PROJECT IDENTIFICATION

TOWN OF BROADWAY

HERITAGE PARK PEDESTRIAN BRIDGE DEBRIS CAPTURE AND PARK FLOODING

Location Description

38.61411, -78.80042

Pedestrian walking bridge spanning Linville Creek within Heritage Park (**Figure 1**), north of Turner Avenue; distinct from the Turner Avenue roadway bridge immediately to the south.

Project Issue

Debris capture and backwater flooding — bridge has structural members below deck level that Town staff note catch floating debris during high-water events with accumulated debris noted to act as a dam (**Figure 2**), backing up Linville Creek and flooding the entire Heritage Park. Past flooding has damaged park infrastructure and required relocation of park equipment.

Project Purpose

Assess recurring debris capture and flooding of Heritage Park and evaluate replacing the pedestrian bridge with a clear-span structure designed to pass debris and high-water flows.

Identified Constraints

Site in regulatory floodway

Additional Information Needed

Design calculations for current bridge design.

Project Proposal and Planning-Level Cost Estimate

An evaluation should first be completed to determine whether the elevation of the bridge members may be causing debris capture and increasing flooding or if it is simply capturing debris incidentally at the same flood stage as general inundation of the floodplain occurs. Detailed modeling of the existing bridge would establish correlation vs. causation, and provide a basis for modeling any proposed future bridge design. Unless the bridge is nearing the end of its lifespan, the expense of replacing it should not be undertaken without confirming need. Should the current pedestrian bridge (**Figure 1**) warrant replacement, a structure designed higher and/or with a slimmer deck and similar or less intrusive piling locations would reduce the occurrence of debris buildup at this Linville Creek crossing. There is currently a stone cross vane maintaining the direction of flow centered on the bridge, which should be maintained in any bridge re-design.



Figure 1. Heritage Park pedestrian bridge across Linville Creek, photo taken facing north (downstream). Stone cross vane structure upstream of bridge partially visible in center of photo.



Figure 2. Photo of debris accumulation at bridge in Heritage Park following a flood event, provided by Town.



Figure 3. Photo of flooding in Heritage Park and debris accumulation at bridge provided by Town. Flood waters appear visible in foreground as well as behind (downstream of) the bridge.

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Survey and Design					**$73,000**
Construction Administration and Oversight					**$20,000**
Access and ESC					**$15,500**
Construction					**$381,700**
Stakeout and As-Built	1	LS	$30,000	$30,000	
Mobilization	1	LS	$19,000	$19,000	
Grading	0.3	AC	$9,000	$2,700	
Bridge Structure	120	LF	$2,500	$300,000	
Asphalt Trail Repair	3,000	SQ FT	$10	$30,000	
Contingency (30%)					**$147,060**
TOTAL ESTIMATED BUDGET					**$637,260**

The table above presents estimated costs for survey and design, inclusive of a floodplain analysis supporting a no-rise certification, and construction/installation of a new bridge structure to replace the current one. A set-aside for trail repair is included to cover repaving areas currently impacted

by tree roots in the vicinity as well as potential damage due to heavy equipment movement during bridge work.

Possible Alternatives and Additional Considerations

The bottom of the existing bridge deck is approximately even with the surrounding floodplain elevation, putting the flood level to inundate the bridge very near the overall floodplain inundation level (**Figure 3**). It is possible that the impact of debris buildup along the bridge deck, while contributing to flooding upstream in the park, may not be a significant precursor to flooding. This section of Linville Creek is within the FEMA designated floodway, so an analysis of the bridge and its impacts on flood events should have been completed as part of the original design. The results of this study could be reviewed to determine if the bridge was installed to design and to what extent debris buildup was a factor in design. Some amount of woody debris is expected to be present and is beneficial habitat in a natural system like Linville Creek, so there will always be some periodic amount of maintenance related to debris removal (**Figure 2**). The balance of maintenance costs of keeping the bridge as it is currently compared to the cost of design and installation of a replacement should be weighed prior to allocating funding.

Given the number of potential projects identified along the Linville Creek corridor, potential cost savings could be realized by creating one hydraulic model encompassing the whole reach. This would ease assessing the impact of individual projects or proposals on the surrounding area.

TMDL/MS4 Considerations

Linville Creek has an approved TMDL and Implementation Plan (IP) for sediment to address a benthic impairment. The watershed drains to the North Fork of the Shenandoah River, which also has a benthic impairment, but no benthic stressor analysis or TMDL has been completed to positively identify pollutants of concern (as of 2026). While Broadway is not an MS4 permittee, Rockingham County became an MS4 permittee in 2025. Unless the scope of work changes, however, a bridge replacement that does not impact bank erosion is unlikely to generate any sediment credits towards MS4 permit goals.

Assumptions

Watershed (via StreamStats 8/5/2026) is 45.7 sq miles (29,228 acres).

Recommended Next Steps

Evaluate the age and condition of the current bridge and obtain and review flood analysis developed in design of existing bridge.

References

USGS. StreamStats v4.33.0. Accessed online 5 August 2026.

PROJECT IDENTIFICATION
TOWN OF BROADWAY
LINVILLE CREEK BANK STABILIZATION

Location Description
38.611806, -78.800889
Linville Creek corridor from Turner Avenue southward through the Heritage Park expansion area and toward the Lions Club / Summit Park area. The priority segment is entirely on town-owned property. The creek continues northward through a separate segment between Turner Avenue and W Lee Street, where up to six private property owners border the creek — this northern segment is lower priority at this time due to the access and ROW constraints involved.

Project Issue
Stream bank erosion and channel sediment accumulation. Linville Creek is actively eroding its banks along this corridor, undermining adjacent sewer infrastructure. An existing sewer line running parallel to the creek on the north segment has already partially collapsed into the channel and been replaced (2019); the remaining exposed section of that line is being relocated approximately 20–30 feet back from the bank as a current capital project. The old collapsed concrete pipe remains in the creek bed and cannot be removed — it will provide some incidental structural support but is not a long-term solution. Sediment is also visibly accumulating in the channel from the south.

Project Purpose
Stabilize Linville Creek banks and protect existing infrastructure.

Identified Constraints
a. Active Norfolk Southern Railroad parallel to stream channel – railroad embankment is the stream bank in sections
b. Probability of land acquisition and/or easements necessary for downstream segment (north of Turner Ave)

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

Project Proposal and Planning-Level Cost Estimate
Linville Creek south of Turner Avenue (upstream) has nearly vertical, eroded banks averaging approximately 6 ft in height along the Town-owned parcel slated for the future Lions Club park (**Figure 1**, **Figure 2**). There is a narrow strip of riparian vegetation remaining on the western bank

that is only sporadically present on the eastern bank where the channel is bound by the railroad. A natural channel restoration in this approximately 500 ft stretch would re-establish a low flow channel and inset floodplain with native riparian vegetation. The ability of flood water to be slowed and absorbed by the vegetation of the inset floodplain bench would reduce further erosion that has endangered utilities. Establishing a primary low-flow channel will mitigate observed sediment deposition at the Turner Avenue bridge (**Figure 3**). Ideally, this work would be concurrent with efforts to relocate the existing sewer line that is fully exposed crossing the stream (**Figure 4**) and would be incorporated into the planning stages of the proposed Lions Club Park. To further increase flood protection, establishment of native riparian vegetation along the northern (downstream) section of Linville Creek along Heritage Park could be included as part of this project. Establishing native vegetation on the currently turfgrass-covered floodplain bench and bank (**Figure 5**) would increase infiltration capacity, reduce flood water velocity, and shade the stream to enhance habitat and recreation along the approximately 750 ft channel section. As both sections align with existing or proposed public parks, maintaining access to the stream in controlled locations within the native plantings should be included in the plan.



Figure 1. Map of Linville Creek in the proximity of Turner Avenue.



Figure 2. Photo of Linville Creek south of Turner Avenue, along site of future Lions Club Park. Photo taken facing south. Railroad tracks on far side of Creek obscured by trees in the foreground.

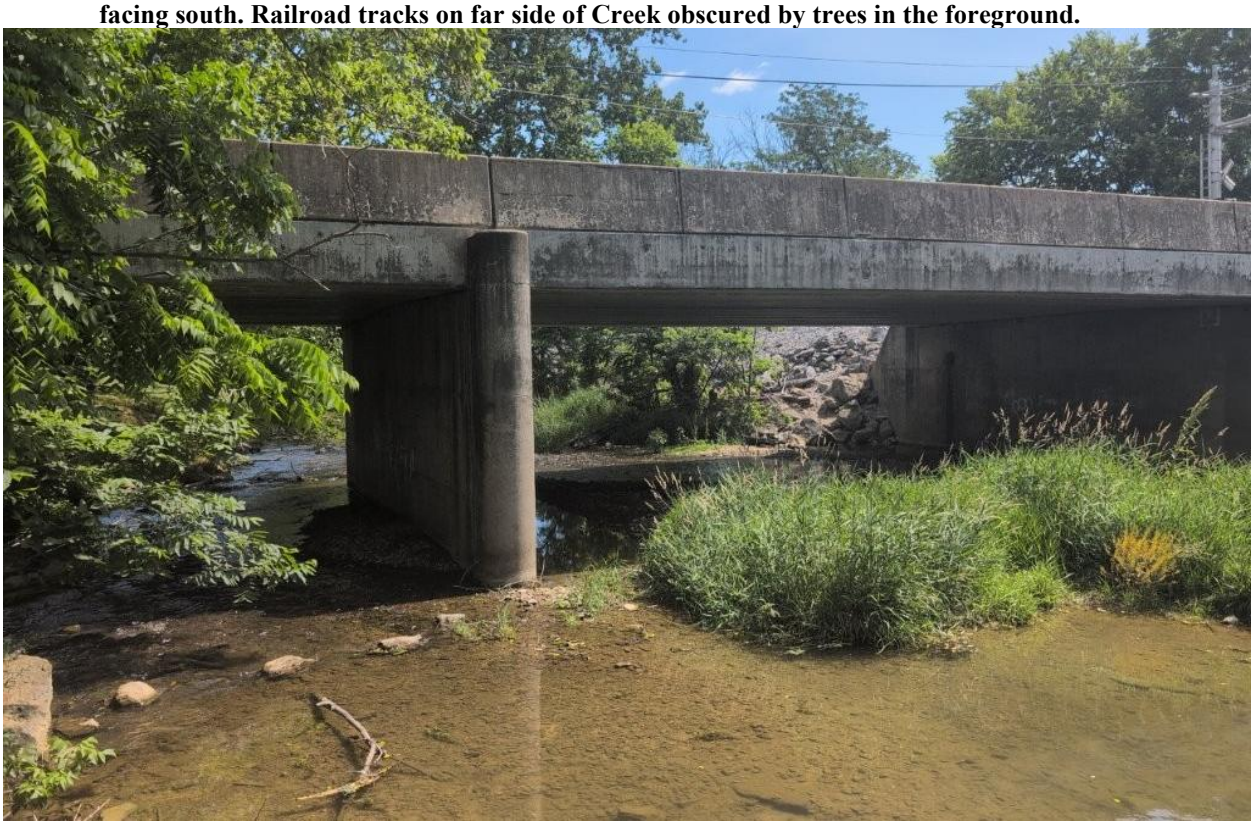


Figure 3. Photo of Turner Avenue bridge crossing Linville Creek, taken facing north. Note deposition harboring vegetative growth in center of Creek.



Figure 4. Sewer line crossing Linville Creek just upstream of Turner Avenue bridge. Photo taken from bridge facing south.



Figure 5. Photo of Linville Creek along Heritage Park (walking trail visible to left), taken facing north.

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Survey and Design					**$70,500**
Construction Administration and Oversight					**$15,000**
Access and ESC					**$22,200**
Construction					**$264,100**
Stakeout and As-Built	1	LS	$36,000	$36,000	
Mobilization	1	LS	$22,000	$22,000	
Clearing	0.35	AC	$30,000	$10,500	
Excavation and Hauling	1,000	CY	$100	$100,000	
Grading	0.7	AC	$8,000	$5,600	
Cross Vane	2	EA	$45,000	$90,000	
Planting – Lions Club Park					**$53,600**
Native Seed and Natural Fiber Matting	1,700	SY	$12	$20,400	
Live Stakes	1,000	EA	$10	$10,000	
Tubelings	2,900	EA	$8	$23,200	
Planting - Heritage Park					**$68,200**
Native Seed and Natural Fiber Matting	1,700	SY	$12	$20,400	
Live Stakes	1,500	EA	$10	$15,000	
Tubelings	4,100	EA	$8	$32,800	
Contingency (30%)					**$148,080**
TOTAL ESTIMATED BUDGET					**$641,680**

The table above presents the estimated costs associated with the existing conditions survey, design, and anticipated permitting (VADEQ, USACE) as well as construction and planting efforts of a stream stabilization project along Linville Creek.

Possible Alternatives and Additional Considerations

Given the number of potential projects identified along the Linville Creek corridor, potential cost savings could be realized by creating one hydraulic model encompassing the whole reach. This would further enable assessing the impact of individual projects or proposals on the surrounding area.

This work should ideally be planned and executed in concert with the future Lions Club Park to minimize disturbance. This work should also be evaluated for impacts to the potential Heritage Park pedestrian bridge project, which is located at the downstream end of this project.

Further downstream, between Heritage Park and Rt 259, is another section of Linville Creek where a section of sewer line is currently being relocated an additional 20-30 feet back from the bank. This reach of the Creek would also benefit from restoration and establishment of a riparian buffer. This length of Linville Creek runs through private property, however, and as such easements and agreements with the landowners will be a necessary first step.

Additionally, if sewer system upgrades/modifications at scale become feasible, perhaps as part of a pump station relocation, the aerial sewer crossing of Linville Creek at Turner Avenue should be evaluated for elimination or burial.

Linville Creek is identified as a backup raw water supply source for the Town, and as such any improvements in riparian vegetation and associated pollutant trapping and nutrient cycling will lower costs to using Linville Creek water should it be necessary.

TMDL/MS4 Considerations

Linville Creek has an approved TMDL and Implementation Plan (IP) for sediment to address a benthic impairment. The presence of an approved TMDL and IP could potentially translate into additional funding sources being available for project implementation. The watershed drains to the North Fork of the Shenandoah River, which also has a benthic impairment, but no benthic stressor analysis or TMDL has been completed to positively identify pollutants of concern (as of 2026). Rockingham County became an MS4 permittee in 2025, and so there is potential permit-related benefit this project's anticipated erosion reduction impacts, especially as the area is in the 2020 Census Urbanized Area.

Assumptions

Watershed (via StreamStats 8/5/2026) is 45.7 sq miles (29,228 acres).
Sewer relocation project is already planned for relocation and as such is not included in this evaluation.

Recommended Next Steps

Evaluate compatibility with the planned Lions Club Park and decide on whether to pursue.

References

USGS. StreamStats v4.33.0. Accessed online 5 August 2026.

Virginia Tech Biological Systems Engineering Department. 2003. Total Maximum Daily Load Development for Linville Creek: Bacteria and General Standard (Benthic) Impairments.

MapTech, Inc. 2014. Linville Creek Watershed Implementation Plan: A Plan to Reduce Bacteria and Sediment in the Linville Creek Watershed. 27 September 2013, Revised 14 April 2014.

PROJECT IDENTIFICATION

TOWN OF BROADWAY

NORTH FORK SHENANDOAH RIVER WATER SUPPLY CORRIDOR

Location Description

38.619654, -78.796123

North Fork Shenandoah River corridor along the northern edge of Broadway, in the vicinity of the water treatment plant intake area near the low-water bridge on Shenandoah Avenue.

Project Issue

Riparian erosion and drinking water supply vulnerability — bank erosion and sediment loading increase turbidity during and after storm events, directly threatening the municipal water supply intake. The North Fork is the Town's primary water source and the backup supply (Linville Creek) is considered compromised. The river is naturally shallow (~1.8 ft in summer) and during a 2026 extreme cold event, the river froze and the water plant shut down entirely.

Project Purpose

Evaluate options to reduce impact of turbidity events and low-stage periods threatening the Town's municipal water supply.

Identified Constraints

a. Private landowners hold riparian rights to the waterline on both banks
b. Infrastructure

Additional Information Needed

a. Presence and location of utilities
b. Current intake design and condition
c. Plant operational information (e.g. capacity, average and peak demand, turbidity records, shutdown history, days of treated water storage available, withdrawal permit limits, etc.)

Project Proposal and Planning-Level Cost Estimate

The water intake structure is located in a section of the river dominated by bedrock (**Figure 1**) and within a stretch of healthy riparian buffer, limiting the capability and utility of improving the intake structure approach through natural channel design and riparian buffer improvement projects. A more thorough assessment of possible engineered improvements to the water intake structure and evaluation of alternative water sources that could be developed for use as an alternative or additional backup supply should be completed. Some efforts along this route have already been completed (evaluation of a spring upstream of Turner Avenue) and should be reviewed before efforts are duplicated.

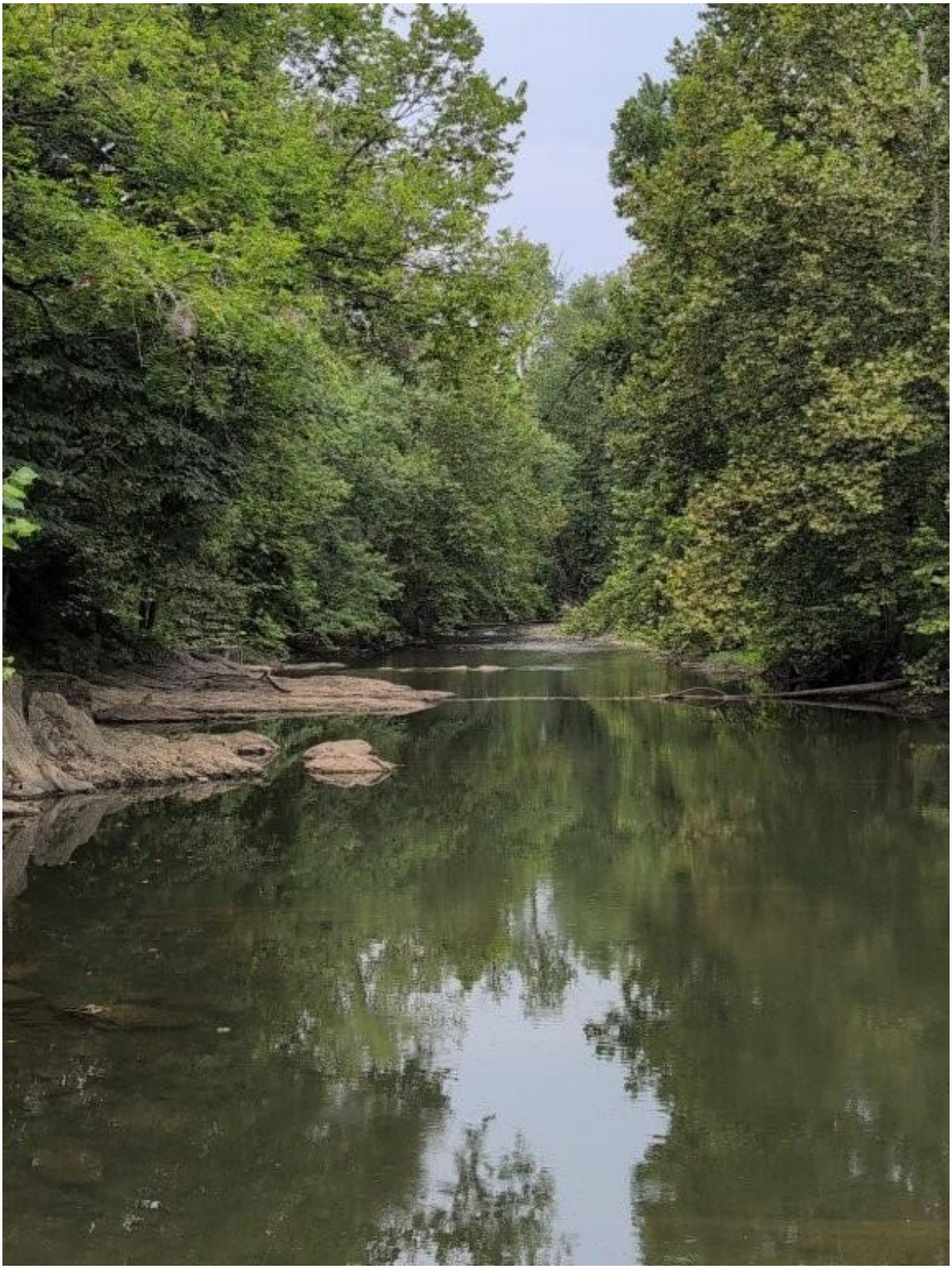


Figure 1. View of Town water intake structure (partially obscured at center-left towards background) and surrounding reach of the North Fork Shenandoah River, photo taken facing west from low water bridge of Shenandoah Avenue crossing.

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Study and Plan Development					**$80,000.00**
Water Intake Structure Improvement Assessment	1	LS	$40,000.00	$40,000.00	
Alternative Water Supply Study	1	LS	$40,000.00	$40,000.00	
Contingency (30%)					**$24,000.00**
TOTAL ESTIMATED BUDGET					**$104,000.00**

The table above presents estimated costs to develop an assessment of the current water intake structure and possible alternatives to improve function, structural, procedural, or otherwise, as well as a study to identify and evaluate possible alternative water supply sources and document their feasibility.

Possible Alternatives and Additional Considerations

Field observations of the riparian buffer along the North Fork in Broadway noted a healthy (though narrow) forested buffer (**Figure 2**, **Figure 3**). While the river is often separated from its overall floodplain by steep banks up to approximately 15 ft high, in many sections there are low benches being actively formed by the natural sorting and depositing of material in the bed. Many of these bench areas were already being actively colonized by both herbaceous and woody vegetation. This indicates a section of river in recovery from prior downcutting/widening due to the hydrologic changes, likely caused by increased development in the watershed among other potential factors. The benefits of implementing a river and/or bank restoration project in this reach (approximately water treatment plant upstream to the western edge of the Town limits) would be outweighed by the disturbance to the existing mature trees and other vegetation currently maintaining stability and retaining sediment in the banks. Some improvement in ecosystem function would be attained by expanding the riparian buffer and establishing additional forested width, particularly where it is narrowest.

Though broader watershed management efforts may help reduce turbidity, a modification of the intake structure may prove the most cost-effective way to minimize intake maintenance. Creation of a stilling well and air purge system may allow for improved intake performance and shorten periods of downtime.

Given the iconic status and recreational value of the North Fork, including an active nonprofit advocate group Friends of the North Fork, a (multi-)county-wide initiative to increase awareness of the causes and impacts of turbidity and excessive sediment in the river ecosystem could prove beneficial above and beyond protecting and improving the Town's water source.



Figure 2. North Fork Shenandoah River looking upstream (west) from Spar Mine Road bridge.



Figure 3. North Fork Shenandoah River looking downstream (east) from Spar Mine Road bridge.

TMDL/MS4 Considerations

North Fork Shenandoah River has a benthic impairment beginning just downstream of the Linville Creek confluence, but no benthic stressor analysis or TMDL has been completed to positively identify pollutants of concern (as of 2026). Benthic impairments in this part of the state are often determined to be caused by excessive sediment and/or nutrient loadings, both of which are addressed by practices that would reduce turbidity following storm events. The Town could reach out to DEQ to determine if the North Fork is planned for TMDL prioritization in the near future, as establishing a TMDL and Implementation Plan opens up additional funding opportunities to implement practices to reduce the pollutant(s) of concern. The North Fork does, however, have an approved bacteria TMDL, so coordination with DEQ may help prioritize implementation of projects in the watershed that reduce both bacteria as well as sediment, such as cattle exclusion fencing.

Rockingham County became an MS4 permittee in 2025, which is an aspect to consider into the future as the area is partially in the 2020 Census Urbanized Area. It is unlikely that the development of an alternative water supply would generate pollutant reductions, but it is possible that other projects or solutions may come from the study that could.

Assumptions

North Fork Shenandoah River Watershed (via StreamStats 4/22/2026) is 231 square miles prior to its junction with Linville Creek.

Recommended Next Steps

Determine prioritization of this project among others and pursue funding for study.

References

USGS. StreamStats v4.33.0. Accessed online 22 April 2026.

Virginia Tech Biological Systems Engineering Department. 2006. Bacteria Total Maximum Daily Load Development for Mill Creek, Stony Creek, and the North Fork of the Shenandoah River.

PROJECT IDENTIFICATION
TOWN OF BROADWAY
SEWER PUMP STATION FLOOD RESILIENCE IMPROVEMENT

Location Description
38.61936, -78.79481
Town of Broadway main sewage pump station, located in the Linville Creek floodplain, is a single point of failure for all town sewage. Pump station conveys wastewater via force main under Linville Creek, across a private farm, to the treatment facility in Town of Timberville.

Project Issue
Flood vulnerability of critical infrastructure — the pump station is the sole wastewater conveyance point for all of Broadway. The site is in the FEMA regulatory floodway and floods when Linville Creek rises, shutting down the entire wastewater system. System is approx. 50 years old and all three pumps ($30,000 each) have failed at various times. System experiences significant infiltration and inflow (I&I) that can overwhelm capacity during wet weather.

Project Purpose
Protect the Town's sole wastewater pump station from flood-related failure and reduce risk of complete wastewater system shutdown during flood events

Identified Constraints
a. Infrastructure
b. Located in FEMA regulatory floodway

Additional Information Needed
a. Detailed information on sewer system (e.g. elevations)
b. Presence of utilities

Project Proposal and Planning-Level Cost Estimate
Lacking an immediate location to fully relocate the pump station, enhancing the floodproofing of the existing pump station is proposed, along with a plausible stream/floodplain restoration effort to enhance the capacity of the Linville Creek floodplain in the area that could be incorporated as a second phase effort to increase flood resilience. A floodplain study will be a necessary first step in either process, both to determine the anticipated flood depths of various scenarios, and to support permitting of any work within the regulatory floodway.

The power equipment was previously raised to the roof of the structure (**Figure 1**) and an upgrade to the grinder pump system is in planning to address debris that has caused repeated failures. There

are vents low on the wall (**Figure 2**) that need to be effectively sealed for floodproofing. If the venting is necessary for safety or regulatory requirements, they should be relocated higher on the building. The door should be retrofitted or replaced to prevent inflow around the door. A sump pump, or backup sump if one is already in place, should be installed to address any waters that would breach the building.

The pump station appears to be offset towards the stream from the main sewer lines, leaving a buffer of approximately 80 feet between the building and the streambank (**Figure 3**). Linville Creek in this reach has very steep, nearly vertical banks at a height of 6-9 feet. There is a narrow strip of riparian vegetation reinforcing the bank on the northern side by the pump station. A portion of this offset could be utilized to re-establish a floodplain connection for Linville Creek. Excavating an inset floodplain in the northern bank and re-establishing a healthy native riparian vegetative buffer would generate additional storage area and flood velocity dissipation in the vicinity of the pump station and other critical infrastructure. A portion of the excavated material could feasibly be re-used to construct an earthen berm along the site, dependent on floodplain study results.



Figure 1. Pump station, Linville Creek in treeline at back, photo taken facing south.



Figure 2. Pump station, photo taken facing north, with vents visible in bottom of wall.



Figure 3. Location map of Broadway sewer pump station.

ITEM/DESCRIPTION	QTY	UNIT	UNIT COST	ITEM SUB-TOTAL	EXTENDED SUB-TOTAL
Phase 1 Floodproofing					**$79,300**
Floodproofing Survey and Design					**$46,000**
Preliminary Floodproofing Implementation					**$15,000**
Phase 1 Contingency (30%)					**$18,300**
Phase 2 Floodplain Restoration					**$878,540**
Floodplain Restoration Survey and Design					**$69,000**
Floodplain Restoration Construction Administration and Oversight					**$30,000**
Floodplain Restoration Access and Erosion/Sediment Control					**$22,200**
Floodplain Restoration Construction					**$464,000**
Stakeout and As-Built	1	LS	$36,000	$36,000	
Mobilization	1	LS	$26,000	$26,000	
Clearing	0.5	AC	$30,000	$15,000	
Excavation and Hauling	3000	CY	$75	$225,000	
Grading	1.5	AC	$8,000	$12,000	
Cross Vane	3	EA	$50,000	$150,000	
Floodplain Restoration Planting					**$90,600**
Native Seed and Natural Fiber Matting	2,800	SY	$12	$33,600	
Live Stakes	1,700	EA	$10	$17,000	
Tubelings	5,000	EA	$8	$40,000	
Phase 2 Contingency (30%)					**$202,740**
TOTAL ESTIMATED BUDGET					**$957,840**

The table above presents estimated costs for a Phase 1 assessment of potential floodproofing efforts for the pump station and estimated costs for some preliminary floodproofing steps: installation of a flood door, structural patches to close off vents in the walls, and sump pump redundancy. The estimates for Phase 2 include survey, design, and anticipated permitting (VADEQ and USACE) for a floodplain restoration effort as well as construction and planting.

Possible Alternatives and Additional Considerations

A deployable barricade system to surround the structure, such as the Aquafence Flood Barricade (https://www.aquafence.com/floodbarricade) could be explored as an alternative or a method that could be used in conjunction with the structural floodproofing. Such a system could provide additional security, but is a solution that would need to be manually deployed each time there is a tangible risk of flooding.

Relocation of the pump station should be more thoroughly evaluated. Invert elevation data on sewer lines was not readily available, limiting the ability of a desktop analysis to evaluate potential locations against the limits of coverage and gravity-based flow. Additionally, if sewer system upgrades/modifications at scale become feasible, perhaps as part of a pump station relocation, the aerial sewer crossing of Linville Creek at Turner Avenue should be evaluated for elimination or burial. The timing of possible stream restoration in that stretch could influence the timeline.

Work in this location is very near the water treatment plant and another potential project along the North Fork Shenandoah River to address the water supply. Efficiency of combining these efforts, perhaps in H&H study efforts, mobilization, or otherwise, should be kept in mind.

TMDL/MS4 Considerations

Linville Creek has an approved TMDL for sediment to address benthic impairment. The watershed drains to the North Fork of the Shenandoah River, which also has a benthic impairment, but no benthic stressor analysis or TMDL has been completed to positively identify pollutants of concern (as of 2026). Rockingham County became an MS4 permittee in 2025, and so the permit-related benefit to projects impacting TMDL-pollutants is an aspect to consider into the future, especially as the area is in the 2020 Census Urbanized Area.

Assumptions

Aside from known breaches in brick outer wall, structure is assumed watertight.
Watershed of Linville Creek (via StreamStats 4/23/2026) is 45.9 square miles.
Estimated 150 linear feet of streambank along parcel for potential floodplain establishment.

Recommended Next Steps

Evaluate funding options for a floodproofing study and effort.

References

USGS. StreamStats v4.33.0. Accessed online 23 April 2026.