



September 05, 2023

Town of Richmond
Attention: Tyler Machia, Zoning Administrator
Planning and Zoning Office
P.O. Box 285
Richmond, VT 05477

RE: Scott Strode, Lots 21 & 22 Subdivision Amendment, Dugway Road, Richmond, Vermont – Stormwater Management Basis of Design

Dear Tyler,

Tailwater Engineering (Tailwater.) was contacted by Barnard & Gervais (B&G) to evaluate the stormwater management for the above-mentioned project. The project is required to obtain an Operational Stormwater Management permit 3-9050 from the State of VT, which requires both water quality treatment and water quantity storage. The proposed project has been designed in accordance with the State Stormwater regulations. This letter is written to specifically discuss the Town's stormwater management requirements which state: *"that all parking areas and associated roadways shall be designed and constructed with detention devices, such as, but not limited to overland grassed and/or stone lined swales, detention basins, and settling ponds, in order to assure that the post development peak flow stormwater volumes from such parking areas and roadways do not exceed the predevelopment quantities based on the run-off from a twenty-five year, twenty-four hour storm event."* Tailwater has performed a pre and post construction hydrologic model of the site for the 25-year rainstorm event using HYDROCAD® Stormwater Modeling Software. The following is a discussion and summary of the results of the modeling exercise.

Stormwater Management Discussion

The overall site has four distinct discharge locations. Compliance with the Town's stormwater regulations is demonstrated at each discharge location.

Sub-Catchment No. 1: Discharge Point No. 1 – 15" Culvert and drainage swale to the Huntington River

The existing site drainage consists of a mostly wooded area located on both hydrologic A and C soils. The watershed also has existing impervious roadway and meadow

areas. The upper wooded section is steeper (greater than 20%) and the meadow section is mostly less than 15%.

The proposed land cover in sub catchment no. 1 does not significantly change much from the current existing conditions. The existing roadway will be converted to a grassed cut area with some retaining walls in sections. There is a slight increase in impervious areas due to the new road being 4' +/- wider than the existing road.

The proposed stormwater management includes the construction of a dry swale with a forebay. This dry swale is designed to infiltrate the entire water quality volume for the 1-inch rainstorm (0.008 ac-ft). This 0.008 ac-ft of available infiltration capacity reduces the direct runoff from the Q25 storm to below existing conditions.

The following are the inputs for both the pre and post models. The model uses TR-20 with the Lag/CN method which is the accepted modeling procedure of the State of Vermont's Stormwater Management Division.

Givens for both Pre & Post all Sub-Catchments

- Per the NRCS, the soils are hydrologic rated A and C which are well to moderately well drained.
- Per NOAA Atlas 14, the 25-year, 24-hour storm depth for Richmond is 4.24-inches.

Existing Conditions Sub-Catchment No. 1

- Land Cover
 - 0.326 acres, woods, hydro A soils
 - 0.210 acres, woods, hydro C soils
 - 0.049 acres, gravel drive
 - 0.110 acres, meadow, hydro A soils
 - Total Area = 0.695 acres
- Average Slope = 22.8 % +/-
- Total runoff volume from 25-year storm = 0.045 acre-feet

Proposed Conditions Sub-Catchment No. 1

- Land Cover
 - 0.222 acres, woods, hydro A soils
 - 0.210 acres, woods, hydro C soils
 - 0.067 acres, gravel drive
 - 0.090 acres, meadow, hydro A soils
 - 0.106 acres, grass, hydro A soils
 - Total Area = 0.695 acres
- Average Slope = 22.8 % +/-

- Pre-routed Total runoff volume from site (not including infiltration practice) = 0.051 acre-feet.
- As noted earlier, the dry swale is sized to infiltrate 0.008 acre-feet of water, therefore the estimated runoff from the post construction 25-year storm event for sub catchment no.1 is (0.051 acre-feet) – (0.008 acre-feet) = 0.043 acre-feet < 0.045 acre-feet.

Sub-Catchment No. 2: Discharge Point No. 2 – 18” Culvert and drainage swale to the Huntington River

The existing site drainage consists of mostly wooded areas located on both hydrologic A and C soils. The watershed also has existing impervious roadway and meadow areas. The upper wooded section is steeper (greater than 20%) and the meadow section is mostly less than 15%.

The proposed land cover in sub catchment no. 2 does not significantly change much from the current existing conditions. The existing roadway will be converted to a grassed cut area with some retaining walls in sections. There is a slight increase in impervious areas due to the new road being 4' +/- wider than the existing road.

The proposed stormwater management includes the construction of a dry swale with a forebay. This dry swale is designed to infiltrate 1.5 times water quality volume for the 1-inch rainstorm (0.046 ac-ft). This 0.046 ac-ft of available infiltration capacity reduces the direct runoff from the Q25 storm to below existing conditions.

The following are the inputs for both the pre and post models. The model uses TR-20 with the Lag/CN method which is the accepted modeling procedure of the State of Vermont’s Stormwater Management Division

Existing Conditions Sub-Catchment No. 2

- Land Cover
 - 0.842 acres, meadow, hydro A soils
 - 0.314 acres, meadow, hydro C soils
 - 0.792 acres, woods, hydro A soils
 - 1.209 acres, woods, hydro C soils
 - 0.191 acres, gravel drive
 - Total Area = 3.348 acres
- Average Slope = 27.3 % +/-
- Total runoff volume from 25-year storm = 0.261 acre-feet

Proposed Conditions Sub-Catchment No. 2

- Land Cover
 - 0.792 acres, woods, hydro A soils

- 1.025 acres, woods, hydro C soils
- 0.267 acres, gravel drive
- 0.678 acres, meadow, hydro A soils
- 0.211 acres, meadow, hydro C soils
- 0.263 acres, grass, hydro A soils
- 0.112 acres, grass, hydro C soil
- Total Area = 3.348 acres
- Average Slope = 26.4 % +/-
- Pre-routed Total runoff volume from site (not including infiltration practice) = 0.276 acre-feet.
- As noted earlier, the dry swale is sized to infiltrate 0.046 acre-feet of water, therefore the estimated runoff from the post construction 25-year storm event for sub catchment no.1 is $(0.276 \text{ acre-feet}) - (0.046 \text{ acre-feet}) = 0.230 \text{ acre-feet} < 0.261 \text{ acre-feet}$.

Sub-Catchment No. 3: Discharge Point No. 3 – Surface and groundwater in the Huntington River watershed

The existing site drainage consists of wooded and meadow areas located on hydrologic A and C soils. The watershed also has existing impervious roadway an old borrow pit area.

The proposed land cover in sub catchment no.3 does not significantly change much from the current existing conditions at the current time. A large cutoff channel will be constructed to direct flow away from the proposed drive and into the proposed dry swale and dry pond. The current system is sized to properly treat and attenuate flows for the next phase of the project, which means it is oversized for this proposed phase of development.

The proposed stormwater management includes the construction of a dry swale with a forebay. This dry swale is designed to infiltrate 0.10 acre-feet when the site is fully developed. The dry pond will be required for future development but is not needed at this time to meet the Town of Richmond stormwater regulations. This 0.10 acre-feet of available infiltration capacity reduces the direct runoff from the Q25 storm to below existing conditions.

The following are the inputs for both the pre and post models. The model uses TR-20 with the Lag/CN method which is the accepted modeling procedure of the State of Vermont's Stormwater Management Division

Existing Conditions Sub-Catchment No. 3

- Land Cover
 - 3.055 acres, woods, hydro A soils

- 0.134 acres, gravel drive
- 4.110 acres, meadow, hydro C soils
- Total Area = 7.299 acres
- Average Slope = 12.5% +/-
- Total runoff volume from 25-year storm = 0.567 acre-feet

Proposed Conditions Sub-Catchment No. 3

- Land Cover
 - 2.923 acres, woods, hydro A soils
 - 0.266 acres, gravel drive
 - 4.110 acres, meadow, hydro C soils
 - Total Area = 7.299 acres
- Average Slope = 12.9 % +/-
- Pre-routed Total runoff volume from site (not including infiltration practice) = 0.568 acre-feet.
- As noted earlier, the dry swale is sized to infiltrate 0.10 acre-feet of water, therefore the estimated runoff from the post construction 25-year storm event for Sub-Catchment No.3 is $(0.568 \text{ acre-feet}) - (0.10 \text{ acre-feet}) = 0.468 \text{ acre-feet} < 0.567 \text{ acre-feet}$.

Sub-Catchment No. 4: Discharge Point No. 4 – Unnamed tributary to the Huntington River

The existing site drainage consists of a meadow with a perimeter tree line. The entire meadow is located on hydrologic A soils. Although they are hydrologic A soils, the seasonal high-water table is within 24” of the ground surface.

The proposed land cover in sub-catchment no.3 will consist of an access drive, a house with an accessory building and a garage. The drainage will be directed as it currently does, towards the north to a bio-retention facility with a perforated underdrain. Water will be treated within the facility and will enter the perforated underdrain and discharge to daylight. The water will discharge at a rate that is less than the existing conditions rate for the 25-year rainstorm event.

The following are the inputs for both the pre and post models. The model uses TR-20 with the Lag/CN method which is the accepted modeling procedure of the State of Vermont’s Stormwater Management Division.

Existing Conditions Sub-Catchment No. 4

- Land Cover
 - 0.034 acres, woods, hydro A soils
 - 0.958 acres, meadow, hydro A soils

- Total Area = 0.992 acres
- Average Slope = 14.0% +/-
- Total runoff rate from 25-year storm = 0.05 cubic feet per second (cfs)

Proposed Conditions Sub-Catchment No. 4

- Land Cover
 - 0.034 acres, woods, hydro A soils
 - 0.717 acres, meadow, hydro A soils
 - 0.100 acres, grass, hydro A soils
 - 0.141 acres, Rooftop, access drive
 - Total Area = 0.992 acres
- Average Slope = 17.0 % +/-
- The pond release rate through the media and the perforated pipe is estimated at 0.04 cubic feet per second which is less than the existing conditions 0.05 cubic feet per second rate.

Culvert Sizing & Discussion

The roadway cross culverts are sized to convey the 25-year storm event without overtopping the road. The following is a summary of the calculated sizing.

Sub-Catchment No. 1

- Maximum Calculated Discharge Rate = 1.13 cfs
- Proposed 15" Culvert (Sta 0+50)
 - Slope = 0.006 ft/ft
 - Length = 35'
 - Barrel capacity = 6.02 cfs

Sub-Catchment No. 2

- Maximum Calculated Discharge Rate = 5.74 cfs
- Proposed 15" Culvert (Sta 1+75)
 - Slope = 0.017 ft/ft
 - Length = 30'
 - Barrel capacity = 10.95 cfs
- Proposed 15" Culvert (Sta 5+80)
 - Slope = 0.010 ft/ft
 - Length = 30'
 - Barrel capacity = 8.4 cfs

Sub-Catchment No. 3

- Maximum Calculated Discharge Rate = 9.33 cfs
- Proposed 24" Culvert (Sta 8+93)
 - Slope = 0.017 ft/ft

- Length = 30'
- Barrel capacity = 38.3 cfs

Steep Slopes

The project has some finish grade slopes that exceed 20%. These areas are minimal and are not long in length. The project is required to obtain a Construction General Permit (CGP) from the State of Vermont due to the amount of ground disturbance. The project is classified as a low-risk site and will need to adhere to the State of VT low-risk erosion control manual. It is important to note that all disturbed grass area over 20% will have Rollmax™ EroNet™ SC150® Erosion Control Blanket installed per manufacturers requirements. All channels over 5% grade will have either Type I or Type II stone fill and silt fence will be constructed throughout the site as needed and maintained as required by the CGP.

Please let me know if you have any questions or comments.

Sincerely,
Tailwater Engineering



Brad Washburn, P.E.
Owner