas. At least 44% pretreatment is required before discharging to an infiltration BMP and the project is required to treat the

1-inch water quality volume (Refer to Standard 4 above). A spill presentation and response plan has been included in the submission.

SW17. Based upon the existing grades and spot shots in the existing paved access driveway adjacent to the vernal pool, it appears that the runoff from this pavement will flow south away from the pond. BETA recommends that additional spot shots along the northerly edge of the pavement adjacent to the pond be conducted to confirm this runoff pattern and if necessary proposed revisions to the driveway to ensure that untreated runoff from the pavement does not flow directly into the pond.

**Bohler:** *Runoff from a small portion of the existing driveway referenced above appears to flow to the vernal pool and wetland #N series. These areas are located outside of the proposed development limits and are expected to remain untouched. Existing vegetation adjacent to the driveway appears well established and provides a natural buffer to the wetlands. It is our belief that impacts proposed to these areas would not be beneficial to the wetlands or their associated buffers and that these areas should remain.*

**BETA2:** *The N & M series wetlands are isolated until the water level exceeds Elevation 220. At that point flow would move northwest into the E series and then through the 12" culvert beneath the entrance driveway. The intent of the comment was to see if minor changes in the roadway grades could be achieved to direct runoff from the access roadway pavement into the N & M series wetlands and away from the vernal pool.*

**Bohler2:** *While changing the roadway grades may provide some beneficial impacts. This would result in a significant increase in wetland and buffer impacts. Existing vegetation adjacent to the driveway appears well established and provides a natural buffer to the wetlands. It is our belief that impacts proposed to these areas would not be beneficial to the wetlands or their associated buffers and that these areas should remain.*

**BETA3:** *No further comments*

**REDEVELOPMENT (STANDARD NUMBER 7):** *Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. The project is considered a redevelopment under the definition of "Development, rehabilitation, expansion, and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area." Existing cart paths and driveways will be removed to result in a net decrease in impervious area. As such, the project need only meet certain standards to the maximum extent practicable.*

SW18. BETA recommends the Applicant complete the redevelopment checklist found in Volume 3 of the MA Stormwater Handbook to document which standards are being met only to the maximum extent practicable.

**Bohler:** *Standards 3 and 4 are met to the maximum extent practicable for a redevelopment. The remaining Standards, 1-2 and 5-10, are fully met.*

**BETA2:** *Comment remains; provide the redevelopment checklist.*

**Bohler2:** *The items outlined in the Redevelopment Checklist, is redundant to the MADEP stormwater standards and summarized within the stormwater management report. The development proposes a reduction of 3 acres of impervious coverage, re-utilizes the existing*

*access road and does not propose a new building or parking area. There is no generated TSS for additional treatment and the basin provides additional reductions in volume and infiltration.*

**BETA3:** *The 2+ acre reduction in the impervious coverage on site does help, however, the applicant is not proposing any additional BMPs for the remaining impervious coverage. Comment remains, provide the checklist.*

- SW19. Show that portion of the existing access driveway that is to remain that will qualify for an LID Site Design Credit based upon the flow length to the receiving water.

**Bohler:** *The site is not protected as a natural conservation area, therefore the existing driveway does not qualify for a LID Site Design Credit.*

**BETA2:** *In accordance with Volume 3, Chapter 1, page 44, the qualifying area does not need to be protected as a natural conservation area. However, the following comment addresses this issue. (See SW20).*

- SW20. BETA recommends that the applicant review the entrance driveway pavement area which is to remain and determine if some measure of treatment is possible to meet the definition of maximum extent possible.

**Bohler:** *Under existing conditions, runoff generated across the entrance driveway flows over hundreds of linear feet of vegetated land receiving TSS removal and allowing for recharge prior to discharging to surrounding resource areas. The number of vehicles proposed to access the site after construction will be significantly reduced compared to existing conditions, ultimately improving the quality of runoff compared with the pre-development condition. It is our belief that minimizing additional impacts onsite is more beneficial to the surrounding natural environment and that additional treatment is not necessary.*

**BETA2:** *The only portion of the entrance driveway that is a concern is that portion between the gravel access driveway into the parking lot and the start of the M series wetlands. BETA agrees that all the runoff from the pavement west of this area will flow across an existing vegetated area which will provide the treatment intended by the standards. However, between the 2 entrance driveways into the gravel parking lot, the adjacent wetlands and the steep grades down from the edge of pavement limit the ability to provide any additional treatment. The area where there could be some treatment provided is the swale between the N & E series wetlands adjacent to the roadway. BETA recommends that the designer look at this area and see if some minor changes in topography could provide some treatment.*

- SW21. There are areas outside the limits of work where existing cart paths and gravel access roadways and parking areas will be abandoned in place. In certain areas these surfaces will be cutoff at both end of the area. BETA recommends that the applicant review these areas which are directly adjacent to the limit of work where these impervious surfaces could easily be removed and loamed and seeded.

**BOHLER:** *A note has been added to the site plans indicating that loam and seed shall be proposed in all areas where gravel or paved cart paths, roadways, and parking areas have been removed / abandoned.*

**BETA2:** *BETA recommends that the note shown on Sheet C-301 relative to restoration of the cart path be expanded to include additional details on time of year, limits on exposure, etc. In addition, those cart paths which will remain should be shown on the proposed grading plans.*

SW22. Provide calculations using performance curves to indicate the approximate TSS removal that will be provided by impervious area disconnection.

**Bohler:** *The Project is a redevelopment and proposes to reduce impervious coverage by approximately three (3) acres as compared to the pre-development condition. As a result, TSS removal rates will be increased across the site and calculations are not required.*

**BETA2:** *BETA recognizes that the redevelopment of the site will significantly reduce the impervious surfaces on site and the water quality benefits associated with the removal. However, in accordance with the handbook, TSS Removal Calculations are required to document compliance with the standards.*

**EROSION AND SEDIMENT CONTROLS (STANDARD NUMBER 8):** *Erosion and sediment controls must be implemented to prevent impacts during construction or land disturbance activities. As the project proposes to disturb greater than one acre of land, it will be required to file a Notice of Intent with EPA and develop a Stormwater Pollution Prevention Plan (SWPPP). Erosion control measures are depicted on the plans include compost sock, silt fence, hay bales, inlet protection, stabilized construction entrance, dust control, erosion control blankets, filter bags for dewatering, and stockpile controls. A construction sequencing plan is included on Sheet C-608.*

SW23. Provide expected date clearing will begin and estimate duration of exposure of cleared areas (§153-12.M).

**Bohler:** *Construction is anticipated to begin May 2024 and continue through the summer. Ground stabilization is expected to occur during the planting season in the fall through approximately November 2024.*

**BETA2:** *No further comments.*

SW24. Remove hay bales from the proposed erosion control plan (BDPG Pg. 11).

**Bohler:** *Hay bales have been removed from the erosion control plan.*

**BETA2:** *Comment addressed.*

SW25. Recommend including a note or callout prohibiting the placement of stockpiles within wetland buffer zones.

**Bohler:** *A note has been added to the erosion control sheets of the revised civil plans.*

**BETA2:** *Comment addressed.*

SW26. Revise construction sequencing to exclude any steps that do not pertain to the project (e.g. buildings, curbing) and include timing of array racking, fencing, and electrical connections.

**Bohler:** *Construction sequencing has been revised accordingly on sheet C-608 of the civil plan set.*

**BETA2:** *Comment addressed.*

SW27. Revise construction sequencing to indicate timing of detention basin construction. Include a provision during restoration to remove any construction period sediment from the basin.

**Bohler:** *Construction sequencing has been revised accordingly on sheet C-608 of the civil plan set.*

**BETA2:** *Comment addressed.*

SW28. Indicate if existing topsoil is to be retained and/or stockpiled and screened for re-use.

**Bohler:** Existing topsoil is expected to be retained and stockpiled onsite.

**BETA2: Comment addressed.**

SW29. The applicant is reminded that a Stormwater permit from the Franklin DPW is required based upon the size of the disturbance.

**Bohler:** Comment acknowledged.

**BETA2: No further comments.**

**OPERATIONS/MAINTENANCE PLAN (STANDARD NUMBER 9):** A Long-Term Operation and Maintenance Plan shall be developed and implemented to ensure that stormwater management systems function as designed. A Stormwater Operation and Maintenance Manual was provided with the Stormwater Management Report.

SW30. Provide owner signature (§153-18.B(5)).

**Bohler:** The Owner's signature has been provided in the revised O&M Plan.

**BETA2: No further comments.**

SW31. Include provision requiring a documentation submittal to the DPW confirming when maintenance has been satisfactory completed (§153-18.B(6)).

**Bohler:** The O&M Plan has been revised accordingly.

**BETA2: No further comments.**

SW32. Indicate the stormwater system owner(s) for the stormwater management system following construction.

**Bohler:** The responsible party has been provided.

**BETA2: No further comments.**

SW33. Indicate the party or parties responsible for maintenance.

**Bohler:** The responsible party has been provided.

**BETA2: No further comments.**

SW34. Indicate how future property owners will be notified of the presence of the stormwater management system and the need for maintenance.

**Bohler:** In the event the property is sold, the Operation and Maintenance Plan will be provided to and will be the responsibility of the new owner.

**BETA2: No further comments.**

SW35. Provide BMP location map.

**Bohler:** A BMP Location map has been provided and is included in the appendices of the revised drainage report.

**BETA2: No further comments.**

SW36. Provide estimated operations and maintenance budget.

**Bohler:** Approximate maintenance budgets have been provided.



**BETA2: No further comments.**

SW37. Eliminate the reference to catch basins since there are none existing or proposed.

**Bohler:** *Catch basins have been eliminated from the O&M Plan and the document has been revised accordingly.*

**BETA2: No further comments.**

SW38. Revise layout of detention basin and/or perimeter fence to allow maintenance vehicle access around the perimeter of the basin at the crest of the berm.

**Bohler:** *Fencing has been revised to allow vehicle access along the access berm.*

**BETA2: No further comments.**

SW39. Where solar array rows are perpendicular to topography, include regular inspection and maintenance of drip edges to mitigate creation of rills and gulleys.

**Bohler:** *The O&M Plan has been revised accordingly.*

**BETA2: No further comments.**

**ILLICIT DISCHARGES (STANDARD NUMBER 10):** *All illicit discharges to the stormwater management system are prohibited. An Illicit Discharge Compliance Statement was provided with the submission.*

SW40. Provide signature of owner on the illicit discharge compliance statement.

**Bohler:** *The Owner's signature has been provided.*

**BETA2: No further comments.**

## **WETLANDS PROTECTION**

The Project proposes work within Areas Subject to Protection and Jurisdiction of the Franklin Conservation Commission, including the 100-foot Buffer Zones to a vegetated wetland, flood plains, and vernal pools. Work within these areas includes portions of the solar array, fencing, gravel access drives, grading, tree clearing, and construction of a detention basin. Therefore, the Applicant is required to submit an NOI to the Town of Franklin Conservation Commission and must obtain an Order of Conditions to complete the proposed work.

If we can be of any further assistance regarding this matter, please contact us at our office.

Very truly yours,

Mr. Gregory Rondeau, Chairman

July 11, 2023

Page 18 of 18

BETA Group, Inc.

A handwritten signature in blue ink, appearing to read "Gary D. James". The signature is fluid and cursive, with the first name "Gary" being the most prominent.

Gary D. James, P.E.

Senior Project Engineer

cc: Amy Love, Town Planner



# TOWN OF FRANKLIN

## DEPARTMENT OF PUBLIC WORKS

Franklin Municipal Building  
257 Fisher Street  
Franklin, MA 02038-3026

July 20, 2023

Mr. Greg Rondeau, Chairman  
Members of the Franklin Planning Board  
355 East Central Street  
Franklin, MA 02038

**RE: Site Plan – Maplegate North Solar**

Dear Mr. Chairman and Members:

We have reviewed the revised materials for the subject project and our previous comments have been addressed.

In reviewing the latest drawings, we note that the detail for the Outlet Control Structure shows the proposed orifice as “per design.” The dimensions of the orifice should be identified in accordance with the stormwater calculations, which call out the opening as 11”w x 3”h with an invert of 203.00.

We recommend this be noted on the final version of the plans.

Should you have any questions or require additional information, please do not hesitate to contact me.

Sincerely,

Michael Maglio, P.E.  
Town Engineer

# Town of Franklin

355 East Central Street  
Franklin, Massachusetts 02038-1352



Phone: (508) 520-4907  
www.franklinma.gov

## DEPARTMENT OF PLANNING AND COMMUNITY DEVELOPMENT

**DATE:** July 19, 2023  
**TO:** Franklin Planning Board  
**FROM:** Department of Planning and Community Development  
**RE:** Maplegate Solar North  
Site Plan

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The DPCD has reviewed the above referenced Site Plan Modification application for the Monday, July 24, 2023 Planning Board meeting and offers the following commentary:

### **General:**

1. The site is accessed through Bellingham at 160 Maple St, and located in the Industrial Zoning District.
2. The Planning Board approved an 81-P ANR plan on January 9, 2023, combining the lots indicated on the application, into one single lot.
3. The proposed project includes the construction solar panels, along with drainage.
4. The Applicant has filed a NOI with the Conservation Commission.
5. Review letters will be provided from BETA, DPW and Fire.

### **Comments from June 26, 2023 Meeting:**

1. The Board requested that the cart paths be removed and add new plantings and/or green space.
2. Applicant has provided a 7ft chain link fence with a wildlife gap.
3. The Board continued to express concern for the noise. Has asked the applicant to provide noise mitigation measures.
4. The Applicant should provide approval from the Conservation Commission for public access to lot 2.
5. Provide easement documents that allows public access to lot 2.
6. Provide the amount of a surety bond for decommissioning.

### Potential Conditions:

1. Applicant shall enter into a monetary agreement (PILOT) at the sole discretion of Administration and the Town of Franklin prior to commencement of construction.
2. A Surety bond in the amount of \$\_\_\_\_\_ shall be issued by a surety company acceptable to the Town of Franklin prior to commencement of construction.

July 10, 2023

Mr. Gregory Rondeau, Chairman  
Franklin Planning Board  
355 East Central Street  
Franklin, MA 02038

**Re: Proposed Solar Array, Parcel 1,  
160 Maple Street, Bellingham,  
Norfolk County, MA**

Dear Mr. Rondeau,

Bohler Engineering is in receipt of a comment letter from BETA Group, Inc., dated June 21, 2023. On behalf of Applicant Nextgrid Mescalbean LLC, Bohler offers the following responses. For clarity, the original comments are in *italics*, while our responses are directly below in **bold** type.

Enclosed Documents:

- One (1) signed and sealed copies of the *Proposed Site Plan Documents* for Nextgrid Mescalbean, LLC prepared by our office dated 5/10/2022, last revised July 10, 2023;
- One (1) 11"x17" copy of the *Proposed Site Plan Documents* for Nextgrid Mescalbean, LLC prepared by our office dated 5/10/2022, last revised July 10, 2023;
- One (1) copy of the NOAA Rainfall Data
- One (1) Revised Existing and Proposed HydroCAD Calculations, prepared by Bohler, dated 7/10/23; and
- One (1) Revised Recharge, Drawdown, Water Quality Volume, Stage Storage Volume, Pipe Sizing, and Outlet Control Sizing Calculations, prepared by Bohler, dated 7/10/23.

## **General Comments**

*Comment # 1 Recommend increasing text size of callouts to improve legibility, particularly on enlarged plans.*

**Response 1: Notes have been enlarged on the Overall Sheets to provide more clarity.**

*BETA2: Text size remains unchanged on enlarged plans. Additionally, the details provided on Sheets C-906 and C-907 are illegible.*

**Response 2: Comment acknowledged. The intent of the overall sheets is to be referenced as a key map only. All text within the individual sheets is plotted at a legible size. Additionally, the details provided on Sheet C-906 and C-907 have been updated per new images received from the manufacture of the equipment.**

## Parking, Loading and Driveway Comments

*Comment #2 BETA defers to the Town regarding the extent of the proposed access road. BETA recommends the Applicant consult with the Town of Franklin Fire Department to determine required driveway widths and the potential need for driveways around the array perimeter.*

**Response 1: The layout has been shared with the Town of Franklin Fire Department and the layout depicts their suggestions for turnaround areas and access points to the equipment pads.**

*BETA2: BETA defers to the Town of Franklin Fire Department.*

**Response 2: Comment acknowledged.**

*Comment #3 Provide plan depicting turning movements along the access roads. Confirm that the turning radius at curves and at turnaround areas is sufficient for a Town of Franklin Fire Apparatus.*

**Response 1: Truck turning plan has been added to the set which depicts the Fire truck access through the site.**

*BETA2: The truck turning movements are not visible or labeled. Comment remains.*

**Response 2: Truck turning movements have been turned on, and the truck turning plan has been added to the set.**

## Industrial District Performance Control Comments

*Comment #4 As noted at the hearing, the inverter noise levels will be approximately 65 decibels. Based upon their proximity to the adjacent industrial building, BETA recommends that the applicant review the abatement provided by the limited vegetation remaining and if necessary provide a barrier around these units to maintain a level of 10 decibels at the property line. (See I2)*

**Response 1: The closest equipment pad is located approximately 564' feet away from the closest property that is not an adjacent solar field. The noise generation levels will not have impacts on the adjacent properties.**

*BETA2: The distance noted is correct; however, there is little vegetation that will remain between the noise generation and the abutting structure. BETA's review of the noise level at the abutting structure shows a level of 35db at the structure. Comment remains.*

**Response 2: The closest equipment pad is located approximately 564' feet away from the closest Residential property line, the residential building is 696' away from the pad. There is existing vegetation and a commercial logging/mulching business located between the residence and the equipment pad. Note the adjacent solar facility has similar equipment at a similar distance without noise attenuating fencing. We do not foresee impacts that would be perceived by the adjacent residence per this use; however, the applicant is willing to work with the board post construction if there is an issue with noise to supplement fencing if there is a perceived noise generation concern.**

# BOHLER //

*Comment #5 Provide data on anticipated sound levels for transformer and related equipment (§185-22.A) and an analysis to ensure that remnant sound levels at adjacent receptors are below ambient levels.*

**Response 1:** Based on the response above, we believe the concern of impact to neighbors is remedied by the significant distance to the adjacent properties. We do not feel a noise analysis is warranted in this condition.

*BETA2: See comment above.*

**Response 2:** There is existing vegetation along the property boundary that will remain. Note that there is also a commercial property that contains heavy equipment, and mulching activities that exists between the solar boundary and the residential properties. These activities would generate higher decibel levels than what we are proposing from the transformers. We do not foresee impacts that would be perceived by the adjacent residence per this use; however, the applicant is willing to work with the board post construction if there is an issue with noise to supplement fencing if there is a perceived noise generation concern.

## **Stormwater Management**

*Comment #6 Provide test pit data in the area of the proposed basin to determine Estimated Seasonal High Groundwater levels (§153-15.A(9)).*

**Response 1:** Four (4) test pits are being scheduled and will be conducted within the limits of the proposed stormwater management basin. The results of the testing will be shared with the Board and BETA upon completion.

*BETA2: No further comments until test pit results are available.*

**Response 2:** As discussed during the last planning board meeting, we are requesting to schedule the test pits prior to construction so that we do not disturb the current activity of the golf course in this location. The proposed basin is located where a current fairway and green is today. The basin bottom will be aligned with the current lower surface elevations of the course, so we will not be proposing a deep cut or have concerns of high groundwater in this location.

*Comment #7 Review cover type area attributed to “paved parking” for subcatchment P1a; the area used is inconsistent with the area depicted on the plans, based on the portions of the access driveway and cart paths designated to remain.*

**Response 1:** Onsite cart paths are proposed to be removed within the limit of work except for those located at wetland crossings. The civil plans have been revised to reflect this work.

*BETA2: The demolition plans depict several cart paths to remain which do not appear to have been accounted for in the model. Confirm accuracy of demolition plans, clearly depict any cart paths to remain on the watershed plans, and revise model as necessary.*

**Response 2:** The civil plans and stormwater models have been revised to accurately depict the extent of the proposed work and have been updated to show consistent data.

*Comment #8 Review cover type area attributed to “gravel” for subcatchment P1a; the area used is inconsistent with the gravel driveway depicted on the plans.*

**Response 1:** Onsite cart paths are proposed to be removed within the limit of work except for those located at wetland crossings. The civil plans have been revised to reflect this work.

*BETA2:* The demolition plans depict gravel areas to remain in the western portion of the Site outside the limits of work, which do not appear to have been accounted for in the model. Confirm accuracy of demolition plans, clearly depict any gravel areas to remain on the watershed plans, and revise model as necessary.

**Response 2:** The demolition plans have been updated to be consistent with the stormwater model data.

*Comment #9* There are no proposed changes to the site north of the pond located northeast of the proposed entrance gate and a portion of this area will flow west towards Maple Street. BETA recommends that the drainage analysis be restricted to the area south of the northern wetlands which are impacted by the development.

**Response 1:** The Project proposes to remove cart paths in the northern portion of the site therefore it has been included in the analysis area.

*BETA2:* Although it is noted on the demolition plans, the limit of work as identified on the plans does not include these areas. There are no notes in the Erosion and sediment control plan either relative to this demolition and restoration either. BETA recommends that a construction detail with notes relative to time requirements for both demolition and restoration be provided on the plans.

**Response 2:** The Project proposes to remove cart paths in the northern portion of the site therefore it has been included in the analysis area. Additionally, this area has been noted on the erosion and sediment control plans.

*Comment #10* Based on the size of the basin and proximity to wetlands, BETA recommends that soil testing be conducted in the footprint of the basin prior to approval.

**Response 1:** Four (4) test pits are being scheduled and will be conducted within the limits of the proposed stormwater management basin. The results of the testing will be shared with the Board and BETA upon completion.

*BETA2:* No further comments until test pit results are available.

**Response 2:** As discussed during the last planning board meeting, we are requesting to schedule the test pits prior to construction so that we do not disturb the current activity of the golf course in this location. The proposed basin is located where a current fairway and green is today. The basin bottom will be aligned with the current lower surface elevations of the course, so we will not be proposing a deep cut or have concerns of high groundwater in this location.

*Comment #11:* Provide a minimum of 4 test pits in the area of the proposed detention basin to establish Estimated Seasonal High Groundwater

**Response 1:** Four (4) test pits are being schedule and will be conducted within the limits of the proposed stormwater management basin. The results of the testing will be shared with the Board and BETA upon completion.

*BETA2:* No further comments until test pit results are available.



**Response 2: Comment acknowledged. See previous response.**

## **Total Suspended Solids**

*Comment #12 For a redevelopment Site, meet one of the following criteria (§153-16.B(2))*

- a. Retain the volume of runoff equivalent to, or greater than, 0.8 inch multiplied by the total post-construction impervious surface area on the Site; and/or*
- b. Remove 80% of the average annual post-construction load of TSS and 50% of the average annual load of total phosphorus.*

**Response 1: The detention basin and associated outlet control structures have been modified to retain and infiltrate more than the required water quality volume for impervious areas on site.**

*BETA2: The use of the basin as an infiltration basin will be dependent on the test pit results. The detail on sheet C-902 should also be modified to show the actual outlet configuration and elevations. No further comments until test pit results are available.*

**Response 2: The detention basin and associated outlet control structures have been modified to retain and infiltrate more than the required water quality volume for impervious areas on site. Additionally, the details have been revised to show the actual outlet configuration. Refer to updated calculations attached within this response letter.**

*Comment #13 Provide means of sediment control, such as a swale or berm, in areas where the proposed gravel road or paved driveway is in close proximity to wetlands (e.g. WF #285-#292, WF #181 - #191, #M Series, and #N Series).*

**Response 1: Swales and stone check dams have been added along the proposed gravel road adjacent to wetland WF #285-292. Refer to the revised civil plans. Existing gravel and/or paved areas draining to wetlands WF#181-191, #M Series, and #N Series are located outside of the proposed development limits and are expected to remain untouched. Vegetation within these areas appears well established and provides a natural buffer to the wetlands. It is our belief that impacts proposed to these areas would not be beneficial to the wetlands or their associated buffers and that these areas should remain. In addition, a reduction in sediment is anticipated since vehicular access to the site will be limited due to the proposed use.**

*BETA2: Provide detail of proposed level spreader and review proposed top elevation for consistency with proposed grading. Provide detail for proposed earthen berm.*

**Response 2: Details for the proposed level spreader and earthen berms have been added to the plan set. Additionally, the grading plans have been updated to reflect a top elevation that is consistent with the proposed grading.**

*Comment #14 Unless required for access, consider removing existing cart paths within the western portion of the property to mitigate impacts to water quality.*

**Response 1: Onsite cart paths are proposed to be removed within the limit of work except for those located at wetland crossings. The civil plans have been revised to reflect this work.**

**BETA2:** *The demolition plans have been modified to reflect the existing cart path removal. However, the existing paved cart paths adjacent to wetland flags 284-294 are scheduled to remain. Based upon the level of construction proposed in this area, extending the erosion control to include these areas should be considered.*

**Response 2:** *Onsite cart paths are proposed to be removed within the limit of work except for those located at wetland crossings. The paved cart path adjacent to wetlands 284-294 have also been modified to be removed. The erosion control measures have been updated to reflect this change. The civil plans have been revised to reflect this work.*

## Critical Areas

**Comment #15** *Based upon the existing grades and spot shots in the existing paved access driveway adjacent to the vernal pool, it appears that the runoff from this pavement will flow south away from the pond. BETA recommends that additional spot shots along the northerly edge of the pavement adjacent to the pond be conducted to confirm this runoff pattern and if necessary proposed revisions to the driveway to ensure that untreated runoff from the pavement does not flow directly into the pond.*

**Response 1:** **Runoff from a small portion of the existing driveway referenced above appears to flow to the vernal pool and wetland #N series. These areas are located outside of the proposed development limits and are expected to remain untouched. Existing vegetation adjacent to the driveway appears well established and provides a natural buffer to the wetlands. It is our belief that impacts proposed to these areas would not be beneficial to the wetlands or their associated buffers and that these areas should remain.**

**BETA2:** *The N & M series wetlands are isolated until the water level exceeds Elevation 220. At that point flow would move northwest into the E series and then through the 12" culvert beneath the entrance driveway. The intent of the comment was to see if minor changes in the roadway grades could be achieved to direct runoff from the access roadway pavement into the N & M series wetlands and away from the vernal pool.*

**Response 2:** **While changing the roadway grades may provide some beneficial impacts. This would result in a significant increase in wetland and buffer impacts. Existing vegetation adjacent to the driveway appears well established and provides a natural buffer to the wetlands. It is our belief that impacts proposed to these areas would not be beneficial to the wetlands or their associated buffers and that these areas should remain.**

## Redevelopment

**Comment #16** *BETA recommends the Applicant complete the redevelopment checklist found in Volume 3 of the MA Stormwater Handbook to document which standards are being met only to the maximum extent practicable.*

**Response 1:** **Standards 3 and 4 are met to the maximum extent practicable for a redevelopment. The remaining Standards, 1-2 and 5-10, are fully met.**

**BETA2:** *Comment remains; provide the redevelopment checklist.*

**Response 2:** The items outlined in the Redevelopment Checklist, is redundant to the MADEP stormwater standards and summarized within the stormwater management report. The development proposes a reduction of 3 acres of impervious coverage, re-utilizes the existing access road and does not propose a new building or parking area. There is no generated TSS for additional treatment and the basin provides additional reductions in volume and infiltration.

*Comment #17 BETA recommends that the applicant review the entrance driveway pavement area which is to remain and determine if some measure of treatment is possible to meet the definition of maximum extent possible.*

**Response 1:** Under existing conditions, runoff generated across the entrance driveway flows over hundreds of linear feet of vegetated land receiving TSS removal and allowing for recharge prior to discharging to surrounding resource areas. The number of vehicles proposed to access the site after construction will be significantly reduced compared to existing conditions, ultimately improving the quality of runoff compared with the pre-development condition. It is our belief that minimizing additional impacts onsite is more beneficial to the surrounding natural environment and that additional treatment is not necessary.

*BETA2: The only portion of the entrance driveway that is a concern is that portion between the gravel access driveway into the parking lot and the start of the M series wetlands. BETA agrees that all the runoff from the pavement west of this area will flow across an existing vegetated area which will provide the treatment intended by the standards. However, between the 2 entrance driveways into the gravel parking lot, the adjacent wetlands and the steep grades down from the edge of pavement limit the ability to provide any additional treatment. The area where there could be some treatment provided is the swale between the N & E series wetlands adjacent to the roadway. BETA recommends that the designer look at this area and see if some minor changes in topography could provide some treatment.*

**Response 2:** By making these minor changes to the topography, there would be an increase in disturbance to the wetland and buffer areas. As there is already sufficient vegetation present to provide a natural buffer. It is our belief that impacts proposed to these areas would not be beneficial to the wetlands or their associated buffers and that these areas should remain.

*Comment #18 There are areas outside the limits of work where existing cart paths and gravel access roadways and parking areas will be abandoned in place. In certain areas these surfaces will be cutoff at both end of the area. BETA recommends that the applicant review these areas which are directly adjacent to the limit of work where these impervious surfaces could easily be removed and loamed and seeded.*

**Response 1:** A note has been added to the site plans indicating that loam and seed shall be proposed in all areas where gravel or paved cart paths, roadways, and parking areas have been removed / abandoned.

*BETA2: BETA recommends that the note shown on Sheet C-301 relative to restoration of the cart path be expanded to include additional details on time of year, limits on exposure, etc. In addition, those cart paths which will remain should be shown on the proposed grading plans.*

**Response 2:** The existing cart path to the north of the site will be removed and replaced with loam and seed. The note has been added relating to manufactures recommendations for installation.

*Comment #19 Provide calculations using performance curves to indicate the approximate TSS removal that will be provided by impervious area disconnection.*

**Response 1: The Project is a redevelopment and proposes to reduce impervious coverage by approximately three (3) acres as compared to the pre-development condition. As a result, TSS removal rates will be increased across the site and calculations are not required.**

*BETA2: BETA recognizes that the redevelopment of the site will significantly reduce the impervious surfaces on site and the water quality benefits associated with the removal. However, in accordance with the handbook, TSS Removal Calculations are required to document compliance with the standards.*

**Response 2: As there is a clear reduction in the amount of impervious cover in the proposed development, there is no TSS calculation to be completed. It is our belief that the basis of impervious impact reduction alone is sufficient to show that the development is compliant with the standards.**

**Bohler acknowledges that Comments #5 and #6 provided in the original comment letter prepared by Michael Maglio, dated May 3, 2023, were not addressed in the comment response package prepared by Bohler and dated June 22, 2023. On behalf of the Applicant, NextGrid Mescalbean, LLC., Bohler offers the following responses and additional information to address both comments. For clarity, the original comments are in *italics*, while our responses are directly below in bold type.**

*Comment #5* Rainfall amounts used in the calculations should be updated to reflect current NOAA Atlas 14 Values.

**Response: The rainfall amounts have been revised as noted. In addition, the infiltration basin has been modified to accommodate the higher rainfall amounts and address Comment #6 below. Please refer to the attached supplemental materials and Tables 1-3 below for the revised rainfall amounts and associated runoff rates and volumes.**

*Comment #6* The spillway elevation for the surface basin is less than 0.10ft higher than the flood elevation for the 100-year storm event. The grading should be revised to provide additional freeboard.

**Response: The infiltration basin has been modified to accommodate the additional rainfall amounts and the spillway elevation has been modified to provide additional freeboard above the 100-year storm event. Please refer to the attached Existing and Proposed HydroCAD reports and Site Plans for the revised basin design.**

The enclosed "Proposed Site Plan Documents" have been revised to expand the proposed infiltration basin and raise the emergency spillway elevations to accommodate the revised rainfall amounts and ensure additional freeboard is provided above the 100-year flood elevation. Revised stormwater calculations are provided ensuring that the required recharge, drawdown, and water quality volumes are met.

**Table 1: Rainfall Data**

Frequency	2-year	10-year	25-year	100-year
Rainfall* (inches)	3.37	5.25	6.42	8.23

\*Values derived from NOAA Atlas 14 on 6/30/23

**Table 2: Design Point Peak Runoff Rate Summary**

Storm Event		Flow Rate (cfs)			
		2-year	10-year	25-year	100-year
Design Point 1	Existing Conditions (Rev2)	46.34	105.38	145.16	208.68
	Proposed Conditions (Rev2)	45.75	104.75	144.87	208.26

**Table 3: Design Point Peak Volume Summary**

Storm Event		Volume (ac-ft)			
		2-year	10-year	25-year	100-year
Design Point 1	Existing Conditions (Rev2)	7.463	16.359	22.458	32.365
	Proposed Conditions (Rev2)	6.578	15.403	21.467	31.302

In summary, the revised stormwater management system results in a reduction in peak rates of runoff and volumes from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies, and continues to meet the MADEP Stormwater Management Standards and Town's Stormwater Management bylaw.

We trust the above is sufficient for your needs at this time. Please do not hesitate to contact us at 508.480.9900 should you have questions or wish to discuss further. We look forward to discussing the project further at the July 24<sup>th</sup> planning board meeting.

Sincerely,

**BOHLER //**



Greg DiBona

CC.  
 Daniel Serber, NextGrid  
 Aaron Culig, NextGrid  
 John Kucich, Bohler  
 Peter Brown, Brown Legal PLLC  
 Allison Finnell, Brown Legal PLLC  
 Amy Love, Town of Franklin  
 Gary D. James, P.E., BETA Group, Inc.



**NOAA Atlas 14, Volume 10, Version 3**  
**Location name: Bellingham, Massachusetts, USA\***  
**Latitude: 42.1067°, Longitude: -71.4412°**  
**Elevation: 230 ft\*\***  
 \* source: ESRI Maps  
 \*\* source: USGS



**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps\\_&\\_aerials](#)

**PF tabular**

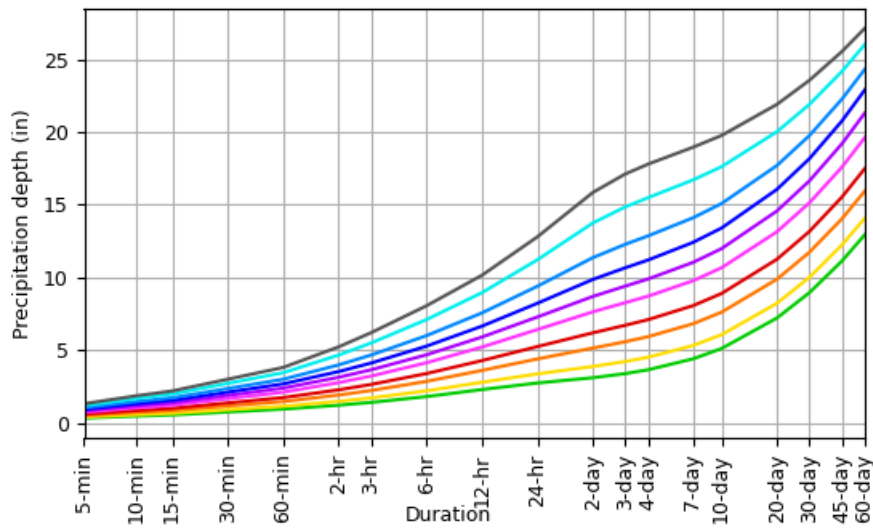
<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.328 (0.251-0.426)	0.396 (0.303-0.515)	0.508 (0.387-0.662)	0.600 (0.455-0.787)	0.728 (0.536-0.996)	0.825 (0.596-1.15)	0.925 (0.651-1.34)	1.04 (0.694-1.53)	1.19 (0.770-1.82)	1.32 (0.833-2.05)
10-min	0.464 (0.356-0.603)	0.561 (0.429-0.730)	0.720 (0.549-0.940)	0.851 (0.646-1.12)	1.03 (0.760-1.41)	1.17 (0.845-1.63)	1.31 (0.922-1.89)	1.47 (0.983-2.17)	1.69 (1.09-2.58)	1.86 (1.18-2.91)
15-min	0.546 (0.418-0.709)	0.660 (0.505-0.858)	0.846 (0.646-1.10)	1.00 (0.760-1.31)	1.21 (0.894-1.66)	1.38 (0.994-1.92)	1.54 (1.08-2.23)	1.73 (1.16-2.55)	1.98 (1.28-3.04)	2.19 (1.39-3.42)
30-min	0.745 (0.571-0.968)	0.902 (0.690-1.17)	1.16 (0.884-1.51)	1.37 (1.04-1.80)	1.66 (1.22-2.27)	1.88 (1.36-2.63)	2.11 (1.48-3.05)	2.36 (1.58-3.50)	2.72 (1.76-4.16)	3.00 (1.90-4.69)
60-min	0.945 (0.724-1.23)	1.14 (0.875-1.49)	1.47 (1.12-1.92)	1.74 (1.32-2.28)	2.11 (1.55-2.88)	2.39 (1.73-3.34)	2.68 (1.88-3.87)	3.00 (2.01-4.44)	3.45 (2.23-5.28)	3.81 (2.41-5.95)
2-hr	1.21 (0.935-1.57)	1.48 (1.14-1.91)	1.91 (1.47-2.48)	2.27 (1.73-2.96)	2.76 (2.05-3.77)	3.13 (2.28-4.37)	3.53 (2.51-5.11)	3.98 (2.68-5.87)	4.66 (3.02-7.10)	5.23 (3.32-8.11)
3-hr	1.40 (1.08-1.81)	1.72 (1.32-2.21)	2.22 (1.71-2.87)	2.64 (2.02-3.43)	3.22 (2.40-4.38)	3.65 (2.67-5.08)	4.11 (2.94-5.96)	4.66 (3.14-6.84)	5.49 (3.57-8.34)	6.20 (3.94-9.59)
6-hr	1.81 (1.40-2.31)	2.20 (1.71-2.82)	2.85 (2.20-3.66)	3.39 (2.61-4.38)	4.13 (3.09-5.60)	4.68 (3.44-6.49)	5.28 (3.80-7.62)	6.00 (4.05-8.75)	7.10 (4.63-10.7)	8.05 (5.14-12.4)
12-hr	2.29 (1.79-2.91)	2.79 (2.17-3.55)	3.61 (2.80-4.60)	4.28 (3.31-5.49)	5.21 (3.92-7.02)	5.90 (4.36-8.13)	6.65 (4.81-9.55)	7.56 (5.13-11.0)	8.96 (5.86-13.4)	10.2 (6.50-15.5)
24-hr	2.74 (2.15-3.46)	3.37 (2.64-4.26)	4.40 (3.43-5.57)	5.25 (4.07-6.69)	6.42 (4.85-8.60)	7.28 (5.41-9.99)	8.23 (5.99-11.8)	9.40 (6.39-13.5)	11.2 (7.36-16.7)	12.8 (8.21-19.4)
2-day	3.10 (2.44-3.89)	3.88 (3.05-4.86)	5.14 (4.03-6.48)	6.19 (4.83-7.84)	7.64 (5.81-10.2)	8.69 (6.51-11.9)	9.86 (7.25-14.1)	11.4 (7.75-16.3)	13.7 (9.04-20.4)	15.8 (10.2-23.9)
3-day	3.39 (2.68-4.23)	4.22 (3.33-5.28)	5.58 (4.39-7.00)	6.71 (5.25-8.47)	8.27 (6.31-11.0)	9.40 (7.06-12.8)	10.7 (7.85-15.2)	12.3 (8.39-17.5)	14.9 (9.78-21.9)	17.1 (11.0-25.7)
4-day	3.65 (2.89-4.55)	4.52 (3.57-5.63)	5.93 (4.68-7.42)	7.10 (5.57-8.94)	8.72 (6.66-11.6)	9.90 (7.44-13.4)	11.2 (8.25-15.9)	12.9 (8.81-18.3)	15.5 (10.2-22.8)	17.8 (11.5-26.7)
7-day	4.40 (3.50-5.45)	5.32 (4.22-6.60)	6.82 (5.40-8.48)	8.06 (6.34-10.1)	9.77 (7.48-12.8)	11.0 (8.30-14.8)	12.4 (9.12-17.4)	14.1 (9.70-20.0)	16.7 (11.1-24.5)	19.0 (12.3-28.3)
10-day	5.11 (4.07-6.31)	6.06 (4.82-7.49)	7.61 (6.04-9.44)	8.90 (7.02-11.1)	10.7 (8.17-13.9)	12.0 (9.01-16.0)	13.4 (9.82-18.6)	15.1 (10.4-21.3)	17.6 (11.7-25.7)	19.8 (12.8-29.4)
20-day	7.22 (5.78-8.85)	8.23 (6.58-10.1)	9.88 (7.88-12.2)	11.3 (8.92-13.9)	13.1 (10.1-17.0)	14.6 (11.0-19.2)	16.1 (11.7-21.9)	17.7 (12.3-24.8)	20.0 (13.4-29.0)	21.9 (14.2-32.4)
30-day	8.96 (7.20-10.9)	10.0 (8.04-12.2)	11.7 (9.39-14.4)	13.2 (10.5-16.3)	15.1 (11.6-19.4)	16.6 (12.5-21.7)	18.2 (13.2-24.5)	19.8 (13.7-27.5)	21.9 (14.6-31.6)	23.6 (15.4-34.7)
45-day	11.1 (8.97-13.5)	12.2 (9.84-14.9)	14.0 (11.3-17.2)	15.5 (12.4-19.1)	17.6 (13.5-22.3)	19.2 (14.4-24.8)	20.8 (15.0-27.7)	22.3 (15.5-30.8)	24.2 (16.2-34.7)	25.5 (16.7-37.5)
60-day	12.9 (10.5-15.7)	14.1 (11.4-17.1)	16.0 (12.8-19.4)	17.5 (14.0-21.4)	19.6 (15.1-24.8)	21.3 (16.0-27.4)	22.9 (16.6-30.3)	24.3 (17.0-33.6)	26.0 (17.5-37.2)	27.1 (17.7-39.7)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

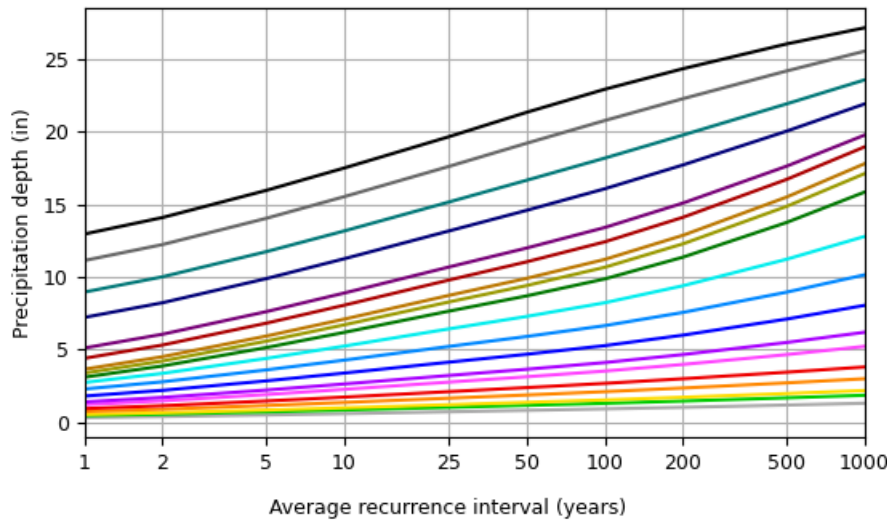
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**PF graphical**

PDS-based depth-duration-frequency (DDF) curves  
 Latitude: 42.1067°, Longitude: -71.4412°



Average recurrence interval (years)
1
2
5
10
25
50
100
200
500
1000



Duration	
5-min	2-day
10-min	3-day
15-min	4-day
30-min	7-day
60-min	10-day
2-hr	20-day
3-hr	30-day
6-hr	45-day
12-hr	60-day
24-hr	

NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Fri Jun 30 15:09:13 2023

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Maps & aerials

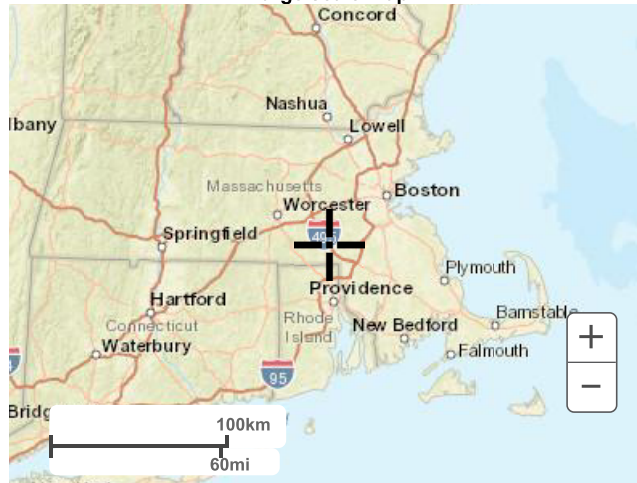
Small scale terrain



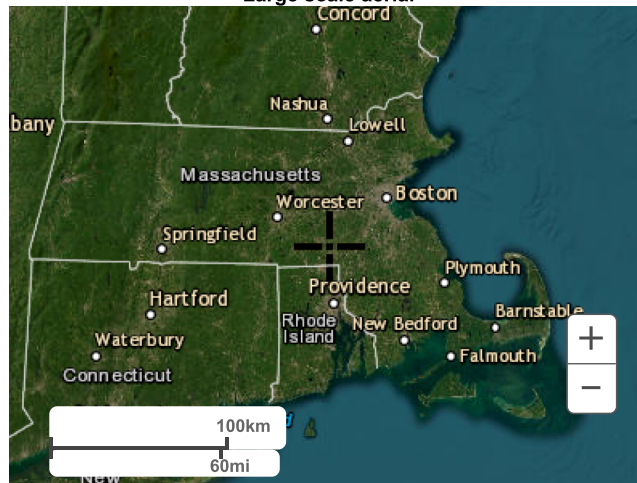
Large scale terrain



Large scale map



Large scale aerial



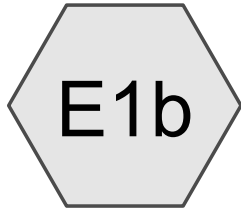
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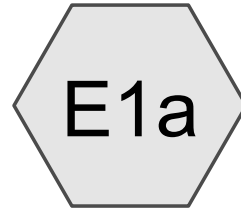
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Silver Spring, MD 20910  
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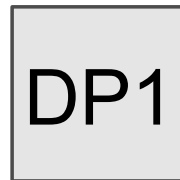




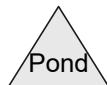
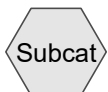
Parcel 2 (Offsite) -  
Overland



Parcel 1 (North) -  
Overland



Wetlands associated  
with Mine Brook



**W201257-EX-North-Rev2**

Prepared by Bohler

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Page 2

**Area Listing (selected nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
43.717	74	>75% Grass cover, Good, HSG C (E1a, E1b)
2.029	96	Gravel surface, HSG C (E1a)
3.088	98	Paved parking, HSG C (E1a, E1b)
0.142	98	Roofs, HSG C (E1a)
1.753	98	Water Surface, HSG C (E1a)
21.405	70	Woods, Good, HSG C (E1a, E1b)
1.847	77	Woods, Good, HSG D (E1a)
<b>73.981</b>	<b>75</b>	<b>TOTAL AREA</b>

**W201257-EX-North-Rev2**

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**Soil Listing (selected nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
72.134	HSG C	E1a, E1b
1.847	HSG D	E1a
0.000	Other	
<b>73.981</b>		<b>TOTAL AREA</b>

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**Ground Covers (selected nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	43.717	0.000	0.000	43.717	>75% Grass cover, Good	E1a, E1b
0.000	0.000	2.029	0.000	0.000	2.029	Gravel surface	E1a
0.000	0.000	3.088	0.000	0.000	3.088	Paved parking	E1a, E1b
0.000	0.000	0.142	0.000	0.000	0.142	Roofs	E1a
0.000	0.000	1.753	0.000	0.000	1.753	Water Surface	E1a
0.000	0.000	21.405	1.847	0.000	23.252	Woods, Good	E1a, E1b
<b>0.000</b>	<b>0.000</b>	<b>72.134</b>	<b>1.847</b>	<b>0.000</b>	<b>73.981</b>	<b>TOTAL AREA</b>	

**W201257-EX-North-Rev2**

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Existing HydroCAD - 7/10/23 - Rev2

Type III 24-hr 2-yr Rainfall=3.37"

Printed 7/10/2023

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Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentE1a: Parcel 1 (North) -** Runoff Area=72.718 ac 6.71% Impervious Runoff Depth=1.21"  
Flow Length=1,822' Tc=44.9 min CN=75 Runoff=45.96 cfs 7.336 af

**SubcatchmentE1b: Parcel 2 (Offsite) -** Runoff Area=1.263 ac 7.92% Impervious Runoff Depth=1.21"  
Flow Length=676' Tc=12.1 min CN=75 Runoff=1.39 cfs 0.127 af

**Reach DP1: Wetlands associated with Mine Brook** Inflow=46.34 cfs 7.463 af  
Outflow=46.34 cfs 7.463 af

**Total Runoff Area = 73.981 ac Runoff Volume = 7.463 af Average Runoff Depth = 1.21"**  
**93.26% Pervious = 68.998 ac 6.74% Impervious = 4.983 ac**

**W201257-EX-North-Rev2**

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Existing HydroCAD - 7/10/23 - Rev2

Type III 24-hr 2-yr Rainfall=3.37"

Printed 7/10/2023

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**Summary for Subcatchment E1a: Parcel 1 (North) - Overland**

Runoff = 45.96 cfs @ 12.66 hrs, Volume= 7.336 af, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-yr Rainfall=3.37"

Area (ac)	CN	Description
0.142	98	Roofs, HSG C
2.988	98	Paved parking, HSG C
2.029	96	Gravel surface, HSG C
42.700	74	>75% Grass cover, Good, HSG C
21.259	70	Woods, Good, HSG C
1.753	98	Water Surface, HSG C
1.847	77	Woods, Good, HSG D
72.718	75	Weighted Average
67.835		93.29% Pervious Area
4.883		6.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.5	50	0.0060	0.04		<b>Sheet Flow, 249.7-249.4 (A-B)</b>
					Woods: Light underbrush n= 0.400 P2= 3.37"
2.1	44	0.0050	0.35		<b>Shallow Concentrated Flow, 249.4-249.2 (B-C)</b>
					Woodland Kv= 5.0 fps
20.2	1,314	0.0240	1.08		<b>Shallow Concentrated Flow, 249.2-218 (C-D)</b>
					Short Grass Pasture Kv= 7.0 fps
0.5	111	0.0360	3.85		<b>Shallow Concentrated Flow, 218-214 (D-E)</b>
					Paved Kv= 20.3 fps
1.7	211	0.0900	2.10		<b>Shallow Concentrated Flow, 214-195 (E-F)</b>
					Short Grass Pasture Kv= 7.0 fps
0.9	92	0.1090	1.65		<b>Shallow Concentrated Flow, 195-185 (F-G)</b>
					Woodland Kv= 5.0 fps
44.9	1,822	Total			

**Summary for Subcatchment E1b: Parcel 2 (Offsite) - Overland**

Runoff = 1.39 cfs @ 12.18 hrs, Volume= 0.127 af, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-yr Rainfall=3.37"

Area (ac)	CN	Description
0.146	70	Woods, Good, HSG C
0.100	98	Paved parking, HSG C
1.017	74	>75% Grass cover, Good, HSG C
1.263	75	Weighted Average
1.163		92.08% Pervious Area
0.100		7.92% Impervious Area

**W201257-EX-North-Rev2**

Prepared by Bohler

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0300	0.18		<b>Sheet Flow, 230-228.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
2.1	153	0.0290	1.19		<b>Shallow Concentrated Flow, 228.5-224 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
3.2	227	0.0570	1.19		<b>Shallow Concentrated Flow, 224-211 (C-D)</b> Woodland Kv= 5.0 fps
1.4	166	0.0780	1.95		<b>Shallow Concentrated Flow, 211-198 (D-E)</b> Short Grass Pasture Kv= 7.0 fps
0.7	80	0.1440	1.90		<b>Shallow Concentrated Flow, 198-186.5 (E-F)</b> Woodland Kv= 5.0 fps
12.1	676	Total			

**Summary for Reach DP1: Wetlands associated with Mine Brook**

Inflow Area = 73.981 ac, 6.74% Impervious, Inflow Depth = 1.21" for 2-yr event  
 Inflow = 46.34 cfs @ 12.65 hrs, Volume= 7.463 af  
 Outflow = 46.34 cfs @ 12.65 hrs, Volume= 7.463 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs

**W201257-EX-North-Rev2**

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Type III 24-hr 10-yr Rainfall=5.25"

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Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentE1a: Parcel 1 (North) -** Runoff Area=72.718 ac 6.71% Impervious Runoff Depth=2.65"  
Flow Length=1,822' Tc=44.9 min CN=75 Runoff=104.48 cfs 16.080 af

**SubcatchmentE1b: Parcel 2 (Offsite) -** Runoff Area=1.263 ac 7.92% Impervious Runoff Depth=2.65"  
Flow Length=676' Tc=12.1 min CN=75 Runoff=3.19 cfs 0.279 af

**Reach DP1: Wetlands associated with Mine Brook** Inflow=105.38 cfs 16.359 af  
Outflow=105.38 cfs 16.359 af

**Total Runoff Area = 73.981 ac Runoff Volume = 16.359 af Average Runoff Depth = 2.65"**  
**93.26% Pervious = 68.998 ac 6.74% Impervious = 4.983 ac**



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Type III 24-hr 10-yr Rainfall=5.25"

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### Summary for Subcatchment E1a: Parcel 1 (North) - Overland

Runoff = 104.48 cfs @ 12.63 hrs, Volume= 16.080 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-yr Rainfall=5.25"

Area (ac)	CN	Description
0.142	98	Roofs, HSG C
2.988	98	Paved parking, HSG C
2.029	96	Gravel surface, HSG C
42.700	74	>75% Grass cover, Good, HSG C
21.259	70	Woods, Good, HSG C
1.753	98	Water Surface, HSG C
1.847	77	Woods, Good, HSG D
72.718	75	Weighted Average
67.835		93.29% Pervious Area
4.883		6.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.5	50	0.0060	0.04		<b>Sheet Flow, 249.7-249.4 (A-B)</b>
					Woods: Light underbrush n= 0.400 P2= 3.37"
2.1	44	0.0050	0.35		<b>Shallow Concentrated Flow, 249.4-249.2 (B-C)</b>
					Woodland Kv= 5.0 fps
20.2	1,314	0.0240	1.08		<b>Shallow Concentrated Flow, 249.2-218 (C-D)</b>
					Short Grass Pasture Kv= 7.0 fps
0.5	111	0.0360	3.85		<b>Shallow Concentrated Flow, 218-214 (D-E)</b>
					Paved Kv= 20.3 fps
1.7	211	0.0900	2.10		<b>Shallow Concentrated Flow, 214-195 (E-F)</b>
					Short Grass Pasture Kv= 7.0 fps
0.9	92	0.1090	1.65		<b>Shallow Concentrated Flow, 195-185 (F-G)</b>
					Woodland Kv= 5.0 fps
44.9	1,822	Total			

### Summary for Subcatchment E1b: Parcel 2 (Offsite) - Overland

Runoff = 3.19 cfs @ 12.17 hrs, Volume= 0.279 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-yr Rainfall=5.25"

Area (ac)	CN	Description
0.146	70	Woods, Good, HSG C
0.100	98	Paved parking, HSG C
1.017	74	>75% Grass cover, Good, HSG C
1.263	75	Weighted Average
1.163		92.08% Pervious Area
0.100		7.92% Impervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0300	0.18		<b>Sheet Flow, 230-228.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
2.1	153	0.0290	1.19		<b>Shallow Concentrated Flow, 228.5-224 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
3.2	227	0.0570	1.19		<b>Shallow Concentrated Flow, 224-211 (C-D)</b> Woodland Kv= 5.0 fps
1.4	166	0.0780	1.95		<b>Shallow Concentrated Flow, 211-198 (D-E)</b> Short Grass Pasture Kv= 7.0 fps
0.7	80	0.1440	1.90		<b>Shallow Concentrated Flow, 198-186.5 (E-F)</b> Woodland Kv= 5.0 fps
12.1	676	Total			

**Summary for Reach DP1: Wetlands associated with Mine Brook**

Inflow Area = 73.981 ac, 6.74% Impervious, Inflow Depth = 2.65" for 10-yr event  
 Inflow = 105.38 cfs @ 12.62 hrs, Volume= 16.359 af  
 Outflow = 105.38 cfs @ 12.62 hrs, Volume= 16.359 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs

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Type III 24-hr 25-yr Rainfall=6.42"

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Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentE1a: Parcel 1 (North) -** Runoff Area=72.718 ac 6.71% Impervious Runoff Depth=3.64"  
Flow Length=1,822' Tc=44.9 min CN=75 Runoff=143.97 cfs 22.075 af

**SubcatchmentE1b: Parcel 2 (Offsite) -** Runoff Area=1.263 ac 7.92% Impervious Runoff Depth=3.64"  
Flow Length=676' Tc=12.1 min CN=75 Runoff=4.39 cfs 0.383 af

**Reach DP1: Wetlands associated with Mine Brook** Inflow=145.16 cfs 22.458 af  
Outflow=145.16 cfs 22.458 af

**Total Runoff Area = 73.981 ac Runoff Volume = 22.458 af Average Runoff Depth = 3.64"**  
**93.26% Pervious = 68.998 ac 6.74% Impervious = 4.983 ac**

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Type III 24-hr 25-yr Rainfall=6.42"

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**Summary for Subcatchment E1a: Parcel 1 (North) - Overland**

Runoff = 143.97 cfs @ 12.62 hrs, Volume= 22.075 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-yr Rainfall=6.42"

Area (ac)	CN	Description
0.142	98	Roofs, HSG C
2.988	98	Paved parking, HSG C
2.029	96	Gravel surface, HSG C
42.700	74	>75% Grass cover, Good, HSG C
21.259	70	Woods, Good, HSG C
1.753	98	Water Surface, HSG C
1.847	77	Woods, Good, HSG D
72.718	75	Weighted Average
67.835		93.29% Pervious Area
4.883		6.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.5	50	0.0060	0.04		<b>Sheet Flow, 249.7-249.4 (A-B)</b>
					Woods: Light underbrush n= 0.400 P2= 3.37"
2.1	44	0.0050	0.35		<b>Shallow Concentrated Flow, 249.4-249.2 (B-C)</b>
					Woodland Kv= 5.0 fps
20.2	1,314	0.0240	1.08		<b>Shallow Concentrated Flow, 249.2-218 (C-D)</b>
					Short Grass Pasture Kv= 7.0 fps
0.5	111	0.0360	3.85		<b>Shallow Concentrated Flow, 218-214 (D-E)</b>
					Paved Kv= 20.3 fps
1.7	211	0.0900	2.10		<b>Shallow Concentrated Flow, 214-195 (E-F)</b>
					Short Grass Pasture Kv= 7.0 fps
0.9	92	0.1090	1.65		<b>Shallow Concentrated Flow, 195-185 (F-G)</b>
					Woodland Kv= 5.0 fps
44.9	1,822	Total			

**Summary for Subcatchment E1b: Parcel 2 (Offsite) - Overland**

Runoff = 4.39 cfs @ 12.17 hrs, Volume= 0.383 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-yr Rainfall=6.42"

Area (ac)	CN	Description
0.146	70	Woods, Good, HSG C
0.100	98	Paved parking, HSG C
1.017	74	>75% Grass cover, Good, HSG C
1.263	75	Weighted Average
1.163		92.08% Pervious Area
0.100		7.92% Impervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0300	0.18		<b>Sheet Flow, 230-228.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
2.1	153	0.0290	1.19		<b>Shallow Concentrated Flow, 228.5-224 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
3.2	227	0.0570	1.19		<b>Shallow Concentrated Flow, 224-211 (C-D)</b> Woodland Kv= 5.0 fps
1.4	166	0.0780	1.95		<b>Shallow Concentrated Flow, 211-198 (D-E)</b> Short Grass Pasture Kv= 7.0 fps
0.7	80	0.1440	1.90		<b>Shallow Concentrated Flow, 198-186.5 (E-F)</b> Woodland Kv= 5.0 fps
12.1	676	Total			

**Summary for Reach DP1: Wetlands associated with Mine Brook**

Inflow Area = 73.981 ac, 6.74% Impervious, Inflow Depth = 3.64" for 25-yr event  
 Inflow = 145.16 cfs @ 12.61 hrs, Volume= 22.458 af  
 Outflow = 145.16 cfs @ 12.61 hrs, Volume= 22.458 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs

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Type III 24-hr 100-yr Rainfall=8.23"

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Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentE1a: Parcel 1 (North) -** Runoff Area=72.718 ac 6.71% Impervious Runoff Depth=5.25"  
Flow Length=1,822' Tc=44.9 min CN=75 Runoff=206.98 cfs 31.812 af

**SubcatchmentE1b: Parcel 2 (Offsite) -** Runoff Area=1.263 ac 7.92% Impervious Runoff Depth=5.25"  
Flow Length=676' Tc=12.1 min CN=75 Runoff=6.31 cfs 0.553 af

**Reach DP1: Wetlands associated with Mine Brook** Inflow=208.68 cfs 32.365 af  
Outflow=208.68 cfs 32.365 af

**Total Runoff Area = 73.981 ac Runoff Volume = 32.365 af Average Runoff Depth = 5.25"**  
**93.26% Pervious = 68.998 ac 6.74% Impervious = 4.983 ac**

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Type III 24-hr 100-yr Rainfall=8.23"

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**Summary for Subcatchment E1a: Parcel 1 (North) - Overland**

Runoff = 206.98 cfs @ 12.61 hrs, Volume= 31.812 af, Depth= 5.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-yr Rainfall=8.23"

Area (ac)	CN	Description
0.142	98	Roofs, HSG C
2.988	98	Paved parking, HSG C
2.029	96	Gravel surface, HSG C
42.700	74	>75% Grass cover, Good, HSG C
21.259	70	Woods, Good, HSG C
1.753	98	Water Surface, HSG C
1.847	77	Woods, Good, HSG D
72.718	75	Weighted Average
67.835		93.29% Pervious Area
4.883		6.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.5	50	0.0060	0.04		<b>Sheet Flow, 249.7-249.4 (A-B)</b>
					Woods: Light underbrush n= 0.400 P2= 3.37"
2.1	44	0.0050	0.35		<b>Shallow Concentrated Flow, 249.4-249.2 (B-C)</b>
					Woodland Kv= 5.0 fps
20.2	1,314	0.0240	1.08		<b>Shallow Concentrated Flow, 249.2-218 (C-D)</b>
					Short Grass Pasture Kv= 7.0 fps
0.5	111	0.0360	3.85		<b>Shallow Concentrated Flow, 218-214 (D-E)</b>
					Paved Kv= 20.3 fps
1.7	211	0.0900	2.10		<b>Shallow Concentrated Flow, 214-195 (E-F)</b>
					Short Grass Pasture Kv= 7.0 fps
0.9	92	0.1090	1.65		<b>Shallow Concentrated Flow, 195-185 (F-G)</b>
					Woodland Kv= 5.0 fps
44.9	1,822	Total			

**Summary for Subcatchment E1b: Parcel 2 (Offsite) - Overland**

Runoff = 6.31 cfs @ 12.17 hrs, Volume= 0.553 af, Depth= 5.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-yr Rainfall=8.23"

Area (ac)	CN	Description
0.146	70	Woods, Good, HSG C
0.100	98	Paved parking, HSG C
1.017	74	>75% Grass cover, Good, HSG C
1.263	75	Weighted Average
1.163		92.08% Pervious Area
0.100		7.92% Impervious Area

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Type III 24-hr 100-yr Rainfall=8.23"

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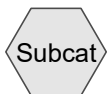
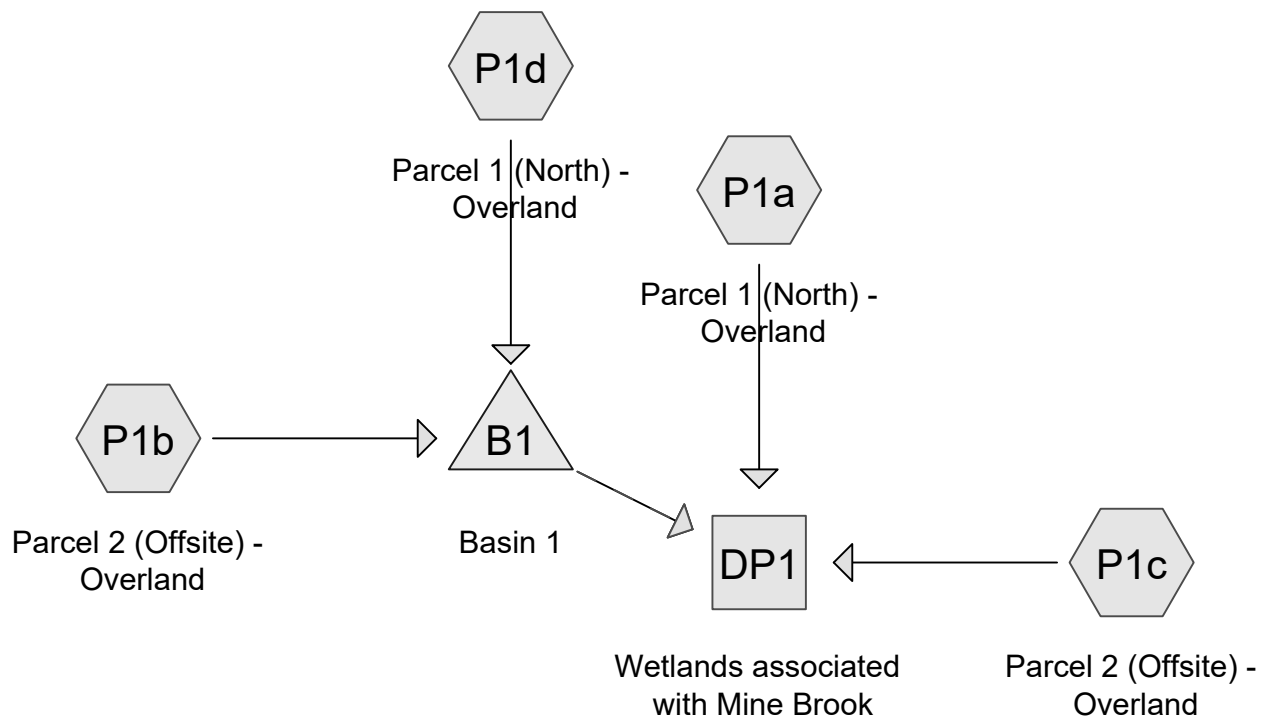
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0300	0.18		<b>Sheet Flow, 230-228.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
2.1	153	0.0290	1.19		<b>Shallow Concentrated Flow, 228.5-224 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
3.2	227	0.0570	1.19		<b>Shallow Concentrated Flow, 224-211 (C-D)</b> Woodland Kv= 5.0 fps
1.4	166	0.0780	1.95		<b>Shallow Concentrated Flow, 211-198 (D-E)</b> Short Grass Pasture Kv= 7.0 fps
0.7	80	0.1440	1.90		<b>Shallow Concentrated Flow, 198-186.5 (E-F)</b> Woodland Kv= 5.0 fps
12.1	676	Total			

**Summary for Reach DP1: Wetlands associated with Mine Brook**

Inflow Area = 73.981 ac, 6.74% Impervious, Inflow Depth = 5.25" for 100-yr event  
 Inflow = 208.68 cfs @ 12.61 hrs, Volume= 32.365 af  
 Outflow = 208.68 cfs @ 12.61 hrs, Volume= 32.365 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs

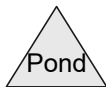




Subcat



Reach



Pond



Link

**Routing Diagram for W201257-PR-North-Rev2**

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**Area Listing (selected nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
55.670	74	>75% Grass cover, Good, HSG C (P1a, P1b, P1c, P1d)
0.686	98	Basin Bottom, 0% imp, HSG C (P1d)
1.588	96	Gravel surface, HSG C (P1a, P1d)
0.710	98	Paved parking, HSG C (P1a, P1b, P1c)
1.753	98	Water Surface, HSG C (P1a)
11.727	70	Woods, Good, HSG C (P1a, P1b, P1c)
1.847	77	Woods, Good, HSG D (P1a)
<b>73.981</b>	<b>75</b>	<b>TOTAL AREA</b>

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**Soil Listing (selected nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
72.134	HSG C	P1a, P1b, P1c, P1d
1.847	HSG D	P1a
0.000	Other	
<b>73.981</b>		<b>TOTAL AREA</b>

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**Ground Covers (selected nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	55.670	0.000	0.000	55.670	>75% Grass cover, Good	P1a, P1b, P1c, P1d
0.000	0.000	0.686	0.000	0.000	0.686	Basin Bottom, 0% imp	P1d
0.000	0.000	1.588	0.000	0.000	1.588	Gravel surface	P1a, P1d
0.000	0.000	0.710	0.000	0.000	0.710	Paved parking	P1a, P1b, P1c
0.000	0.000	1.753	0.000	0.000	1.753	Water Surface	P1a
0.000	0.000	11.727	1.847	0.000	13.574	Woods, Good	P1a, P1b, P1c
<b>0.000</b>	<b>0.000</b>	<b>72.134</b>	<b>1.847</b>	<b>0.000</b>	<b>73.981</b>	<b>TOTAL AREA</b>	

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**Pipe Listing (selected nodes)**

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	B1	202.00	201.80	26.5	0.0075	0.013	12.0	0.0	0.0

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Type III 24-hr 2-yr Rainfall=3.37"

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Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentP1a: Parcel 1 (North) -** Runoff Area=64.438 ac 3.67% Impervious Runoff Depth=1.21"  
Flow Length=1,823' Tc=36.2 min CN=75 Runoff=45.49 cfs 6.501 af

**SubcatchmentP1b: Parcel 2 (Offsite) -** Runoff Area=0.595 ac 9.24% Impervious Runoff Depth=1.27"  
Flow Length=485' Tc=8.9 min CN=76 Runoff=0.76 cfs 0.063 af

**SubcatchmentP1c: Parcel 2 (Offsite) -** Runoff Area=0.668 ac 6.74% Impervious Runoff Depth=1.21"  
Flow Length=615' Tc=8.4 min CN=75 Runoff=0.82 cfs 0.067 af

**SubcatchmentP1d: Parcel 1 (North) -** Runoff Area=8.280 ac 0.00% Impervious Runoff Depth=1.27"  
Flow Length=690' Tc=15.6 min CN=76 Runoff=8.82 cfs 0.878 af

**Reach DP1: Wetlands associated with Mine Brook** Inflow=45.75 cfs 6.578 af  
Outflow=45.75 cfs 6.578 af

**Pond B1: Basin 1** Peak Elev=203.02' Storage=31,388 cf Inflow=9.47 cfs 0.941 af  
Discarded=0.20 cfs 0.603 af Primary=0.03 cfs 0.010 af Secondary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.613 af

**Total Runoff Area = 73.981 ac Runoff Volume = 7.509 af Average Runoff Depth = 1.22"**  
**96.67% Pervious = 71.518 ac 3.33% Impervious = 2.463 ac**

**W201257-PR-North-Rev2**

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Proposed HydroCAD - 7/10/23 - Rev2

Type III 24-hr 2-yr Rainfall=3.37"

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**Summary for Subcatchment P1a: Parcel 1 (North) - Overland**

Runoff = 45.49 cfs @ 12.54 hrs, Volume= 6.501 af, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-yr Rainfall=3.37"

Area (ac)	CN	Description
0.610	98	Paved parking, HSG C
1.488	96	Gravel surface, HSG C
29.951	74	>75% Grass cover, Good, HSG C
17.208	74	>75% Grass cover, Good, HSG C
11.581	70	Woods, Good, HSG C
1.753	98	Water Surface, HSG C
1.847	77	Woods, Good, HSG D
64.438	75	Weighted Average
62.075		96.33% Pervious Area
2.363		3.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0060	0.06		<b>Sheet Flow, 249.7-249.4 (A-B)</b> Grass: Dense n= 0.240 P2= 3.37"
22.4	1,681	0.0320	1.25		<b>Shallow Concentrated Flow, 249.4-195 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
0.9	92	0.1090	1.65		<b>Shallow Concentrated Flow, 195-185 (C-D)</b> Woodland Kv= 5.0 fps
36.2	1,823	Total			

**Summary for Subcatchment P1b: Parcel 2 (Offsite) - Overland**

Runoff = 0.76 cfs @ 12.14 hrs, Volume= 0.063 af, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-yr Rainfall=3.37"

Area (ac)	CN	Description
0.091	70	Woods, Good, HSG C
0.055	98	Paved parking, HSG C
0.449	74	>75% Grass cover, Good, HSG C
0.595	76	Weighted Average
0.540		90.76% Pervious Area
0.055		9.24% Impervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0300	0.18		<b>Sheet Flow, 230-228.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
4.2	435	0.0610	1.73		<b>Shallow Concentrated Flow, 228.5-202 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
8.9	485	Total			

**Summary for Subcatchment P1c: Parcel 2 (Offsite) - Overland**

Runoff = 0.82 cfs @ 12.13 hrs, Volume= 0.067 af, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-yr Rainfall=3.37"

Area (ac)	CN	Description
0.055	70	Woods, Good, HSG C
0.045	98	Paved parking, HSG C
0.568	74	>75% Grass cover, Good, HSG C
0.668	75	Weighted Average
0.623		93.26% Pervious Area
0.045		6.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	42	0.0520	0.22		<b>Sheet Flow, 238.7-236.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
0.1	8	0.0750	1.37		<b>Shallow Concentrated Flow, 236.5-235.9 (B-C)</b> Woodland Kv= 5.0 fps
0.4	28	0.0670	1.29		<b>Shallow Concentrated Flow, 235.9-234 (C-D)</b> Woodland Kv= 5.0 fps
3.8	458	0.0810	1.99		<b>Shallow Concentrated Flow, 234-197 (D-E)</b> Short Grass Pasture Kv= 7.0 fps
0.8	79	0.1200	1.73		<b>Shallow Concentrated Flow, 197-187.5 (E-F)</b> Woodland Kv= 5.0 fps
8.4	615	Total			

**Summary for Subcatchment P1d: Parcel 1 (North) - Overland**

Runoff = 8.82 cfs @ 12.23 hrs, Volume= 0.878 af, Depth= 1.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2-yr Rainfall=3.37"



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Area (ac)	CN	Description
7.494	74	>75% Grass cover, Good, HSG C
* 0.686	98	Basin Bottom, 0% imp, HSG C
0.100	96	Gravel surface, HSG C
8.280	76	Weighted Average
8.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0140	0.09		<b>Sheet Flow, 242-241.3 (A-B)</b> Grass: Dense n= 0.240 P2= 3.37"
6.4	640	0.0570	1.67		<b>Shallow Concentrated Flow, 241.3-205 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
15.6	690	Total			

**Summary for Reach DP1: Wetlands associated with Mine Brook**

Inflow Area = 73.981 ac, 3.33% Impervious, Inflow Depth = 1.07" for 2-yr event  
 Inflow = 45.75 cfs @ 12.53 hrs, Volume= 6.578 af  
 Outflow = 45.75 cfs @ 12.53 hrs, Volume= 6.578 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs

**Summary for Pond B1: Basin 1**

Inflow Area = 8.875 ac, 0.62% Impervious, Inflow Depth = 1.27" for 2-yr event  
 Inflow = 9.47 cfs @ 12.22 hrs, Volume= 0.941 af  
 Outflow = 0.23 cfs @ 22.18 hrs, Volume= 0.613 af, Atten= 98%, Lag= 597.2 min  
 Discarded = 0.20 cfs @ 22.18 hrs, Volume= 0.603 af  
 Primary = 0.03 cfs @ 22.18 hrs, Volume= 0.010 af  
 Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 203.02' @ 22.18 hrs Surf.Area= 32,734 sf Storage= 31,388 cf

Plug-Flow detention time= 1,014.0 min calculated for 0.613 af (65% of inflow)  
 Center-of-Mass det. time= 905.0 min ( 1,766.1 - 861.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	202.00'	146,792 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.00	28,692	0	0
203.00	32,646	30,669	30,669
204.00	36,655	34,651	65,320
205.00	40,722	38,689	104,008
206.00	44,845	42,784	146,792

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Device	Routing	Invert	Outlet Devices
#1	Primary	202.00'	<b>12.0" Round Culvert X 2.00</b> L= 26.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 202.00' / 201.80' S= 0.0075 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	203.00'	<b>11.0" W x 3.0" H Vert. Orifice X 2.00</b> C= 0.600
#3	Device 1	205.00'	<b>24.0" x 24.0" Horiz. Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads
#4	Secondary	205.50'	<b>20.0' long x 10.0' breadth Broad-Crested Rectangular Weir X 2.00</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	202.00'	<b>0.270 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.20 cfs @ 22.18 hrs HW=203.02' (Free Discharge)↳ **5=Exfiltration** (Exfiltration Controls 0.20 cfs)**Primary OutFlow** Max=0.02 cfs @ 22.18 hrs HW=203.02' (Free Discharge)↳ **1=Culvert** (Passes 0.02 cfs of 4.78 cfs potential flow)↳ **2=Orifice** (Orifice Controls 0.02 cfs @ 0.48 fps)↳ **3=Grate** ( Controls 0.00 cfs)**Secondary OutFlow** Max=0.00 cfs @ 1.00 hrs HW=202.00' (Free Discharge)↳ **4=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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Type III 24-hr 10-yr Rainfall=5.25"

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Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentP1a: Parcel 1 (North) -** Runoff Area=64.438 ac 3.67% Impervious Runoff Depth=2.65"  
Flow Length=1,823' Tc=36.2 min CN=75 Runoff=103.40 cfs 14.249 af

**SubcatchmentP1b: Parcel 2 (Offsite) -** Runoff Area=0.595 ac 9.24% Impervious Runoff Depth=2.74"  
Flow Length=485' Tc=8.9 min CN=76 Runoff=1.70 cfs 0.136 af

**SubcatchmentP1c: Parcel 2 (Offsite) -** Runoff Area=0.668 ac 6.74% Impervious Runoff Depth=2.65"  
Flow Length=615' Tc=8.4 min CN=75 Runoff=1.88 cfs 0.148 af

**SubcatchmentP1d: Parcel 1 (North) -** Runoff Area=8.280 ac 0.00% Impervious Runoff Depth=2.74"  
Flow Length=690' Tc=15.6 min CN=76 Runoff=19.75 cfs 1.893 af

**Reach DP1: Wetlands associated with Mine Brook** Inflow=104.75 cfs 15.403 af  
Outflow=104.75 cfs 15.403 af

**Pond B1: Basin 1** Peak Elev=203.59' Storage=50,595 cf Inflow=21.08 cfs 2.029 af  
Discarded=0.22 cfs 0.641 af Primary=1.50 cfs 1.006 af Secondary=0.00 cfs 0.000 af Outflow=1.72 cfs 1.647 af

**Total Runoff Area = 73.981 ac Runoff Volume = 16.425 af Average Runoff Depth = 2.66"**  
**96.67% Pervious = 71.518 ac 3.33% Impervious = 2.463 ac**

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**Summary for Subcatchment P1a: Parcel 1 (North) - Overland**

Runoff = 103.40 cfs @ 12.51 hrs, Volume= 14.249 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-yr Rainfall=5.25"

Area (ac)	CN	Description
0.610	98	Paved parking, HSG C
1.488	96	Gravel surface, HSG C
29.951	74	>75% Grass cover, Good, HSG C
17.208	74	>75% Grass cover, Good, HSG C
11.581	70	Woods, Good, HSG C
1.753	98	Water Surface, HSG C
1.847	77	Woods, Good, HSG D
64.438	75	Weighted Average
62.075		96.33% Pervious Area
2.363		3.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0060	0.06		<b>Sheet Flow, 249.7-249.4 (A-B)</b>
					Grass: Dense n= 0.240 P2= 3.37"
22.4	1,681	0.0320	1.25		<b>Shallow Concentrated Flow, 249.4-195 (B-C)</b>
					Short Grass Pasture Kv= 7.0 fps
0.9	92	0.1090	1.65		<b>Shallow Concentrated Flow, 195-185 (C-D)</b>
					Woodland Kv= 5.0 fps
36.2	1,823	Total			

**Summary for Subcatchment P1b: Parcel 2 (Offsite) - Overland**

Runoff = 1.70 cfs @ 12.13 hrs, Volume= 0.136 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10-yr Rainfall=5.25"

Area (ac)	CN	Description
0.091	70	Woods, Good, HSG C
0.055	98	Paved parking, HSG C
0.449	74	>75% Grass cover, Good, HSG C
0.595	76	Weighted Average
0.540		90.76% Pervious Area
0.055		9.24% Impervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0300	0.18		<b>Sheet Flow, 230-228.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
4.2	435	0.0610	1.73		<b>Shallow Concentrated Flow, 228.5-202 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
8.9	485	Total			

**Summary for Subcatchment P1c: Parcel 2 (Offsite) - Overland**

Runoff = 1.88 cfs @ 12.12 hrs, Volume= 0.148 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 10-yr Rainfall=5.25"

Area (ac)	CN	Description
0.055	70	Woods, Good, HSG C
0.045	98	Paved parking, HSG C
0.568	74	>75% Grass cover, Good, HSG C
0.668	75	Weighted Average
0.623		93.26% Pervious Area
0.045		6.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	42	0.0520	0.22		<b>Sheet Flow, 238.7-236.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
0.1	8	0.0750	1.37		<b>Shallow Concentrated Flow, 236.5-235.9 (B-C)</b> Woodland Kv= 5.0 fps
0.4	28	0.0670	1.29		<b>Shallow Concentrated Flow, 235.9-234 (C-D)</b> Woodland Kv= 5.0 fps
3.8	458	0.0810	1.99		<b>Shallow Concentrated Flow, 234-197 (D-E)</b> Short Grass Pasture Kv= 7.0 fps
0.8	79	0.1200	1.73		<b>Shallow Concentrated Flow, 197-187.5 (E-F)</b> Woodland Kv= 5.0 fps
8.4	615	Total			

**Summary for Subcatchment P1d: Parcel 1 (North) - Overland**

Runoff = 19.75 cfs @ 12.22 hrs, Volume= 1.893 af, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
 Type III 24-hr 10-yr Rainfall=5.25"

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Area (ac)	CN	Description
7.494	74	>75% Grass cover, Good, HSG C
* 0.686	98	Basin Bottom, 0% imp, HSG C
0.100	96	Gravel surface, HSG C
8.280	76	Weighted Average
8.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0140	0.09		<b>Sheet Flow, 242-241.3 (A-B)</b> Grass: Dense n= 0.240 P2= 3.37"
6.4	640	0.0570	1.67		<b>Shallow Concentrated Flow, 241.3-205 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
15.6	690	Total			

**Summary for Reach DP1: Wetlands associated with Mine Brook**

Inflow Area = 73.981 ac, 3.33% Impervious, Inflow Depth = 2.50" for 10-yr event  
 Inflow = 104.75 cfs @ 12.51 hrs, Volume= 15.403 af  
 Outflow = 104.75 cfs @ 12.51 hrs, Volume= 15.403 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs

**Summary for Pond B1: Basin 1**

Inflow Area = 8.875 ac, 0.62% Impervious, Inflow Depth = 2.74" for 10-yr event  
 Inflow = 21.08 cfs @ 12.21 hrs, Volume= 2.029 af  
 Outflow = 1.72 cfs @ 14.46 hrs, Volume= 1.647 af, Atten= 92%, Lag= 134.9 min  
 Discarded = 0.22 cfs @ 14.46 hrs, Volume= 0.641 af  
 Primary = 1.50 cfs @ 14.46 hrs, Volume= 1.006 af  
 Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 203.59' @ 14.46 hrs Surf.Area= 35,007 sf Storage= 50,595 cf

Plug-Flow detention time= 539.9 min calculated for 1.645 af (81% of inflow)  
 Center-of-Mass det. time= 466.0 min ( 1,304.5 - 838.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	202.00'	146,792 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.00	28,692	0	0
203.00	32,646	30,669	30,669
204.00	36,655	34,651	65,320
205.00	40,722	38,689	104,008
206.00	44,845	42,784	146,792

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Type III 24-hr 10-yr Rainfall=5.25"

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Device	Routing	Invert	Outlet Devices
#1	Primary	202.00'	<b>12.0" Round Culvert X 2.00</b> L= 26.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 202.00' / 201.80' S= 0.0075 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	203.00'	<b>11.0" W x 3.0" H Vert. Orifice X 2.00</b> C= 0.600
#3	Device 1	205.00'	<b>24.0" x 24.0" Horiz. Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads
#4	Secondary	205.50'	<b>20.0' long x 10.0' breadth Broad-Crested Rectangular Weir X 2.00</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	202.00'	<b>0.270 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.22 cfs @ 14.46 hrs HW=203.59' (Free Discharge)↳ **5=Exfiltration** (Exfiltration Controls 0.22 cfs)**Primary OutFlow** Max=1.50 cfs @ 14.46 hrs HW=203.59' (Free Discharge)↳ **1=Culvert** (Passes 1.50 cfs of 7.33 cfs potential flow)↳ **2=Orifice** (Orifice Controls 1.50 cfs @ 3.27 fps)↳ **3=Grate** ( Controls 0.00 cfs)**Secondary OutFlow** Max=0.00 cfs @ 1.00 hrs HW=202.00' (Free Discharge)↳ **4=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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Type III 24-hr 25-yr Rainfall=6.42"

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Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentP1a: Parcel 1 (North) -** Runoff Area=64.438 ac 3.67% Impervious Runoff Depth=3.64"  
Flow Length=1,823' Tc=36.2 min CN=75 Runoff=142.38 cfs 19.561 af

**SubcatchmentP1b: Parcel 2 (Offsite) -** Runoff Area=0.595 ac 9.24% Impervious Runoff Depth=3.75"  
Flow Length=485' Tc=8.9 min CN=76 Runoff=2.32 cfs 0.186 af

**SubcatchmentP1c: Parcel 2 (Offsite) -** Runoff Area=0.668 ac 6.74% Impervious Runoff Depth=3.64"  
Flow Length=615' Tc=8.4 min CN=75 Runoff=2.59 cfs 0.203 af

**SubcatchmentP1d: Parcel 1 (North) -** Runoff Area=8.280 ac 0.00% Impervious Runoff Depth=3.75"  
Flow Length=690' Tc=15.6 min CN=76 Runoff=27.01 cfs 2.584 af

**Reach DP1: Wetlands associated with Mine Brook** Inflow=144.87 cfs 21.467 af  
Outflow=144.87 cfs 21.467 af

**Pond B1: Basin 1** Peak Elev=204.10' Storage=69,068 cf Inflow=28.82 cfs 2.770 af  
Discarded=0.23 cfs 0.664 af Primary=2.18 cfs 1.703 af Secondary=0.00 cfs 0.000 af Outflow=2.41 cfs 2.367 af

**Total Runoff Area = 73.981 ac Runoff Volume = 22.534 af Average Runoff Depth = 3.66"**  
**96.67% Pervious = 71.518 ac 3.33% Impervious = 2.463 ac**



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**Summary for Subcatchment P1a: Parcel 1 (North) - Overland**

Runoff = 142.38 cfs @ 12.50 hrs, Volume= 19.561 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-yr Rainfall=6.42"

Area (ac)	CN	Description
0.610	98	Paved parking, HSG C
1.488	96	Gravel surface, HSG C
29.951	74	>75% Grass cover, Good, HSG C
17.208	74	>75% Grass cover, Good, HSG C
11.581	70	Woods, Good, HSG C
1.753	98	Water Surface, HSG C
1.847	77	Woods, Good, HSG D
64.438	75	Weighted Average
62.075		96.33% Pervious Area
2.363		3.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0060	0.06		<b>Sheet Flow, 249.7-249.4 (A-B)</b>
					Grass: Dense n= 0.240 P2= 3.37"
22.4	1,681	0.0320	1.25		<b>Shallow Concentrated Flow, 249.4-195 (B-C)</b>
					Short Grass Pasture Kv= 7.0 fps
0.9	92	0.1090	1.65		<b>Shallow Concentrated Flow, 195-185 (C-D)</b>
					Woodland Kv= 5.0 fps
36.2	1,823	Total			

**Summary for Subcatchment P1b: Parcel 2 (Offsite) - Overland**

Runoff = 2.32 cfs @ 12.13 hrs, Volume= 0.186 af, Depth= 3.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-yr Rainfall=6.42"

Area (ac)	CN	Description
0.091	70	Woods, Good, HSG C
0.055	98	Paved parking, HSG C
0.449	74	>75% Grass cover, Good, HSG C
0.595	76	Weighted Average
0.540		90.76% Pervious Area
0.055		9.24% Impervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0300	0.18		<b>Sheet Flow, 230-228.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
4.2	435	0.0610	1.73		<b>Shallow Concentrated Flow, 228.5-202 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
8.9	485	Total			

**Summary for Subcatchment P1c: Parcel 2 (Offsite) - Overland**

Runoff = 2.59 cfs @ 12.12 hrs, Volume= 0.203 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-yr Rainfall=6.42"

Area (ac)	CN	Description
0.055	70	Woods, Good, HSG C
0.045	98	Paved parking, HSG C
0.568	74	>75% Grass cover, Good, HSG C
0.668	75	Weighted Average
0.623		93.26% Pervious Area
0.045		6.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	42	0.0520	0.22		<b>Sheet Flow, 238.7-236.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
0.1	8	0.0750	1.37		<b>Shallow Concentrated Flow, 236.5-235.9 (B-C)</b> Woodland Kv= 5.0 fps
0.4	28	0.0670	1.29		<b>Shallow Concentrated Flow, 235.9-234 (C-D)</b> Woodland Kv= 5.0 fps
3.8	458	0.0810	1.99		<b>Shallow Concentrated Flow, 234-197 (D-E)</b> Short Grass Pasture Kv= 7.0 fps
0.8	79	0.1200	1.73		<b>Shallow Concentrated Flow, 197-187.5 (E-F)</b> Woodland Kv= 5.0 fps
8.4	615	Total			

**Summary for Subcatchment P1d: Parcel 1 (North) - Overland**

Runoff = 27.01 cfs @ 12.22 hrs, Volume= 2.584 af, Depth= 3.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 25-yr Rainfall=6.42"

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Area (ac)	CN	Description
7.494	74	>75% Grass cover, Good, HSG C
* 0.686	98	Basin Bottom, 0% imp, HSG C
0.100	96	Gravel surface, HSG C
8.280	76	Weighted Average
8.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0140	0.09		<b>Sheet Flow, 242-241.3 (A-B)</b> Grass: Dense n= 0.240 P2= 3.37"
6.4	640	0.0570	1.67		<b>Shallow Concentrated Flow, 241.3-205 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
15.6	690	Total			

**Summary for Reach DP1: Wetlands associated with Mine Brook**

Inflow Area = 73.981 ac, 3.33% Impervious, Inflow Depth = 3.48" for 25-yr event  
 Inflow = 144.87 cfs @ 12.50 hrs, Volume= 21.467 af  
 Outflow = 144.87 cfs @ 12.50 hrs, Volume= 21.467 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs

**Summary for Pond B1: Basin 1**

Inflow Area = 8.875 ac, 0.62% Impervious, Inflow Depth = 3.75" for 25-yr event  
 Inflow = 28.82 cfs @ 12.21 hrs, Volume= 2.770 af  
 Outflow = 2.41 cfs @ 14.19 hrs, Volume= 2.367 af, Atten= 92%, Lag= 118.7 min  
 Discarded = 0.23 cfs @ 14.19 hrs, Volume= 0.664 af  
 Primary = 2.18 cfs @ 14.19 hrs, Volume= 1.703 af  
 Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 204.10' @ 14.19 hrs Surf.Area= 37,069 sf Storage= 69,068 cf

Plug-Flow detention time= 475.3 min calculated for 2.367 af (85% of inflow)  
 Center-of-Mass det. time= 411.8 min ( 1,241.4 - 829.6 )

Volume	Invert	Avail.Storage	Storage Description
#1	202.00'	146,792 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.00	28,692	0	0
203.00	32,646	30,669	30,669
204.00	36,655	34,651	65,320
205.00	40,722	38,689	104,008
206.00	44,845	42,784	146,792

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Device	Routing	Invert	Outlet Devices
#1	Primary	202.00'	<b>12.0" Round Culvert X 2.00</b> L= 26.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 202.00' / 201.80' S= 0.0075 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	203.00'	<b>11.0" W x 3.0" H Vert. Orifice X 2.00</b> C= 0.600
#3	Device 1	205.00'	<b>24.0" x 24.0" Horiz. Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads
#4	Secondary	205.50'	<b>20.0' long x 10.0' breadth Broad-Crested Rectangular Weir X 2.00</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	202.00'	<b>0.270 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.23 cfs @ 14.19 hrs HW=204.10' (Free Discharge)↳ **5=Exfiltration** (Exfiltration Controls 0.23 cfs)**Primary OutFlow** Max=2.18 cfs @ 14.19 hrs HW=204.10' (Free Discharge)↳ **1=Culvert** (Passes 2.18 cfs of 9.42 cfs potential flow)↳ **2=Orifice** (Orifice Controls 2.18 cfs @ 4.76 fps)↳ **3=Grate** ( Controls 0.00 cfs)**Secondary OutFlow** Max=0.00 cfs @ 1.00 hrs HW=202.00' (Free Discharge)↳ **4=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

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Type III 24-hr 100-yr Rainfall=8.23"

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Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**SubcatchmentP1a: Parcel 1 (North) -** Runoff Area=64.438 ac 3.67% Impervious Runoff Depth=5.25"  
Flow Length=1,823' Tc=36.2 min CN=75 Runoff=204.60 cfs 28.190 af

**SubcatchmentP1b: Parcel 2 (Offsite) -** Runoff Area=0.595 ac 9.24% Impervious Runoff Depth=5.37"  
Flow Length=485' Tc=8.9 min CN=76 Runoff=3.30 cfs 0.266 af

**SubcatchmentP1c: Parcel 2 (Offsite) -** Runoff Area=0.668 ac 6.74% Impervious Runoff Depth=5.25"  
Flow Length=615' Tc=8.4 min CN=75 Runoff=3.72 cfs 0.292 af

**SubcatchmentP1d: Parcel 1 (North) -** Runoff Area=8.280 ac 0.00% Impervious Runoff Depth=5.37"  
Flow Length=690' Tc=15.6 min CN=76 Runoff=38.54 cfs 3.704 af

**Reach DP1: Wetlands associated with Mine Brook** Inflow=208.26 cfs 31.302 af  
Outflow=208.26 cfs 31.302 af

**Pond B1: Basin 1** Peak Elev=204.95' Storage=102,164 cf Inflow=41.11 cfs 3.970 af  
Discarded=0.25 cfs 0.702 af Primary=2.98 cfs 2.820 af Secondary=0.00 cfs 0.000 af Outflow=3.24 cfs 3.522 af

**Total Runoff Area = 73.981 ac Runoff Volume = 32.452 af Average Runoff Depth = 5.26"**  
**96.67% Pervious = 71.518 ac 3.33% Impervious = 2.463 ac**

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Type III 24-hr 100-yr Rainfall=8.23"

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**Summary for Subcatchment P1a: Parcel 1 (North) - Overland**

Runoff = 204.60 cfs @ 12.50 hrs, Volume= 28.190 af, Depth= 5.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-yr Rainfall=8.23"

Area (ac)	CN	Description
0.610	98	Paved parking, HSG C
1.488	96	Gravel surface, HSG C
29.951	74	>75% Grass cover, Good, HSG C
17.208	74	>75% Grass cover, Good, HSG C
11.581	70	Woods, Good, HSG C
1.753	98	Water Surface, HSG C
1.847	77	Woods, Good, HSG D
64.438	75	Weighted Average
62.075		96.33% Pervious Area
2.363		3.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.9	50	0.0060	0.06		<b>Sheet Flow, 249.7-249.4 (A-B)</b> Grass: Dense n= 0.240 P2= 3.37"
22.4	1,681	0.0320	1.25		<b>Shallow Concentrated Flow, 249.4-195 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
0.9	92	0.1090	1.65		<b>Shallow Concentrated Flow, 195-185 (C-D)</b> Woodland Kv= 5.0 fps
36.2	1,823	Total			

**Summary for Subcatchment P1b: Parcel 2 (Offsite) - Overland**

Runoff = 3.30 cfs @ 12.13 hrs, Volume= 0.266 af, Depth= 5.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-yr Rainfall=8.23"

Area (ac)	CN	Description
0.091	70	Woods, Good, HSG C
0.055	98	Paved parking, HSG C
0.449	74	>75% Grass cover, Good, HSG C
0.595	76	Weighted Average
0.540		90.76% Pervious Area
0.055		9.24% Impervious Area

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Type III 24-hr 100-yr Rainfall=8.23"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	50	0.0300	0.18		<b>Sheet Flow, 230-228.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
4.2	435	0.0610	1.73		<b>Shallow Concentrated Flow, 228.5-202 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
8.9	485	Total			

**Summary for Subcatchment P1c: Parcel 2 (Offsite) - Overland**

Runoff = 3.72 cfs @ 12.12 hrs, Volume= 0.292 af, Depth= 5.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-yr Rainfall=8.23"

Area (ac)	CN	Description
0.055	70	Woods, Good, HSG C
0.045	98	Paved parking, HSG C
0.568	74	>75% Grass cover, Good, HSG C
0.668	75	Weighted Average
0.623		93.26% Pervious Area
0.045		6.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	42	0.0520	0.22		<b>Sheet Flow, 238.7-236.5 (A-B)</b> Grass: Short n= 0.150 P2= 3.37"
0.1	8	0.0750	1.37		<b>Shallow Concentrated Flow, 236.5-235.9 (B-C)</b> Woodland Kv= 5.0 fps
0.4	28	0.0670	1.29		<b>Shallow Concentrated Flow, 235.9-234 (C-D)</b> Woodland Kv= 5.0 fps
3.8	458	0.0810	1.99		<b>Shallow Concentrated Flow, 234-197 (D-E)</b> Short Grass Pasture Kv= 7.0 fps
0.8	79	0.1200	1.73		<b>Shallow Concentrated Flow, 197-187.5 (E-F)</b> Woodland Kv= 5.0 fps
8.4	615	Total			

**Summary for Subcatchment P1d: Parcel 1 (North) - Overland**

Runoff = 38.54 cfs @ 12.21 hrs, Volume= 3.704 af, Depth= 5.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100-yr Rainfall=8.23"

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Type III 24-hr 100-yr Rainfall=8.23"

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Area (ac)	CN	Description
7.494	74	>75% Grass cover, Good, HSG C
* 0.686	98	Basin Bottom, 0% imp, HSG C
0.100	96	Gravel surface, HSG C
8.280	76	Weighted Average
8.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0140	0.09		<b>Sheet Flow, 242-241.3 (A-B)</b> Grass: Dense n= 0.240 P2= 3.37"
6.4	640	0.0570	1.67		<b>Shallow Concentrated Flow, 241.3-205 (B-C)</b> Short Grass Pasture Kv= 7.0 fps
15.6	690	Total			

**Summary for Reach DP1: Wetlands associated with Mine Brook**

Inflow Area = 73.981 ac, 3.33% Impervious, Inflow Depth = 5.08" for 100-yr event  
 Inflow = 208.26 cfs @ 12.50 hrs, Volume= 31.302 af  
 Outflow = 208.26 cfs @ 12.50 hrs, Volume= 31.302 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs

**Summary for Pond B1: Basin 1**

Inflow Area = 8.875 ac, 0.62% Impervious, Inflow Depth = 5.37" for 100-yr event  
 Inflow = 41.11 cfs @ 12.21 hrs, Volume= 3.970 af  
 Outflow = 3.24 cfs @ 14.22 hrs, Volume= 3.522 af, Atten= 92%, Lag= 120.7 min  
 Discarded = 0.25 cfs @ 14.22 hrs, Volume= 0.702 af  
 Primary = 2.98 cfs @ 14.22 hrs, Volume= 2.820 af  
 Secondary = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs  
 Peak Elev= 204.95' @ 14.22 hrs Surf.Area= 40,537 sf Storage= 102,164 cf

Plug-Flow detention time= 460.9 min calculated for 3.522 af (89% of inflow)  
 Center-of-Mass det. time= 407.9 min ( 1,227.2 - 819.3 )

Volume	Invert	Avail.Storage	Storage Description
#1	202.00'	146,792 cf	<b>Custom Stage Data (Prismatic)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
202.00	28,692	0	0
203.00	32,646	30,669	30,669
204.00	36,655	34,651	65,320
205.00	40,722	38,689	104,008
206.00	44,845	42,784	146,792



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Proposed HydroCAD - 7/10/23 - Rev2

Type III 24-hr 100-yr Rainfall=8.23"

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Device	Routing	Invert	Outlet Devices
#1	Primary	202.00'	<b>12.0" Round Culvert X 2.00</b> L= 26.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 202.00' / 201.80' S= 0.0075 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	203.00'	<b>11.0" W x 3.0" H Vert. Orifice X 2.00</b> C= 0.600
#3	Device 1	205.00'	<b>24.0" x 24.0" Horiz. Grate X 2.00</b> C= 0.600 Limited to weir flow at low heads
#4	Secondary	205.50'	<b>20.0' long x 10.0' breadth Broad-Crested Rectangular Weir X 2.00</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#5	Discarded	202.00'	<b>0.270 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.25 cfs @ 14.22 hrs HW=204.95' (Free Discharge)↳ **5=Exfiltration** (Exfiltration Controls 0.25 cfs)**Primary OutFlow** Max=2.98 cfs @ 14.22 hrs HW=204.95' (Free Discharge)↳ **1=Culvert** (Passes 2.98 cfs of 11.85 cfs potential flow)↳ **2=Orifice** (Orifice Controls 2.98 cfs @ 6.51 fps)↳ **3=Grate** ( Controls 0.00 cfs)**Secondary OutFlow** Max=0.00 cfs @ 1.00 hrs HW=202.00' (Free Discharge)↳ **4=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

**Proposed Solar Array - Parcel 1**  
**160 Maple Street**  
**Bellingham, MA**  
**Bohler Job Number: W201257**  
**April 13, 2023**  
**Revised July 10, 2023**

**MA DEP Standard 3: Recharge Volume Calculations**

<b>Required Recharge Volume - A Soils (0.60 in.)</b>	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
<b>Recharge Volume Required (cf)</b>	<b>0</b>

<b>Required Recharge Volume - B Soils (0.35 in.)</b>	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
<b>Recharge Volume Required (cf)</b>	<b>0</b>

<b>Required Recharge Volume - C Soils (0.25 in.)</b>	
Existing Site Impervious Area (ac)	5.259
Proposed Site Impervious Area (ac)	2.298
Proposed Increase in Site Impervious Area (ac)	-2.961
<b>Recharge Volume Required (cf)</b>	<b>0</b>

<b>Required Recharge Volume - D Soils (0.10 in.)</b>	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
<b>Recharge Volume Required (cf)</b>	<b>0</b>

<b>Total Recharge Volume Required (cf)</b>	<b>0</b>
--	----------

<b>Recharge Volume Adjustment Factor</b>	
Impervious Area Directed to Infiltration BMP (ac)	<b>0.000</b>
%Impervious Directed to Infiltration BMP	
Adjustment Factor	
<b>Adjusted Total Recharge Volume Required (cf)</b>	

<b>Provided Recharge Volume*</b>	
Basin 1 (B1)	30,669
<b>Total Recharge Volume Provided (cf)</b>	<b>30,669</b>

**Input Required**

\*Volume provided below lowest outlet in cubic feet (cf)

Proposed Solar Array - Parcel 1  
160 Maple Street  
Bellingham, MA  
Bohler Job Number: W201257  
April 13, 2023  
Revised July 10, 2023

MA DEP Standard 3: Drawdown Time Calculations

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Drawdown Time - Basin 1 (B1)	
Volume below outlet pipe (Rv) (cf)	30,669
Soil Type	Silt Loam - C
Infiltration rate (K)*	0.27
Bottom Area (sf)	28,692
<b>Drawdown time (Hours)*</b>	<b>47.5</b>

\*Infiltration Rates taken from Rawls Table

\*\*Drawdown time =  $Rv / (K \times \text{bottom area})$

**Proposed Solar Array - Parcel 1**  
**160 Maple Street**  
**Bellingham, MA**  
**Bohler Job Number: W201257**  
**April 13, 2023**  
*Revised July 10, 2023*

**MA DEP Standard 4: Water Quality Volume Calculations**

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<b>Water Quality Volume Required</b>	
Water Quality Volume runoff (in.)*	0.8
Total Post Development Impervious Area (sf)	100,101
<b>Required Water Quality Volume (cf)</b>	<b>6,673</b>
*Water Quality volume runoff is equal to 0.8 inches of runoff times the total impervious area of the post development project site (per Town Bylaw). Impervious area includes gravel and paved surfaces.	

<b>Water Quality Volume Provided*</b>	
Basin 1 (B1)	30,669
<b>Total Provided Water Quality Volume (cf)</b>	<b>30,669</b>

**Required Recharge Provided**

\*Volume provided below lowest outlet pipe in cubic feet (cf)

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Stage Storage Volume - 7/10/23 - Rev2

Type III 24-hr 2-yr Rainfall=3.37"

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## Stage-Area-Storage for Pond B1: Basin 1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
202.00	28,692	0	202.51	30,709	15,147
202.01	28,732	287	202.52	30,748	15,454
202.02	28,771	575	202.53	30,788	15,762
202.03	28,811	863	202.54	30,827	16,070
202.04	28,850	1,151	202.55	30,867	16,379
202.05	28,890	1,440	202.56	30,906	16,688
202.06	28,929	1,729	202.57	30,946	16,997
202.07	28,969	2,018	202.58	30,985	17,306
202.08	29,008	2,308	202.59	31,025	17,616
202.09	29,048	2,598	202.60	31,064	17,927
202.10	29,087	2,889	202.61	31,104	18,238
202.11	29,127	3,180	202.62	31,143	18,549
202.12	29,166	3,472	202.63	31,183	18,861
202.13	29,206	3,763	202.64	31,223	19,173
202.14	29,246	4,056	202.65	31,262	19,485
202.15	29,285	4,348	202.66	31,302	19,798
202.16	29,325	4,641	202.67	31,341	20,111
202.17	29,364	4,935	202.68	31,381	20,425
202.18	29,404	5,229	202.69	31,420	20,739
202.19	29,443	5,523	202.70	31,460	21,053
202.20	29,483	5,817	202.71	31,499	21,368
202.21	29,522	6,113	202.72	31,539	21,683
202.22	29,562	6,408	202.73	31,578	21,999
202.23	29,601	6,704	202.74	31,618	22,315
202.24	29,641	7,000	202.75	31,658	22,631
202.25	29,681	7,297	202.76	31,697	22,948
202.26	29,720	7,594	202.77	31,737	23,265
202.27	29,760	7,891	202.78	31,776	23,583
202.28	29,799	8,189	202.79	31,816	23,901
202.29	29,839	8,487	202.80	31,855	24,219
202.30	29,878	8,786	202.81	31,895	24,538
202.31	29,918	9,085	202.82	31,934	24,857
202.32	29,957	9,384	202.83	31,974	25,176
202.33	29,997	9,684	202.84	32,013	25,496
202.34	30,036	9,984	202.85	32,053	25,817
202.35	30,076	10,284	202.86	32,092	26,137
202.36	30,115	10,585	202.87	32,132	26,458
202.37	30,155	10,887	202.88	32,172	26,780
202.38	30,195	11,188	202.89	32,211	27,102
202.39	30,234	11,491	202.90	32,251	27,424
202.40	30,274	11,793	202.91	32,290	27,747
202.41	30,313	12,096	202.92	32,330	28,070
202.42	30,353	12,399	202.93	32,369	28,393
202.43	30,392	12,703	202.94	32,409	28,717
202.44	30,432	13,007	202.95	32,448	29,042
202.45	30,471	13,312	202.96	32,488	29,366
202.46	30,511	13,617	202.97	32,527	29,691
202.47	30,550	13,922	202.98	32,567	30,017
202.48	30,590	14,228	202.99	32,606	30,343
202.49	30,629	14,534	203.00	32,646	30,669
202.50	30,669	14,840	203.01	32,686	30,996

**Proposed Solar Array - Parcel 1**  
**160 Maple Street**  
**Bellingham, MA**  
**Bohler Job Number: W201257**  
**April 13, 2023**  
**Revised July 10, 2023**

**Rational Pipe Sizing Calculations**

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LOCATION		IMPERVIOUS			OTHER			SUM CA	Tc (min)	I (in/hr)	Q (cfs)	D (in)	S (ft/ft)	Material	n	Q Full (cfs)	V Full (fps)
FROM	TO	A	C	CA	A	C	CA										
OCS100	FES100	Flow from HydroCAD 100-year storm event (split between outlets)									1.49	12	0.008	RCP	0.012	3.34	4.26
OCS200	FES200	Flow from HydroCAD 100-year storm event (split between outlets)									1.49	12	0.008	RCP	0.012	3.45	4.40

**Proposed Solar Array - Parcel 1**  
**160 Maple Street**  
**Bellingham, MA**  
**Bohler Job Number: W201257**  
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**Rip Rap Sizing Calculations**

Design Period Storm: 100 Year

Rip Rap Apron Sizing Calculations											
Location	Pipe Size (in.)	Pipe Size (ft.)	Q (cfs)	TW (ft.)	V (fps)	W1 (ft.)	La (ft.)	W2 (ft.)	W3 (ft.)	Apron Type	Rip Rap Type
FES100	12	1.0	1.49	0.20	4.26	3.00	10	10	NA	A	Modified
FES200	12	1.0	1.49	0.20	4.40	3.00	10	10	NA	A	Modified

Based ConnDOT Drainage Manual - Type A, B, and C Riprap Aprons

Outlet Velocity (fps)  
 0-8 - Modified  
 8-10 - Intermediate  
 10-14 - Standard