PROJECT IDENTIFICATION
TOWN OF BRIDGEWATER
COOKS CREEK ARBORETUM STREAMBANK STABILIZATION

Location Description
38.38646, -78.95052
Cooks Creek Arboretum on the western side of the Town of Bridgewater along Cooks Creek (**Figure 1**); arboretum is located within the floodplain and is designed to periodically flood.

Project Issue
Streambank erosion — Cooks Creek banks at the arboretum show some erosion that could benefit from stabilization; no acute bank failures or threats to infrastructure identified; arboretum is designed to be in the floodplain and the creek naturally overtops its banks during significant events; town staff described erosion as present but not acute.

Project Purpose
Stabilize eroding Cooks Creek banks at the arboretum using low-profile, naturalistic approaches consistent with the arboretum's floodplain character and aesthetic.

Identified Constraints
a. Current stormwater utilities present
b. Work should be carefully planned and executed in arboretum to protect vegetation
c. Arboretum trails
d. FEMA floodplain

Additional Information Needed
a. Evaluation of erosion extent and rate
b. Presence of utilities

Project Proposal and Planning-Level Cost Estimate
Portions of the streambank along Cooks Creek within the Arboretum have begun to degrade and erode, leading to steep slopes in certain areas (**Figure 2**). Left untreated, erosion of these banks could worsen, causing banks to fail and fall into the creek. This would potentially endanger infrastructure in the area and would send large amounts of sediment into Cooks Creek, leading to pollution and sedimentation downstream. There are some stormwater outfalls throughout the site (**Figure 1**) which may send water into the creek during floods with high energy and velocity, exacerbating erosion (**Figure 3**; **Figure 4**). The more severe problem area of the two is the stormwater ditch that leads into Cooks Creek on the south side of the Arboretum, near the parking lot (**Figure 3**). To address these concerns, the Town of Bridgewater could convert this ditch into

a regenerative stormwater conveyance (RSC) to both control erosion and generate sediment and nutrient reduction credits. RSCs are designed to convey and treat stormwater before entering the creek, through a sequence of riffles and shallow pools filled with a sand and wood chip filter media that dissipate energy and detain and infiltrate stormwater. The southern ditch is well-suited for an RSC, as the channel is partially pre-excavated due to the erosion, reducing the additional excavation needed to install the filter media and stone weirs. A step-pool channel would also work well in this location, though it would not provide nutrient reduction credits that the RSC generates by infiltrating and treating stormwater in the filter media. The second stormwater outfall (**Figure 4**) has been largely stabilized via riprap but could be evaluated in the future for conversion to an RSC should there be a desire to remove the existing riprap.

A streambank restoration project could be implemented for Cooks Creek, targeting the unstable banks that are found throughout the park. Given the generally low bank heights and mature trees in the vicinity, increased bank stability could be achieved with plantings of native live stakes and tubelings along the stream's bank and edge. Vegetation rooted into the exposed banks will provide stability to the soil and slow the velocity of water flowing through the channel. Native vegetation would also enhance the ecosystem at the Arboretum, providing habitat and food for wildlife. This would also improve aesthetics along the existing walking trail. The Town could implement more trails that allow access to and views of Cooks Creek at select locations along the proposed riparian enhancement. These improvements target bank instability along Cooks Creek, while also providing benefits for the ecosystem and enhancing recreational use of the Arboretum.



Figure 1. Site map of Cooks Creek Arboretum, noting important infrastructure within the property. Cooks Creek flows from north to south.



Figure 2. Steep, erodible bank of Cooks Creek with arboretum trail and grounds visible in background. Photograph taken facing north.



Figure 3. Erosion along stormwater channel leading to Cooks Creek (visible in background) on the south side of the Arboretum. Photograph was taken facing northwest.



Figure 4. Stormwater channel lined with riprap entering Cooks Creek toward the middle portion of the Arboretum. The channel drains a nearby subdivision on the Arboretum's western border.

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Phase 1: Stormwater Conveyance					**$396,357**
Survey and Design					**$50,000**
Construction Administration and Oversight					**$20,000**
Access and Erosion/Sediment Control					**$7,200**
Construction: Stormwater Conveyance					**$227,690**
Stakeout	1	LS	$10,000	$10,000	
As-Built Survey	1	LS	$10,000	$10,000	
Mobilization	1	LS	$20,000	$20,000	
Clearing	0.1	AC	$30,000	$3,000	
Grading	0.2	AC	$9,000	$1,800	
Excavation	800	CY	$20	$16,000	
Excess Haul Offsite	800	CY	$45	$36,000	
Class II Riprap	500	TON	$180	$90,000	
Geotextile Fabric	170	SY	$5	$850	
Filter Bed Media Sand	400	CY	$80	$32,000	
Filter Bed Media Wood Chips	100	CY	$60	$6,000	
Native Seed and Natural Fiber Matting	170	SY	$12	$2,040	
Phase 1 Contingency (30%)					**$91,467**

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Phase 2: Streambank Planting and Trail Construction					**$224,432**
Survey and Design					**$25,000**
Construction Administration and Oversight					**$20,000**
Trail Construction					**$32,100**
Temporary Construction Entrance	1	EA	$4,500	$4,500	
Super Silt Fence	200	LF	$9	$1,800	
Orange Safety Mesh	350	LF	$4	$1,400	
Trail Construction	100	SY	$84	$8,400	
Stakeout and As-Built	1	LS	$16,000	$16,000	
Planting					**$95,540**
Riparian Buffer Seed and Straw	1,900	SY	$3	$5,700	
Live Stakes	2,800	EA	$10	$28,000	
Tubelings	7,730	EA	$8	$61,840	
Phase 2 Contingency (30%)					**$51,792**
TOTAL ESTIMATED BUDGET					**$620,789**

The table above provides separate estimated budgets for the stormwater conveyance as Phase 1 and the streambank plantings for Cooks Creek as Phase 2. Phase 1 includes design and installation of a regenerative stormwater conveyance channel to repair the current erosion and generate nutrient reduction credits for the MS4 program. Phase 2 includes plantings along approximately 1,400 linear feet of Cooks Creek through the Arboretum as well as approximately 150 feet of additional gravel trail to maintain access to the stream. This streambank stabilization could also generate nutrient credits, dependent upon the results of a bank stability analysis, which would be part of the design efforts. These phases do not have to be approached in this order, however – i.e., the plantings along Cooks Creek could be accomplished regardless of the stormwater conveyance work. Additionally, some savings may be achieved by approaching the two tasks as one, in mobilization, survey, and design efforts could be combined.

Possible Alternatives and Additional Considerations

Currently, there is no plan to address the northern outfall (**Figure 1**, **Figure 4**). The riprap lining this stormwater ditch seems to be intact, with little noticeable erosion along the stormwater conveyance itself. There is a steep drop in elevation between the stormwater channel and Cooks Creek along the bank; this area could eventually deteriorate and lead to bank destabilization, requiring a more robust design like a step-pool or regenerative stormwater channel. These two stormwater conveyances could also be converted into more natural channels, installing step-pool sequences and planting with vegetation.

Bank stabilization plantings were recommended rather than a full stream restoration to minimize grading and overall disturbance to the Arboretum. Further downstream, the banks of Cooks Creek were visibly steep, bare, and eroding, presenting an opportunity to extend the project bounds downstream if the adjacent landowner is amenable.

TMDL/MS4 Considerations

The Town of Bridgewater is an MS4 locality. The Town is located within the North River watershed, with portions of the Town draining first into Dry River or Cooks Creek (tributaries of North River). Cooks Creek has an approved TMDL for sediment and phosphorus. Addressing the stormwater outlets along the creek and implementing a stream restoration project would provide sediment and nutrient credits the Town of Bridgewater could use toward the TMDL reductions and MS4 permitting needs.

Assumptions

Watershed (via StreamStats 8/20/2026) is 20.8 square miles, taken from the project coordinates
1400 linear feet of Cooks Creek assumed to receive riparian plantings with 150 feet of trails added.
RSC channel assumed 150 feet long and 30 feet wide.

Recommended Next Steps

Assess the need for additional nutrient reduction credits to achieve MS4 permit requirements.

References

JMU and EEE Consulting. 2019. Revision of the Benthic Total Maximum Daily Load (TMDL) Developed for the Blacks Run and Cooks Creek Watershed Located in the City of Harrisonburg and Rockingham County.

USGS. StreamStats v4.33.0. Accessed online 20 August 2026.

Virginia Tech Department of Biological Systems Engineering. 2006. Bacteria Total Maximum Daily Load Development for North River.

PROJECT IDENTIFICATION

TOWN OF BRIDGEWATER

CANNERY WOODS AND DRY RIVER ROAD STORMWATER DETENTION AND DRAINAGE CAPACITY

Location Description

38.39946, -78.96689

Cannery Woods subdivision draining southward toward Dry River Road in the northern portion of town (**Figure 1**); three homes at the base of the drainage slope are the primary affected properties; Dry River Road frontage and the Millview neighborhood at the corner are downstream receiving areas; town/county boundary runs through some affected backyards.

Project Issue

Stormwater capacity exceedance during extreme rain events — existing pipe system conveying flow west down the hill along Cannery Woods Drive cannot handle runoff from extreme storms; three homes experienced backyard flooding during event in prior year was approximately a 1000-year storm (~6 inches of rain in one hour, July 15, 2025).

Project Purpose

Assess the stormwater drainage capacity in the Cannery Woods / Dry River Road corridor to reduce backyard flooding.

Identified Constraints

a. Contributing drainage from both Town and County
b. Existing infrastructure/utilities

Additional Information Needed

a. Results of preliminary assessment
b. Current stormwater infrastructure capacity
c. Location and path of existing stormwater conveyances
d. Existing drainage easements

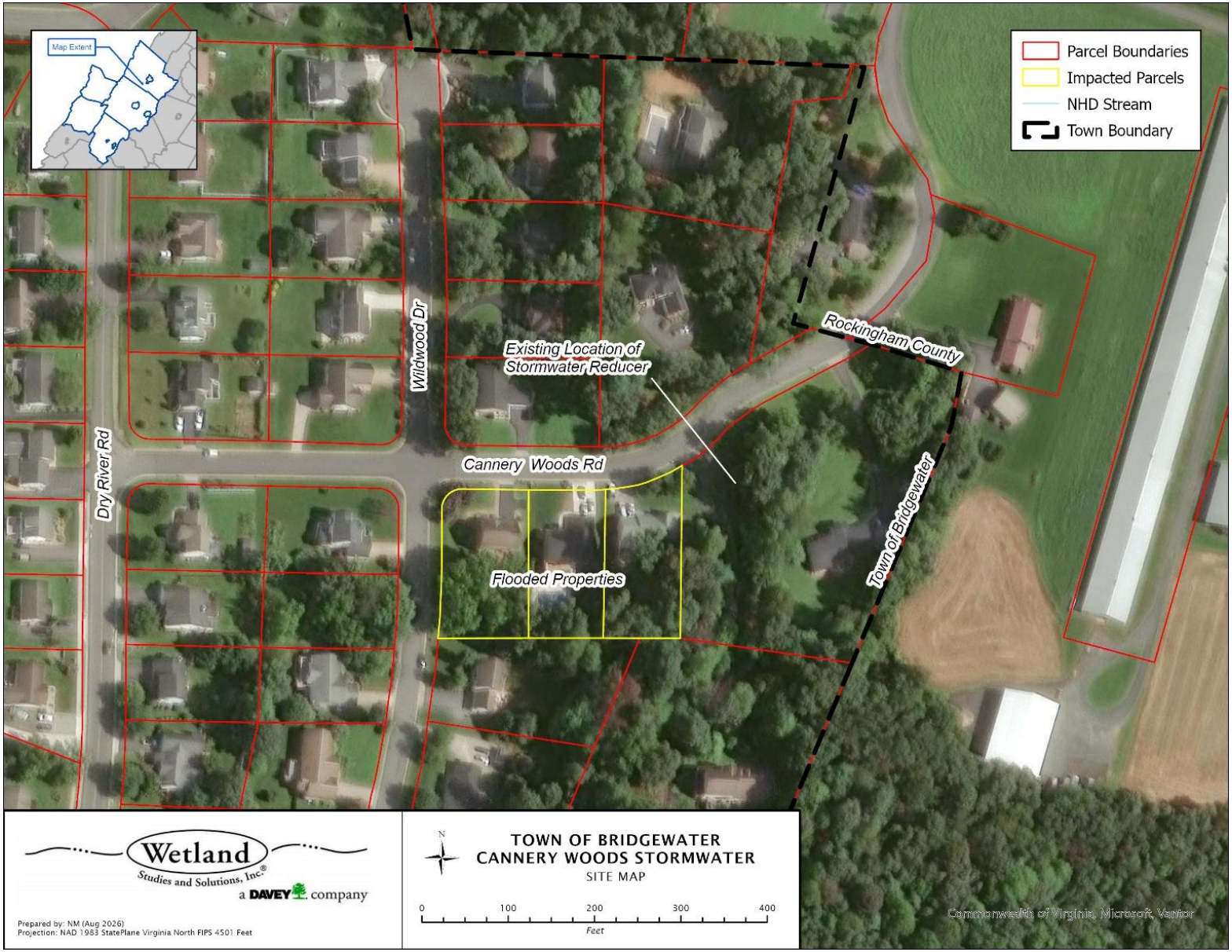

Figure 1. Site map for the Cannery Woods subdivision with previously flooded parcels and nearby stormwater infrastructure noted.

Project Proposal and Planning-Level Cost Estimate

To properly address flooding concerns in the Cannery Woods subdivision, it is recommended that the Town first completes the preliminary engineering report (PER) on the area. This report is currently in progress and would aid in understanding the current stormwater capacity and next steps to address the flood concerns in this neighborhood. Should the report deem infrastructure improvements necessary, the Town could retrofit the existing stormwater infrastructure to convey a greater volume of floodwater. Currently, there is a reducer on the stormwater inlet capturing drainage above the affected properties (**Figure 2**). The infrastructure in that location is likely where floodwater began to back up and flow into neighboring yards. This should be verified by the PER. Depending on the findings of the studies and engineering report, pipes and inlets in this area could be resized to prevent backwatering and flooding. The report might also find that the system is currently functioning correctly for the designed storm and that the storm that flooded this area was an isolated event beyond a reasonably high design capacity.



Figure 2. Stormwater reducer that previously backed up leading to flooding in the area.

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Survey and Study					**$75,000.00**
Existing Conditions Survey	1	LS	$25,000.00	$25,000.00	
H&H Study, PER	1	LS	$50,000.00	$50,000.00	
Contingency (30%)					**$22,500.00**
TOTAL ESTIMATED BUDGET					**$97,500.00**

The table above presents estimated costs for completing a survey, H&H study, and PER to quantify and describe the capacity of the existing system and any proposed changes. Depending on the extent and status of the PER noted as in progress by Town staff, there could be significant cost savings. Estimation of costs associated with construction-phase efforts will require additional study and scoping.

Possible Alternatives and Additional Considerations

Dependent on the results of the PER, it's possible the site could benefit from retrofitting the current basin around the stormwater reducer to either expand the detention pond or incorporate a bioretention cell to store the excess water as it enters the stormwater inlet. Similarly, the installation of a detention or infiltration practice elsewhere could be explored and at least one nearby landowner has responded positively to such an installation on their property. A detention pond would only decrease the peak flow, while a bioretention cell would attenuate the flood peak while increasing infiltration and filtering certain pollutants. Either of these designs could be implemented along with improvements to the existing stormwater infrastructure. Additionally, the Town could incentivize upstream residents to implement structures like rain gardens or rain barrels to capture rainfall from these severe storm events, decreasing the amount of runoff travelling downhill.

TMDL/MS4 Considerations

The Town of Bridgewater is an MS4 locality. The Cannery Woods neighborhood drains into Dry River (a tributary of North River), which has an approved TMDL for total fecal coliform. The work suggested in this document would not assist in the removal or treatment of pollutants before entering into Dry River, so there are few TMDL or MS4 benefits to this project.

Assumptions

Watershed (via StreamStats 8/18/2026) is approximately 12 acres, funneling into the backyards of properties on Cannery Woods Drive.

Recommended Next Steps

Revisit the PER noted as in-progress to determine needs to complete this effort and whether additional data collection is necessary.

References

USGS. StreamStats v4.33.0. Accessed online 18 August 2026.

Virginia Tech Department of Biological Systems Engineering. 2001. Fecal Coliform TMDL for Dry River, Rockingham County, Virginia.

Virginia Tech Department of Biological Systems Engineering. 2006. Bacteria Total Maximum Daily Load Development for North River.

PROJECT IDENTIFICATION

TOWN OF BRIDGEWATER

FOUNTAINHEAD SUBDIVISION STORMWATER SYSTEM REHABILITATION — BRIAN LANE, CINDIE LANE, AND STEPHEN CIRCLE

Location Description

38.38387, -78.9647

Fountainhead subdivision, Town of Bridgewater; three residential streets — Brian Lane, Cindie Lane, and Stephen Circle have inadequate stormwater infrastructure; drains generally southward.

Project Issue

Localized flooding from stormwater: inadequate stormwater infrastructure in a 1970s subdivision (Brian Lane, Cindie Lane, and Stephen Circle) of approximately 50–60 residents. The system is undersized for the drainage area and cannot handle significant rain events without overflowing into streets. Street flooding noted by Town staff occurs regularly, not only during extreme storms. Aging water and sewer lines in the same corridor create a compounding multi-infrastructure deficiency. CDBG planning grant (completed with CSPDC) has produced a design basis for combined water, sewer, and stormwater improvements.

Project Purpose

Rehabilitate the stormwater system throughout Fountainhead subdivision to eliminate recurring street flooding, coordinated with water and sewer improvements under the existing CDBG planning framework.

Identified Constraints

a. Existing infrastructure and property boundaries
b. Existing design for water, sewer, and stormwater improvements
c. Existing easements or attainment of landowner agreements

Additional Information Needed

a. Existing stormwater infrastructure details and capacity
b. Stormwater easement locations
c. Existing construction design and schedule

Project Proposal and Planning-Level Cost Estimate

Efforts are currently underway to address the flooding concerns along Stephen Circle, Brian Lane, and Cindie Lane. Work is under design to rework ditches and replace and add culverts to increase stormwater conveyance within the community. Depending on the stage of design and implementation, there are additional stormwater improvements that could be included to further

handle floodwater during these storms. One such improvement is a vegetated dry swale. This BMP could be installed on the boundary of two properties on Brian Lane or Stephen Circle; two potential locations are noted in **Figure 1**. Currently, it appears that there is a drop inlet at the end of Stephen Circle (**Figure 2**) that conveys stormwater to the concrete ditch behind the community. At the end of Brian Lane, there is a set of culverts for stormwater (**Figure 3**). Grassed swales in either of these two locations could tie into existing infrastructure, with the potential need for retrofitting inlets or conveyances. The addition of a swale into the designs could slow the flow of water and attenuate the flood peak before entering the stormwater infrastructure. Implementation and construction of this feature would depend on the stage of the current designed improvements, the possibility to modify these plans, and the status of funding for these water and sewer improvements. Presuming the schedule and funding aligns with the ongoing effort, a swale would be a helpful feature to improve flood resilience within and downstream of the Fountainhead subdivision.



Figure 1. Fountainhead subdivision map, marking two potential locations for a vegetated swale.



Figure 2. Drop inlet at the end of Stephen Circle (partially obscured by shrub), presumed to convey flow to the concrete ditch pictured in the background. Photograph was taken facing southwest.



Figure 3. Culverts at the end of Brian Lane conveying flow from Cindie Lane (visible in background). Photograph taken facing southeast.

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Dry Swale Design					**$25,000**
Construction Administration and Oversight					**$8,000**
Construction Access and ESC					**$8,400**
Dry Swale Construction					**$157,450**
As-Built Survey	1	LS	$10,000	$10,000	
Mobilization	1	LS	$8,000	$8,000	
Excavation and Hauling	380	CY	$65	$24,700	
Vegetated Swale	380	CY	$300	$114,000	
Permanent Seeding and Straw	250	SY	$3	$750	
Contingency (30%)					**$59,655**
TOTAL ESTIMATED BUDGET					**$258,505**

The table above presents estimated costs for the design and installation of two dry swales. Additional survey is not accounted for prior to design, as the ongoing design work for the water and sewer updates are assumed to have adequate survey data which could be re-used here as a cost savings.

Possible Alternatives and Additional Considerations

There are some additional measures that residents within the Fountainhead community could take to increase resilience in this area. Residents in the area could be encouraged to install residential-scale stormwater management practices to promote infiltration and enhance flood reduction efforts. One such practice would include the installation of rain gardens throughout the community, which are shallow vegetated depressions. These structures are built to catch and absorb runoff and rainfall, recharging groundwater in the process. Community members could also install rain barrels and other infrastructure to collect rainfall from roofs and other impervious surfaces. These residential projects could utilize the Virginia Conservation Assistance Program (VCAP) funding which is administered by the Shenandoah Valley Soil and Water Conservation District (SVSWCD). Though installation of an individual residential-scale BMP is unlikely to significantly affect system performance, if implemented at a broader scale the cumulative impact may achieve notable enhancement.

<u>TMDL/MS4 Considerations</u>

The Town of Bridgewater holds an MS4 permit. The Town is located within the North River watershed, with portions of the Town draining first into Dry River. These two rivers have approved TMDLs for total fecal coliform. The current designs for ditch and culvert improvements in the Fountainhead subdivision would likely not work to address the pollutant concerns in the TMDLs.

The dry swale BMP does provide some volume and nutrient reductions and could be considered targeting bacteria given the infiltration aspect of dry swale design.

Assumptions

Watershed (via StreamStats 8/18/2026) is 0.34 square miles, taken south of Meadow Lane.
An estimated 95 linear foot and 15 ft wide vegetated swale at the end of Stephen Circle and a 75 linear foot and 12 ft wide swale on Brian Lane budgeted. Savings assumed in survey and design given the existing design work which should provide the necessary information to inform dry swale sizing and design.

Recommended Next Steps

Evaluate the current status of the planned water and sewer updates in the neighborhood and whether the addition of the dry swales could be reasonably incorporated.

References

USGS. StreamStats v4.33.0. Accessed online 18 August 2026.
Virginia Tech Department of Biological Systems Engineering. 2001. Fecal Coliform TMDL for Dry River, Rockingham County, Virginia.
Virginia Tech Department of Biological Systems Engineering. 2006. Bacteria Total Maximum Daily Load Development for North River.

PROJECT IDENTIFICATION

TOWN OF BRIDGEWATER

NORTH MAIN STREET STORMWATER DRAINAGE CAPACITY IMPROVEMENTS — GREEN STREET TO DEPOT STREET

Location Description

38.3853, -78.9725

North Main Street corridor from approximately Green Street (southern boundary) to Depot Street (northern boundary, near the grocery store); primary commercial street in the town center.

Project Issue

Stormwater drainage capacity — during intense storm events the existing infrastructure along North Main Street (**Figure 1**) cannot convey runoff adequately, causing significant temporary street pooling on both sides of the road. Ponding dissipates within approximately 30 minutes but represents a recurring capacity shortfall and safety concern on a primary commercial corridor.

Project Purpose

Improve stormwater drainage capacity along North Main Street to reduce temporary street flooding during intense rain events on the town's primary commercial corridor.

Identified Constraints

a. Underground utilities
b. Collaboration with VDOT
c. Proximity of buildings to the road

Additional Information Needed

a. Existing stormwater capacity
b. Location of Utilities
c. Presence of easements

Project Proposal and Planning-Level Cost Estimate

In order to properly identify and address the flooding issues along North Main Street, an H&H study should be completed, followed by a preliminary engineering report (PER). These will identify the exact deficiencies and limitations within the current stormwater system and propose projects that address the exact issue.



Figure 1. Site map for the North Main Street corridor showing notable streets and curb inlet locations.

One known constraint within the system is the capacity of curb inlets. North Main Street has been repaved and refinished since the curb inlets have been installed; however, the road has not been milled down during these improvements. Thus, the inlets have been partially blocked with pavement over time, potentially serving as a source of restriction and flooding along the roadway (**Figure 2**). If the results of the H&H study indicate that the stormwater system would have adequate capacity if the inlets were appropriately clear, the solution becomes repaving rather than retrofitting/expanding an existing stormwater system. This road and drainage infrastructure is maintained and owned by VDOT, so this project would require extensive coordination with the state agency whether the final solution is repaving, expanding the stormwater network, or some combination.



Figure 2. Constricted curb inlet along N Main Street (Google, n.d.).

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Local Stormwater Study					**$98,000.00**
Survey and Assessment	1	LS	$18,000.00	$18,000.00	
H&H Study	1	LS	$35,000.00	$35,000.00	
PER	1	LS	$45,000.00	$45,000.00	
Contingency (30%)					**$29,400.00**
TOTAL ESTIMATED BUDGET					**$127,400.00**

Estimation of costs associated with construction-phase efforts will require additional study and scoping.

Possible Alternatives and Additional Considerations

Alternative designs would largely depend on the results of the H&H study and preliminary engineering report. These reports might find that other infrastructure in the system is undersized, requiring replacement. This might involve resizing or adding curb inlets, installing larger storm sewer piping or adjusting the outlet structures. There is a notable lack of curb inlets along North Main Street between the Mount Crawford Avenue and Virginia Avenue intersections (**Figure 1**). This is approximately 750 feet of road without a stormwater inlet, which may be insufficient to properly convey floodwater, though the topography is steeper in this section than along the block from Mount Crawford Avenue to Depot Street.

The Town has begun the use of permeable pavers in certain areas to replace the impervious surfaces. This has been implemented in nearby areas, at an intersection on Green Street. These pavers could be installed in additional areas that are susceptible to the highest severity of flooding, allowing water to infiltrate rapidly.

TMDL/MS4 Considerations

The Town of Bridgewater holds an MS4 permit. The Town is located within the North River watershed, with portions of the Town draining first into Dry River (a tributary of North River). These two rivers have approved TMDLs for total fecal coliform. Improvements to the road and stormwater infrastructure along North Main Street would not work to remove bacteria or achieve goals regarding the MS4 permit.

Assumptions

Watershed (via StreamStats 8/19/2026) is 0.68 square miles, taken on N Main St between Green St and Dinkel Ave.

Recommended Next Steps

Begin outreach to VDOT regarding scheduled repavement efforts that could incorporate milling the road surface back to the elevation for which curb inlets were designed.

References

Google. (n.d.). [*Curb inlet on North Main Street, Bridgewater, Virginia*] [Street View]. Google Maps. Retrieved August 19, 2026.

USGS. StreamStats v4.33.0. Accessed online 19 August 2026.

Virginia Tech Department of Biological Systems Engineering. 2001. Fecal Coliform TMDL for Dry River, Rockingham County, Virginia.

Virginia Tech Department of Biological Systems Engineering. 2006. Bacteria Total Maximum Daily Load Development for North River.

PROJECT IDENTIFICATION

TOWN OF BRIDGEWATER

NORTH RIVER CORRIDOR BANK STABILIZATION AND RIPARIAN ASSESSMENT — WILDWOOD PARK TO SANDY BOTTOM PARK

Location Description

38.3788384, -78.9763272

North River corridor along the southwestern edge of the Town of Bridgewater (**Figure 1**).

Project Issue

Stream bank erosion and riparian stabilization needs — periodic high-water events stress the riverbanks along the corridor where the Town has been strategically acquiring property and chaining together a string of parks and trails to enhance recreational use of the riparian area in lieu of development that would be severely impacted by flood events. No acute erosion failures identified thus far; Town staff noted "a little bit of bank erosion" without specific acute failure points. Primary concern is whether erosion is progressively reducing the riparian buffer's effectiveness or threatening park infrastructure rather than flooding per se, as the park corridor is designed to flood.

Project Purpose

Assess whether bank erosion is actively threatening park infrastructure or reducing riparian buffer effectiveness along the North River corridor; identify specific locations warranting stabilization investment.

Identified Constraints

a. Presence of utilities and infrastructure
b. Park activities
c. Easements and/or possibility of acquisition

Additional Information Needed

a. Erosion extent, rate, and location
b. Location of utilities

Project Proposal and Planning-Level Cost Estimate

The Town of Bridgewater has identified that erosion along the North River may require stabilization in certain areas to ensure stability of the riparian buffer. Currently, a study is needed to identify the exact locations of severe erosion along the river from Wildwood Park to Sandy Bottom Park, the extent of bank erosion, and the rate of bank retreat. This would allow for a more accurate scope of work and a better allocation of resources to address these issues.

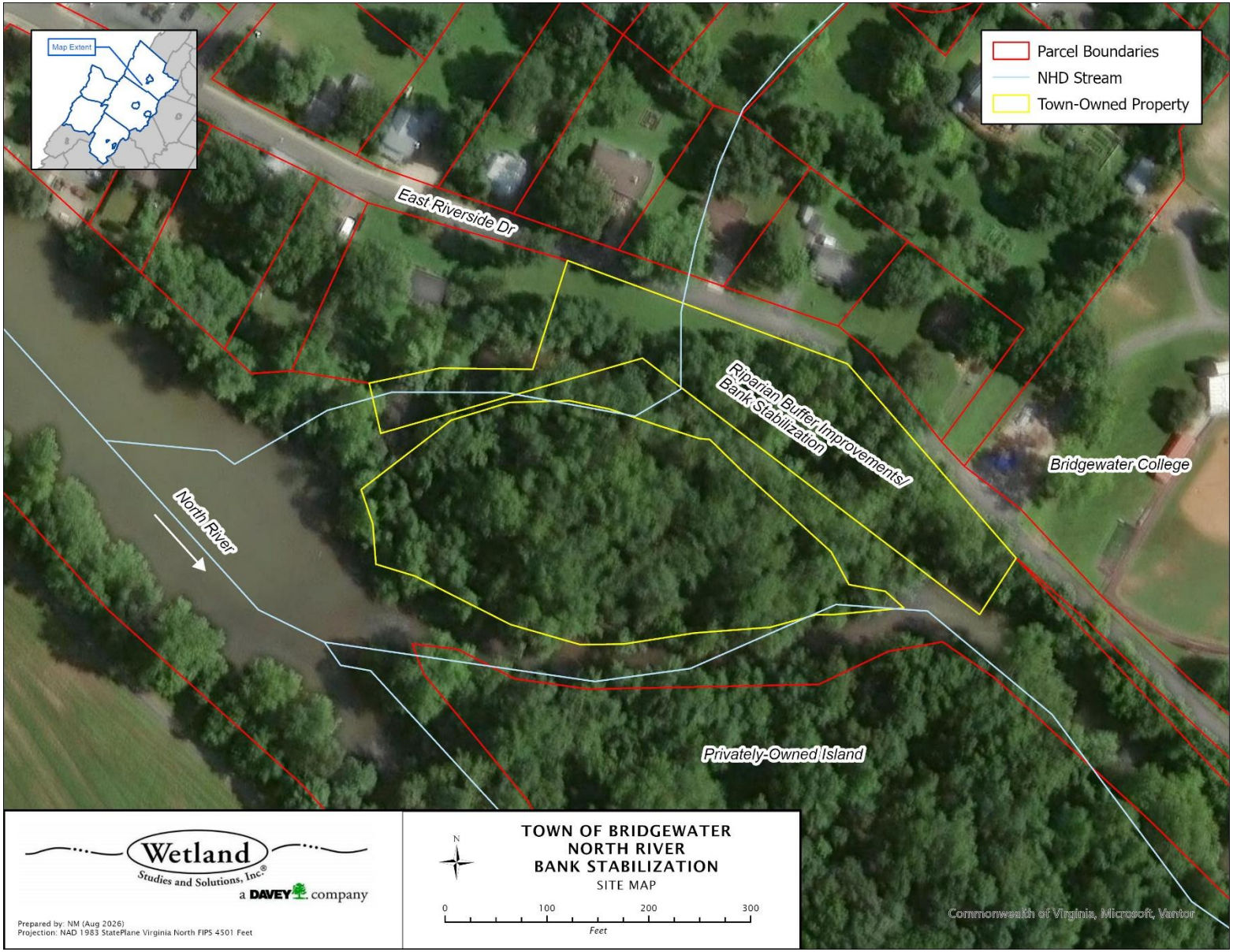

Figure 1. Site map for the identified bank stabilization project along the North River. Flow is from west to east.

There is one particular location that has been noted along East Riverside Drive that likely requires attention (**Figure 1**). The North River in this area is very close to the roadway. In its current state, there is a narrow riparian buffer between the North River and East Riverside Drive, less than 50 feet wide (**Figure 2**, **Figure 3**). The site needs to be closely assessed to determine if future floods and high flows could potentially lead to undercuts and instability of the roadway and nearby infrastructure.



Figure 2. Existing riparian buffer along the North River adjacent to East Riverside Drive, river immediately to right. Photograph taken facing southeast.

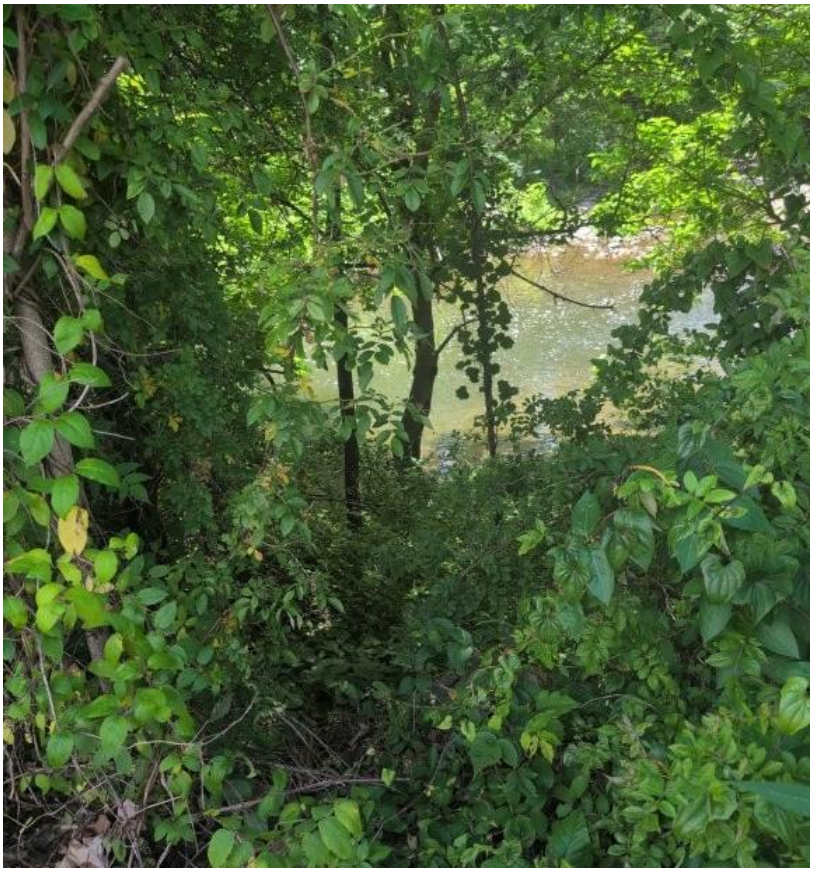

Figure 3. Riparian buffer and vegetated area between the North River and East Riverside Drive. Photograph taken facing southwest from the shoulder of East Riverside Drive with no zoom to show proximity of river.

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Stream Assessment					**$75,000**
Stream Channel Condition Assessment	1	LS	$45,000	$45,000	
Preliminary Engineering Report	1	LS	$30,000	$30,000	
Contingency (30%)					**$22,500**
TOTAL ESTIMATED BUDGET					**$97,500**

The table above presents estimated costs for performing a stream channel condition assessment, including bank erosion hazard indices, and a subsequent report. Estimation of costs associated with construction-phase efforts will require additional study and scoping.

Possible Alternatives and Additional Considerations

This location is already being evaluated for connection to the Riverwalk and the nearby 7 Bridges and Edgebrier Parks, enhancing the park system in the Town. A park in this area could also connect to the nearby island in the North River owned by the Town of Bridgewater. At a minimum, additional riparian plantings would further protect the river banks from potential erosion. Plantings

could be implemented in the short term, but if there is a possibility that earthwork or stone installation is warranted/possible that should impact timing so that plantings aren't established only to be ripped out a few years later. Hard stabilization measures, such as a stone toe to protect the bank or a vane structure to encourage flow away from the bank could be constructed. The corridor is likely too narrow along East Riverside Drive to grade the bank to reduce steepness in the area of highest concern, but may be plausible in the adjacent stretches.

TMDL/MS4 Considerations

The Town of Bridgewater is an MS4 locality, one of the smaller localities that holds an MS4 permit. This site is located adjacent to the North River, which had an approved TMDL to address total fecal coliform. Stabilizing the banks along North River would not provide any bacteria reduction benefits, but if erosion is reduced credits toward sediment and nutrient reduction for the Chesapeake Bay TMDL could be achieved.

Assumptions

Watershed of the North River (via StreamStats 8/19/2026) is 296 square miles at the location of concern. Approximately 7,200 linear feet of stream assessment included in estimated budget.

Recommended Next Steps

Begin outreach with appropriate landowners regarding site access to perform a stream assessment.

References

USGS. StreamStats v4.33.0. Accessed online 19 August 2026.

Virginia Tech Department of Biological Systems Engineering. 2001. Fecal Coliform TMDL for Dry River, Rockingham County, Virginia.

Virginia Tech Department of Biological Systems Engineering. 2006. Bacteria Total Maximum Daily Load Development for North River.