Public Draft

Selected Streams in the Cacapon HUC8 Area

Implementation Guidance and

Advance Restoration Plan Development

September 2025

Prepared for:
West Virginia Department of Environmental Protection
Division of Water and Waste Management
Water Quality Standards and Assessment Section

Prepared by:
Tetra Tech, Inc.
1538 Kanawha Blvd E, Suite 110
Charleston, WV 25311

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1. Introduction

During the "Pre-TMDL Monitoring" phase of a traditional TMDL development project in the Cacapon River and Little Cacapon River watersheds, WVDEP performed monitoring at many locations to comprehensively assess the status of water quality standard attainment. As a part of that effort, biological monitoring was performed across a network of stations to evaluate the narrative water quality criterion 47 CSR 2 §3.2.9. as applied to aquatic life. In part, that criterion prohibits adverse impact to the biological components of aquatic ecosystems. WVDEP routinely assesses the criterion in State waters by sampling benthic macroinvertebrates and comparing results to the impairment threshold of an index of biological integrity (IBI).

In general, the biological condition of waters in the Cacapon River and Little Cacapon River watersheds was observed to be excellent. Out of 110 recently assessed locations, WVDEP identified biological integrity impairment at 20 stations. Many of those identified impairments were relatively mild in that biological scores were just below the IBI threshold. A stressor identification process was conducted for the impaired streams. Identified stressors included organic enrichment and/or sedimentation. Parameters that may indicate organic enrichment stress are an abundance of algae, diatom growth, low levels of dissolved oxygen, high levels of nitrogen or phosphorus, or high fecal coliform bacteria counts. Sedimentation stress may be indicated by poor to marginal ratings of riffle/run embeddedness and pool sediment deposition Rapid Bioassessment Protocol habitat parameters. WVDEP typically also evaluates benthic community compositions and the results of the predictive Observed/expected modeling to determine potential biological stressors.

Preparatory activities for West Virginia TMDL development projects not only generate water quality and biological monitoring information ("Pre-TMDL Monitoring") but also identify and characterize the most-likely pollutant sources impacting impaired waters ("TMDL Source Tracking"). WVDEP source tracking activities in the watersheds of biologically impaired streams identified pastures with unmanaged riparian areas and uncontrolled livestock access to streams as the most likely source of impacts. In many of those watersheds, unmanaged pastures were the only significant problematic source identified.

Unmanaged pastures can degrade water quality and introduce biological stress through various mechanisms. Runoff from upland pasture and direct deposition of animal wastes in the stream and riparian zone can elevate nutrient and sediment loads and concentrations locally and in downstream waters. Increased nutrients can promote algal growth which, in turn, can depress dissolved oxygen when microorganisms consume organic materials. Increased sediment erosion from degraded streambanks can deposit in riffle/run habitats, limiting the habitat available for sensitive organisms and altering community composition. Additional stress may be associated with the lack of stream shading and increased water temperature.

The multitude of potential stressors and mechanisms associated with unmanaged pastures presents technical challenges for TMDL development because of uncertainties associated with identification of the significant causative stressor(s) and the TMDL endpoints for which stress would be mitigated. Causative stressor uncertainties may be magnified in scenarios where biological impacts are relatively mild and likely result from a combination of stressors. Uncertainties associated with TMDL endpoints for organic enrichment stress mitigation exist due to the lack of aquatic life protection water quality criteria

for nutrients and difficulties encountered by WVDEP in generating information to support local nitrogen or phosphorus endpoints. WVDEP increased its nutrient monitoring effort in the pre-TMDL monitoring for the Cacapon River and Little Cacapon River project over prior projects, but did not detect significant nutrient concentration elevation in streams with identified organic enrichment stress. The lack of correlation might indicate that nutrient mechanisms are less important for stress mitigation, or the relationship may be confounded by plant utilization between sources and stream monitoring locations. Additional uncertainties exist with respect to the pollutant-specific efficiencies of available management practices. Even if technical challenges can be overcome, the TMDLs will be costly and, in and of themselves, will not further the implementation necessary to achieve calculated nonpoint source pollutant reductions.

Based on the findings of the stressor identification process, source tracking information, and the described technical challenges associated with traditional TMDL development, WVDEP decided to pursue an Advance Restoration Plan (ARP) for this subset of impaired waters of the Cacapon River and Little Cacapon River watersheds. An ARP is a near-term plan, or description of actions, with a schedule and milestones, which is more immediately beneficial or practicable to achieving WQS than TMDLs. Water quality standard attainment for the impaired streams of this ARP is inextricably linked to implementation of a limited set of BMPs, and cost share programs are available to deliver those BMPs to agricultural producers with greatly reduced out-of-pocket expense. With a focus on achieving water quality standards as soon as possible, WVDEP has concluded that a direct implementation effort such as an ARP should be attempted.

Whereas the challenges (and cost) to develop traditional TMDLs for these impairments are great, the solution to criterion attainment is relatively simple. Given the consistency of source type and the proximity of sources to stations for which degraded biological integrity has been observed, WVDEP is confident that water quality criterion attainment is achievable if pasture management Best Management Practices (BMPs) are implemented. Most potential biological stressors can be mitigated through implementation of livestock access restriction and vegetated pasture buffers, and those management practices are currently available under cost share programs that substantively limit the economic impact to agricultural producers.

ARPs do not have the same effect as TMDLs with respect to addressing impaired waters that have been identified by state Section 303(d) lists and Integrated Reports (IR). The development and approval of a TMDL causes prompt removal of the waterbody/impairment from the Section 303(d) list and reclassification of the impairment from IR Category 5 (*impaired and needing TMDL*) to IR Category 4A (*impaired with TMDL completed*). IR Category 4A is an intermediate step in the traditional impaired water restoration pathway and classification thereunder is not contingent upon implementing the necessary pollutant reductions and documenting attainment of waters quality standards. After management practices are implemented and standard attainment is documented, IR Category 4A waters may be reclassified in IR Categories 1 or 2 (*meeting all or some designated uses*), as appropriate.

In contrast, the waterbody/impairments on the Section 303(d) list for which ARPs are developed will remain there and in IR Category 5 until implementation is accomplished and water quality standard attainment is achieved. Documentation of a successful ARP will result in concurrent actions that remove the impairment from the Section 303(d) list and recategorize the waterbody from IR Category 5 to IR Category 1 or 2. If the actions proposed in the ARP are not accomplished or do not result in water quality

standard attainment, traditional TMDL development at a later date is expected for the impaired waterbody.

This report will describe the project scope in terms of waterbody impairments and pollutant sources, the management practices available to agricultural producers, the methods WVDEP and partners will pursue to initiate and accelerate BMP implementation, and the protocols that will be used to track management practice implementation and evaluate/document future water quality improvements.

2. ARP Project Scope

The primary intent of this ARP is to plan actions that will resolve observed nonattainment of the narrative water quality criterion relating to the biological integrity of West Virginia waters. The criterion is codified in 47 CSR 2 §3.2.9. and prohibits wastes in State waters that cause significant adverse impact to the biological components of aquatic ecosystems, as summarized below:

> §47-2-3. Conditions Not Allowable in State Waters.
>
> 3.1. Certain characteristics of sewage, industrial wastes and other wastes cause pollution and are objectionable in all waters of the state. Therefore, the Secretary does hereby proclaim that the following general conditions are not to be allowed in any of the waters of the state.
>
> 3.2. No sewage, industrial wastes or other wastes present in any of the waters of the state shall cause therein or materially contribute to any of the following conditions thereof:
>
> > 3.2.9. Any other condition, including radiological exposure, which adversely alters the integrity of the waters of the State including wetlands; no significant adverse impact to the chemical, physical, hydrologic, or biological components of aquatic ecosystems shall be allowed.

WVDEP uses benthic macroinvertebrates to assess biological integrity through the application of a multi-metric index of biological integrity (IBI). WVDEP's bioassessment methodology compares IBI scores to reference conditions to determine attainment.

The specific streams and watersheds included in the ARP are listed in Table 1 and displayed in Figure 1. Dillons Run and its tributary Gunbarrel Hollow, Kale Hollow, Old Man Run and Tear Coat Creek are within the Cacapon River watershed. Three Churches Run is within the Little Cacapon River watershed. In each of these streams, the biomonitoring performed by WVDEP indicated nonattainment of the 47 CSR 2 §3.2.9. criterion.

Table 1. Biologically impaired streams within ARP project scope

Stream Name	NHD Stream Code	WV Stream Code
Dillons Run	WV-PU-1-BI	WVPC-11
Gunbarrel Hollow	WV-PU-1-BI-2	WVPC-11-A
Kale Hollow	WV-PU-1-BQ	WVPC-12.5
Old Man Run	WV-PU-1-BS	WVPC-13
Tear Coat Creek	WV-PU-1-AS-30	WVPC-7-F
Three Churches Run	WV-PU-49-AH	WVP-19-F

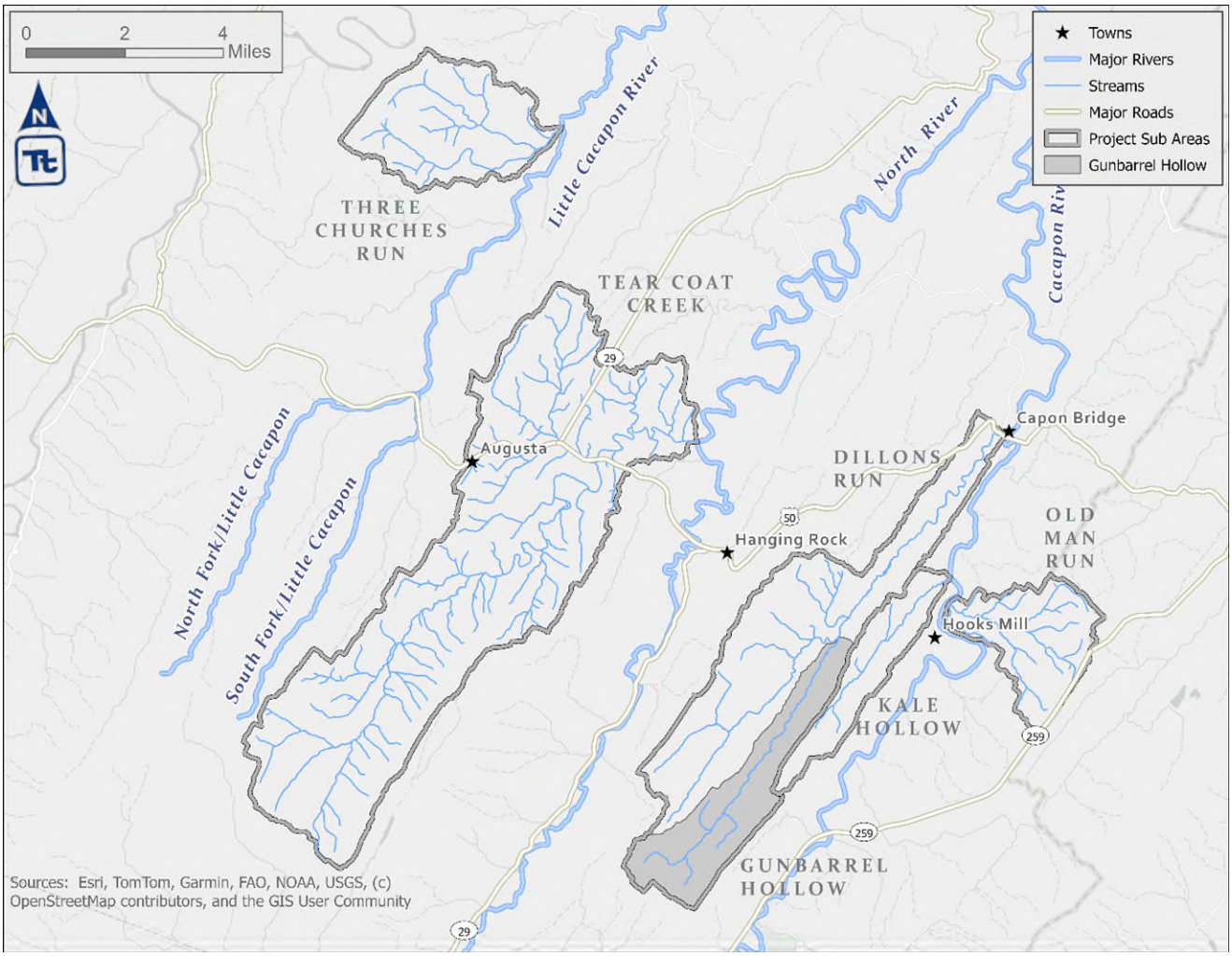

Figure 1. Streams and watersheds within ARP Scope

2.1 Sources within ARP Project

After nonattainment determinations, WVDEP performed source tracking work within the watersheds of project streams to identify/characterize potential causative sources. In all project sub areas, unmanaged pastures were identified as the most likely sources that impact biological condition. In many of those watersheds, unmanaged pastures were the only significant problematic source identified.

As a component of their source tracking activities, WVDEP first visually assesses the pasture/grassland areas provided in the National Land Cover Database (NLCD) (USGS MRLC 2021) to distinguish pastures from grasslands. Pastures are then classified in terms of their potential impacts to water quality. Table 2 displays the five pasture classifications in decreasing impact order and describes the associated characteristics used in this project to accomplish classification.

Table 2. WVDEP Source-Tracking pasture classification characteristics

Pasture Class	Description
Riparian	Near-stream pasture areas where livestock would have uncontrolled stream access that are adjacent to moderate and high runoff potential pastures. Area is calculated by the length of stream abutting the mapped pasture and a uniform width of 35 feet.
High Runoff Potential	Hillside pastures immediately adjacent to the stream where livestock have uncontrolled stream access, and winter feedlots in bottomland areas.
Moderate Runoff Potential	Bottomland pastures where livestock have uncontrolled stream access. Note: This classification may also be applied to certain steep slope pasture and winter feedlot areas with stream access control, but those areas are not the implementation focus of this ARP.
Low Runoff Potential	Bottomland pastures with controlled livestock stream access and hillside pastures with >100 feet of vegetated area between the pasture and stream.
Ridge/Plateau	Gently sloped pasture areas (generally <3% slope) located on ridgetop or plateau having at least 300 feet of vegetated area between the pasture and stream.

2.2 Project Sub-Areas

Figures 2 through 7 provide displays of WVDEP biological monitoring and pasture source tracking results for each project sub-area. No High Runoff Potential Pasture areas were identified in any of the watersheds. The focus of this project is to implement livestock exclusion and buffer BMPs upon the Riparian Pasture areas (red polygons in the figures below) to remove direct livestock waste deposition into streams and stream corridors and buffer the pollutant runoff from the Moderate Runoff Potential Pasture areas (pink and orange polygons).

With respect to implementation goals and progress accounting, currently unmanaged riparian pastures that are near observation stations for which impairment has already been identified have been distinctly classified as Focus Pasture Category A opportunity areas (pink). Unmanaged riparian pastures that are more remote from the stations have been distinctly classified as Focus Pasture Category B opportunity areas (orange). Non-Focus Pasture areas are indicated in green.

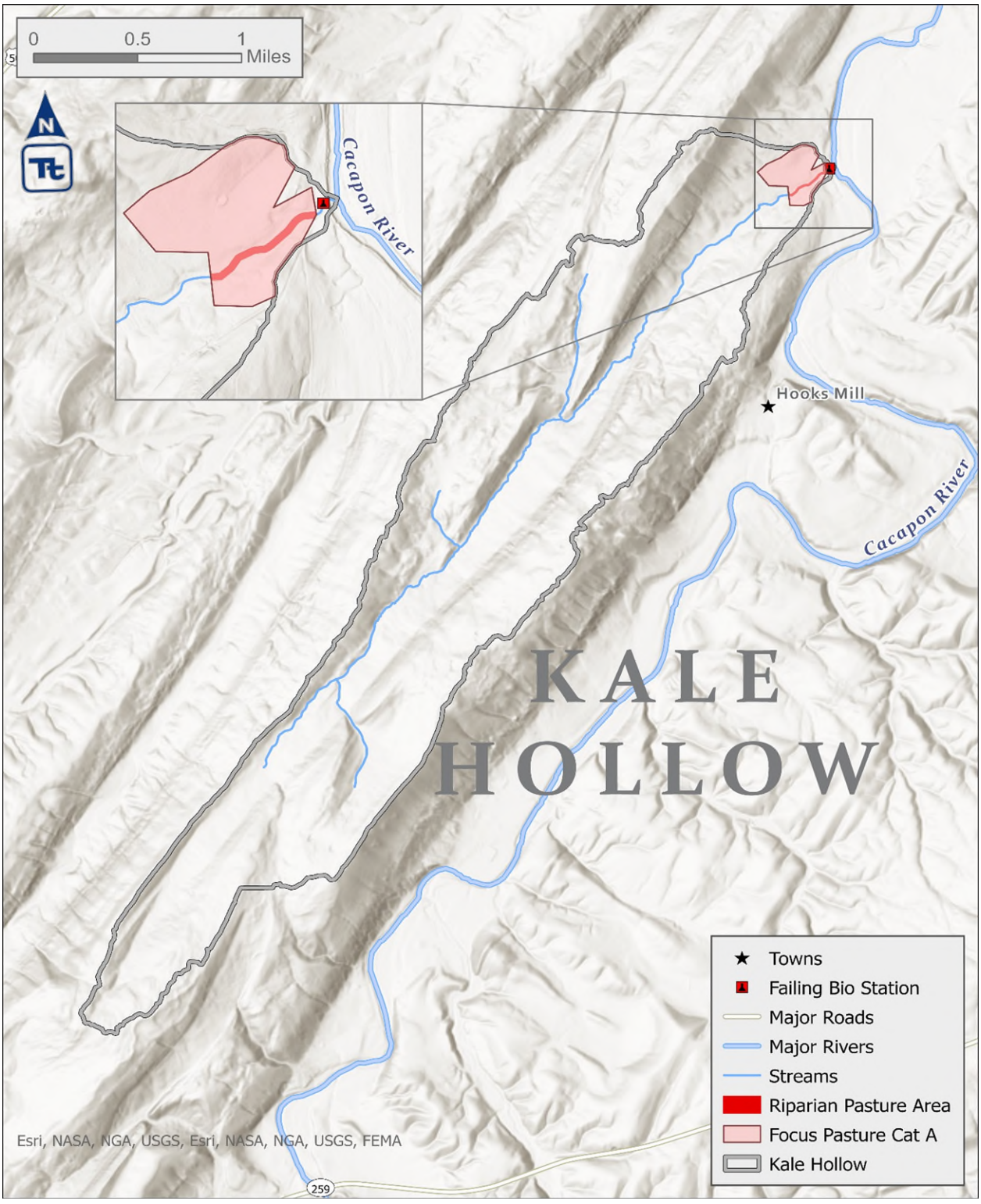

Figure 2. Pasture sources and biological monitoring stations in Kale Hollow

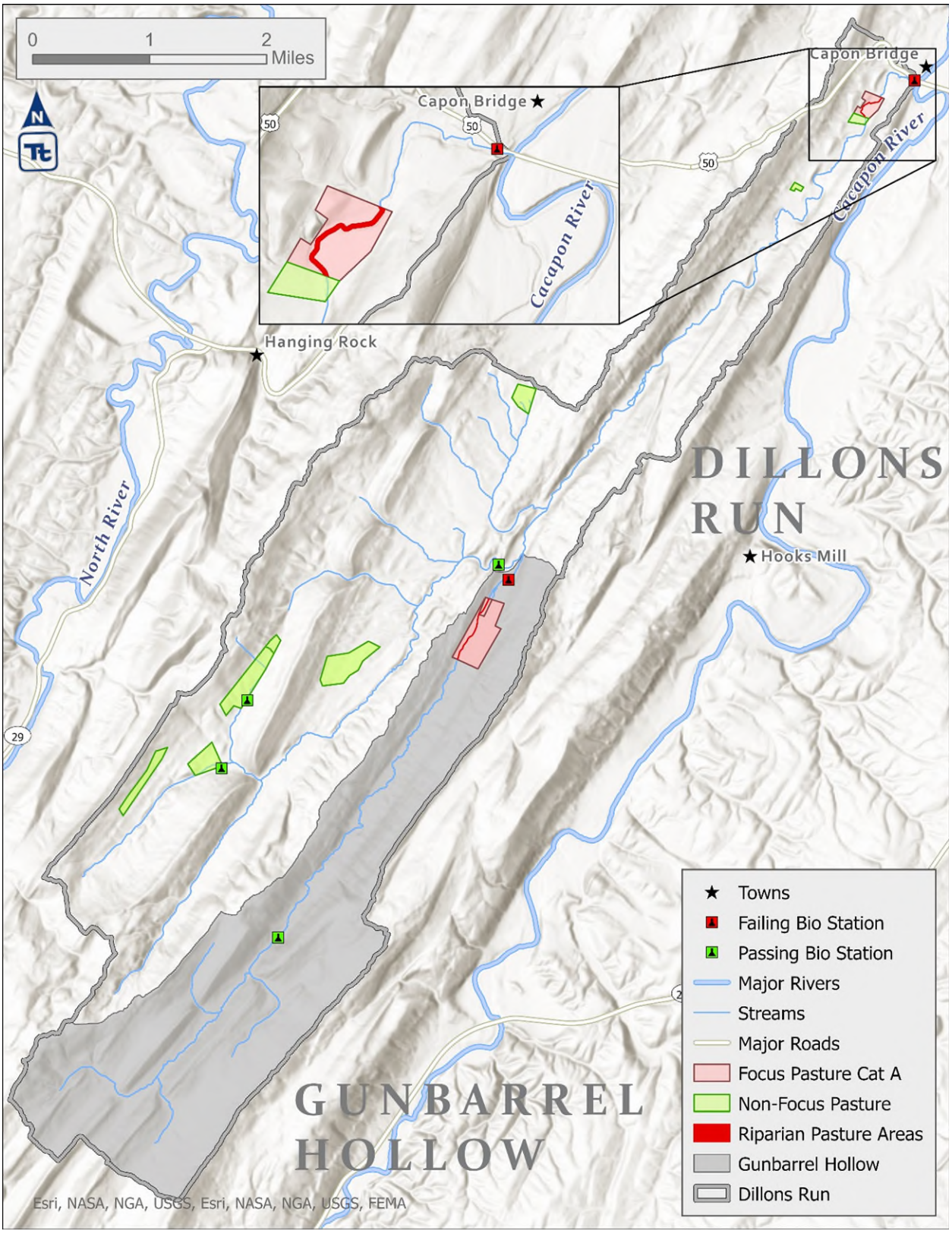

Figure 3. Pasture sources and biological monitoring stations in Dillons Run and Gunbarrel Hollow

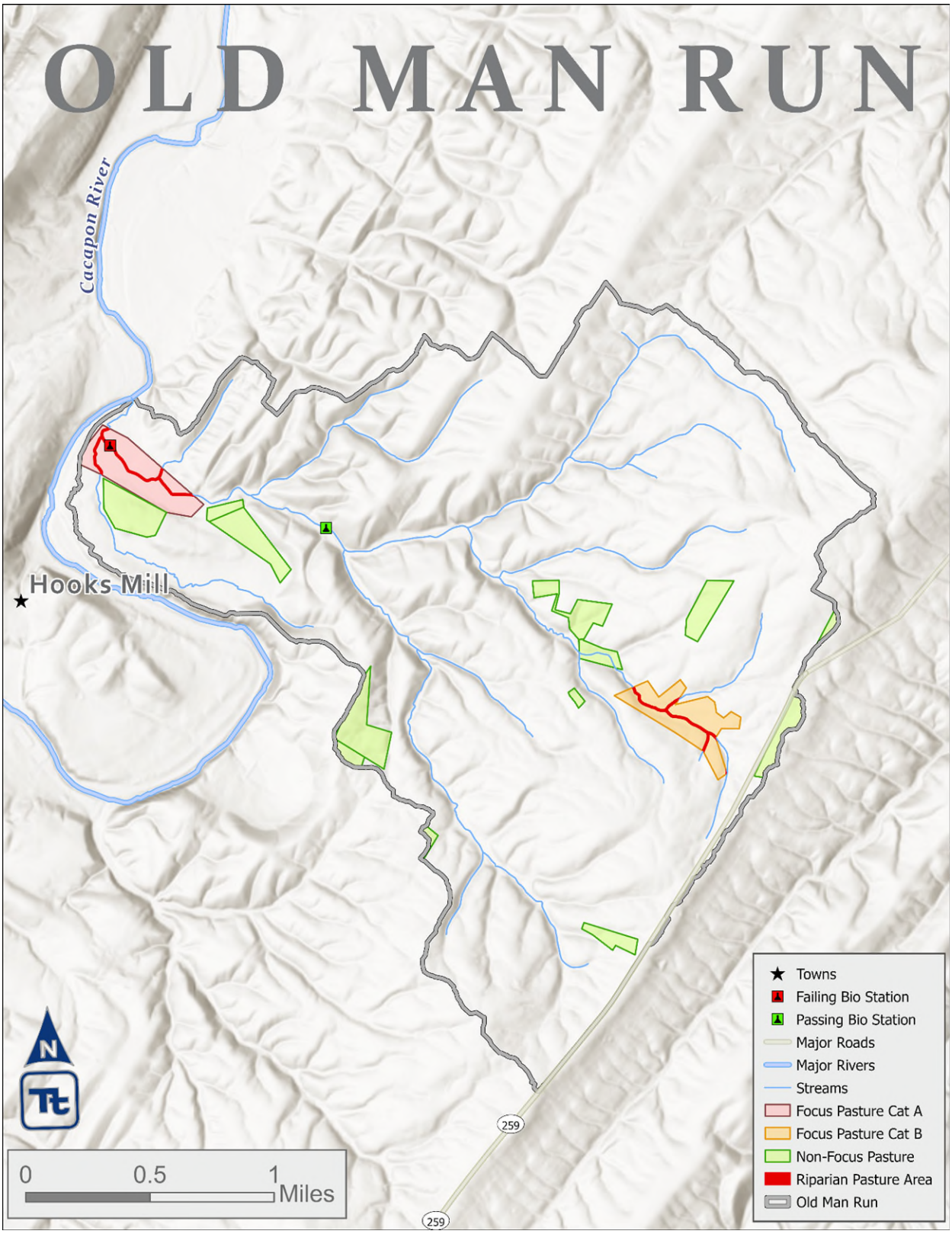

Figure 4. Pasture sources and biological monitoring stations in Old Man Run

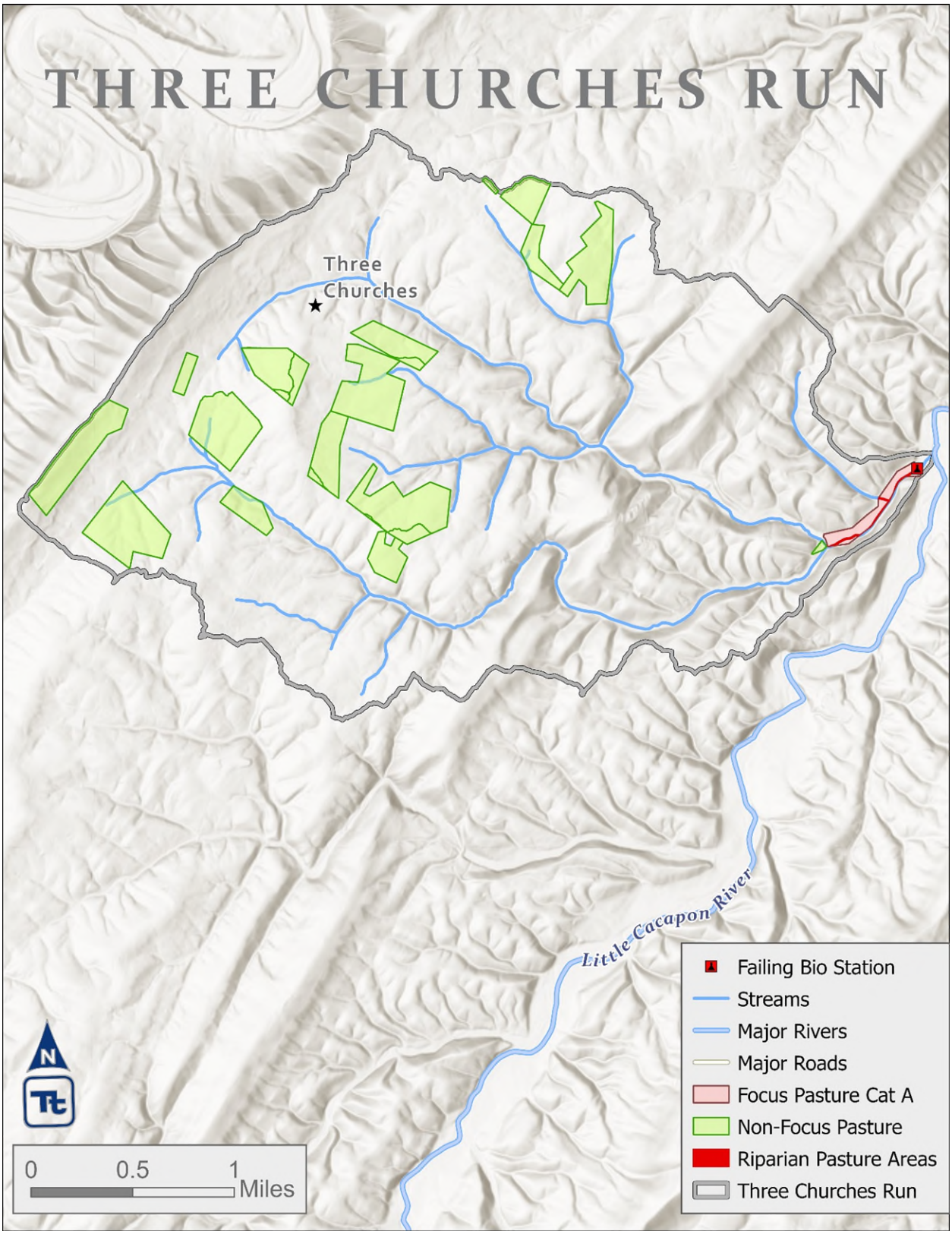

Figure 5. Pasture sources and biological monitoring stations in Three Churches Run

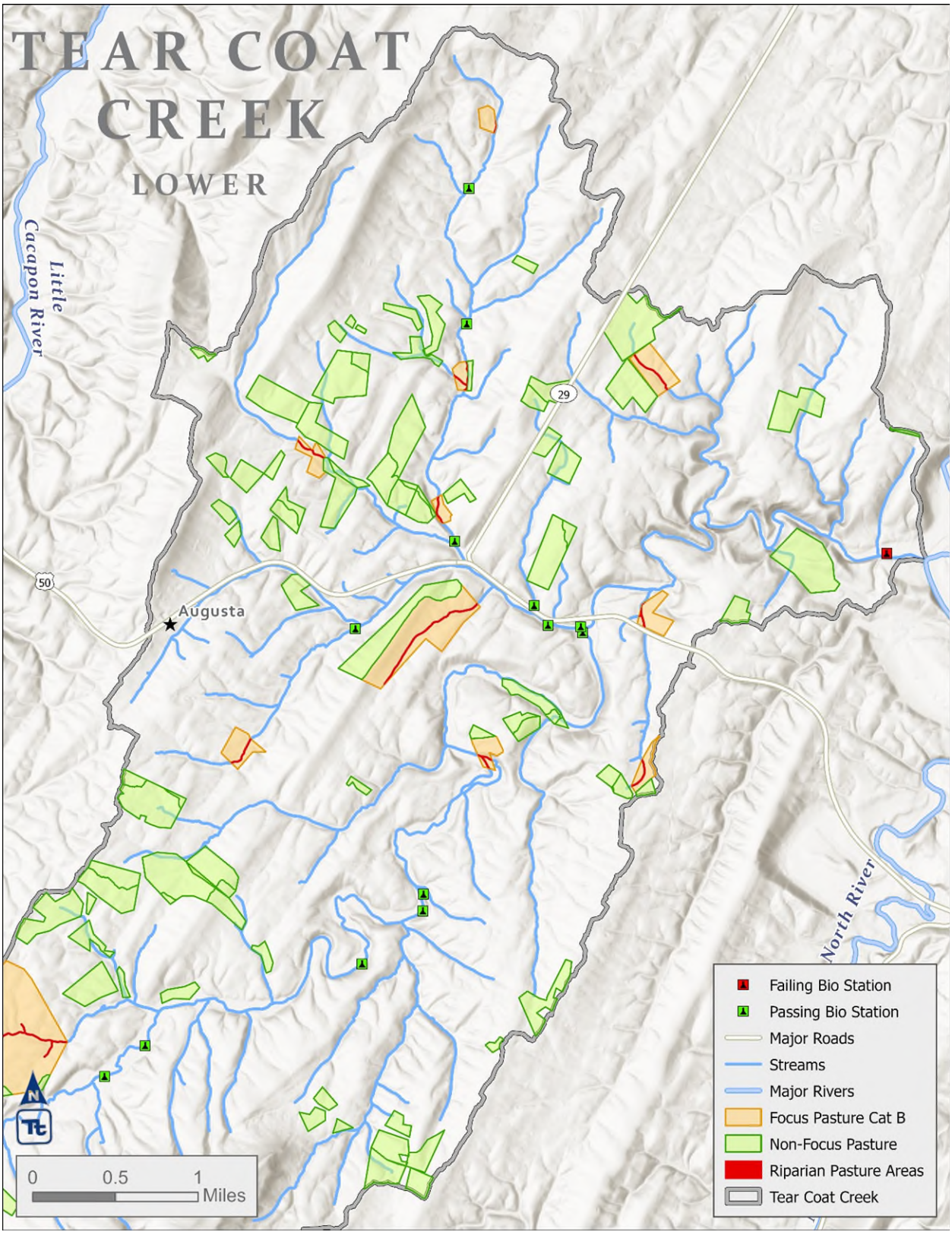

Figure 6. Pasture sources and biological monitoring stations in the Lower Tear Coat Creek watershed

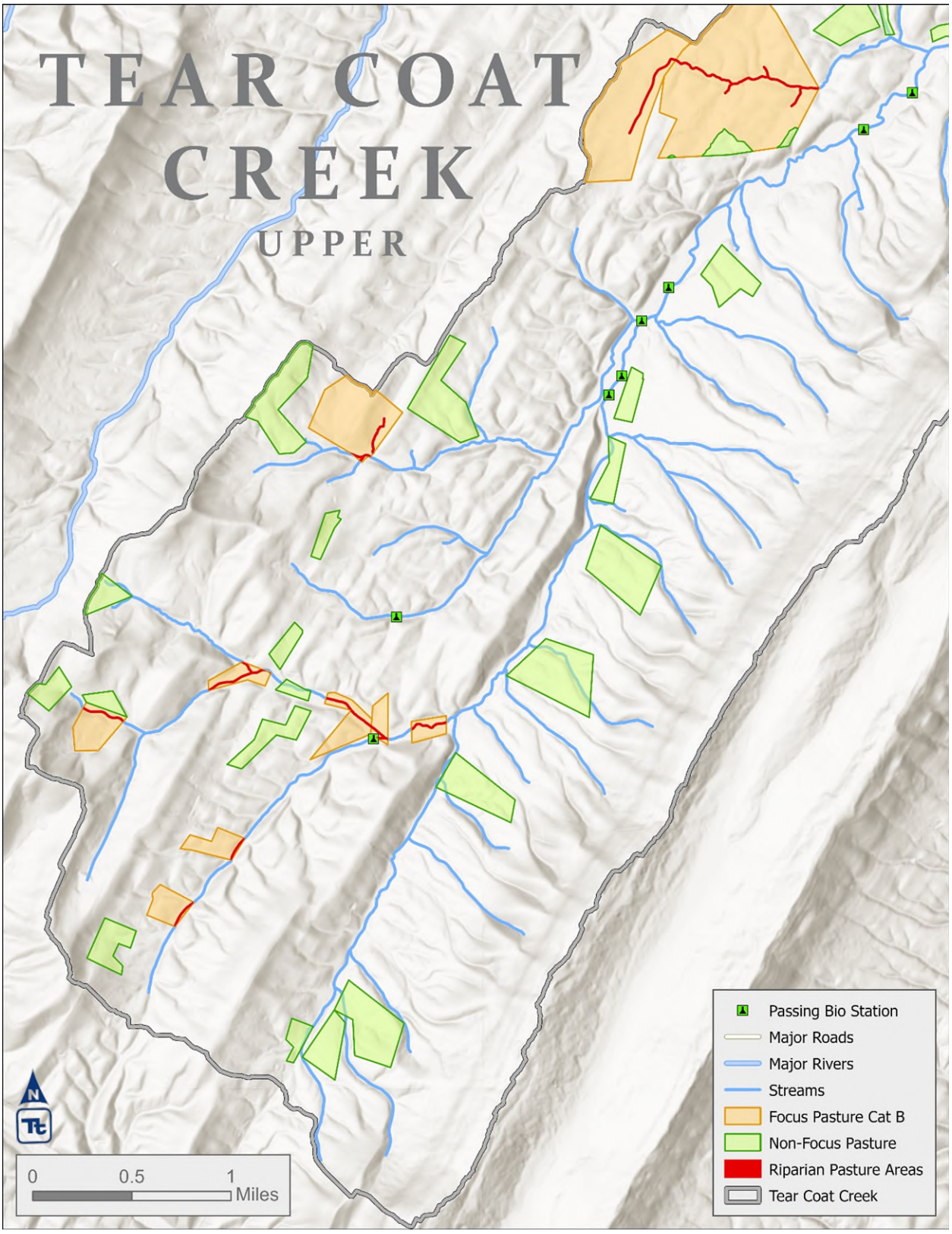

Figure 7. Pasture sources and biological monitoring stations in the Upper Tear Coat Creek watershed

It is important to note that singular unmanaged riparian pastures have been identified near the biological monitoring stations in Dillons Run, Gunbarrel Hollow/Dillons Run , Kale Hollow and Three Churches Run, and no other unmanaged pastures were identified in the watersheds of those streams. Similarly, specific unmanaged riparian pastures have been identified near an observation station in Old Man Run, but additional unmanaged riparian pastures have been identified further upstream in that watershed. Unmanaged pastures located near the non-attaining monitoring stations are displayed as pink polygons in the graphics. BMP implementation addressing those pastures is anticipated to provide direct and positive impact on the observed biological condition at the stations and they are included in the implementation focus of this project as Focus Pasture Category A opportunity areas.

In the Tear Coat Creek watershed, the direct linkage of unmanaged riparian pastures with nearby biological impairment stations is less evident than the other project streams. Tear Coat Creek is the largest sub area within the project scope. Biological monitoring has been performed at multiple locations, but biological impairment has only been identified at one location near its mouth. The more remote unmanaged riparian pastures in the Tear Coat Creek and Old Man Run watersheds are displayed as orange polygons in the graphics and are included in the implementation focus of this project as Focus Pasture Category B opportunity areas. They are alternately classified because multiple BMP implementation projects may need to occur before measurable biological improvement would be expected at non-attaining station locations farther downstream. BMP implementation remains important for those pastures because they may be causing depressed local biological water quality conditions that have not been directly monitored and because they will accomplish multiple co-benefits.

3. Pasture Best Management Practices

3.1 BMP Types

The primary goal of this project is to resolve local biological impairments via accelerated implementation of pasture management BMPs that provide livestock stream exclusion and vegetative buffers that filter the pasture export of multiple pollutants. A secondary objective is to gain knowledge of the efficacy of various practice types with respect to the goal. The pasture management practices that are targeted in this project and available through federal and state cost assistance programs all provide livestock access restriction but vary with respect to buffer width requirements, buffer vegetation type requirements, and financial provisions. Some practices allow limited haying and pasturing of the buffer while others prohibit those activities. At the outset of this project, WVDEP intends to encourage and track all BMPs with livestock access restriction and reevaluate biological condition after implementation.

CREP CP22 with wide, forested buffer requirements and no allowance for agricultural production use of the buffer area is believed to be most beneficial for overall water quality protection. The implementation of alternative BMPs with less restrictive requirements may be more desired by some producers and provide the necessary biological lift. Biological re-evaluation after the implementation of the practice variants will provide valuable information with respect to the impact of the BMPs upon local biological condition that can be used in future projects of this type. The most common programs and practices available to agricultural producers are discussed below.

3.2 West Virginia's Conservation Reserve Enhancement Program

West Virginia's Conservation Reserve Enhancement Program (WV CREP) is a Federal and State partnership program designed to provide funding and technical services to agricultural producers to establish permanent land cover and conservation practices that reduce soil erosion, improve water quality and enhance wildlife habitat. It is an enhancement of the United States Department of Agriculture (USDA) Conservation Reserve Program (CRP) with multiple partners providing increased funding and technical assistance. More information can be obtained from https://www.fsa.usda.gov/tools/informational/fact-sheets/conservation-reserve-enhancement-program-crep-west-virginia

WV CREP partners include:

USDA Farm Service Agency (FSA)
USDA Natural Resources Conservation Service (NRCS)
United States US Fish and Wildlife Service (USFWS)
West Virginia Conservation Agency (WVCA)
West Virginia Department of Agriculture (WVDA)
West Virginia Department of Environmental Protection (WVDEP)
West Virginia Division of Natural Resources (WVDNR)
West Virginia Division of Forestry (WVDOF)

The USDA Farm Service Agency (FSA) administers CREP through the local FSA County Offices, and the USDA Natural Resources Conservation Service (NRCS) is the primary technical service provider. The West Virginia Conservation Agency is the lead agency for the State's CREP Partners.

Conservation Practice 22 – Riparian Buffer (CP-22) is the WV CREP practice most applicable to this project, primarily providing forested buffers on marginal pastureland, i.e. pastureland along streams and waterbodies. Under CP-22, livestock exclusion fencing, water development, tree planting and stream crossing practices may be eligible for financial assistance if needed. Under WV CREP, CP-22 buffers on marginal pastureland must be 35 feet in width, include livestock exclusion fencing, and be designed and managed as forest cover.

WV CREP provides multiple state and federal financial payments and incentives under 10-to-15-year contracts. The program provides annual rental payments for land area approved for CREP under the contract and shares the cost for installation and maintenance of necessary practices (e.g., fencing, buffer plantings, alternative water development) with the producer. Multiple upfront incentive payments are also provided for WV CREP sign-up and practice installation, including special state and federal incentive payments for practices implemented in the Chesapeake Bay watershed.

WV CREP financial assistance provides producers with long-term income from enrolled lands and practice installation income at little to no cost to the producer. Landowners or tenants of agricultural land may offer their land for enrollment into WV CREP at any time by contacting their local FSA County Office or by contacting any of the WV CREP Partner Agencies.

Farm Service Agency
Romney Service Center
500 E Main Street

Romney, WV 26757
Phone: (304) 822-3020

3.3 USDA Natural Resources Conservation Service (NRCS) Programs

NRCS offers technical and financial assistance for agricultural working lands and supports producers who improve and sustain natural resources on their operation by implementing management practices. NRCS offers financial assistance through the Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP) and technical assistance through Conservation Technical Assistance (CTA). EQIP and CSP can be used to install the pasture management practices that are the focus of this ARP, and CTA is provided by NRCS initially, and over the course of contracts pursued by the producer.

Both EQIP and CSP can assist with installation of infrastructure such as fence to exclude livestock from sensitive areas, divide pastures for better utilization and reduce overgrazing; watering systems to facilitate better grazing distribution and provide off stream water sources as well as re-seeding/planting of areas that have been degraded by livestock or cropping. These programs also cost share for participants to implement better grazing management through rotational grazing which increases their positive results. In general, EQIP practice requirements may be less restrictive than those associated with WV CREP. Riparian buffers may be forest or low herbaceous vegetation, and buffer widths may range from 10 to 35 feet. Limited haying and grazing of herbaceous buffer may be allowable.

Interested participants simply need to contact the local NRCS office to schedule a meeting with an NRCS representative to meet with them on their property. NRCS will gather information and write a specific plan for their farm which is tailored to their objectives.

Natural Resources Conservation Service
500 E Main Street
Romney, WV 26757
Phone: (304) 822-3020

Online information links:

NRCS Fact Sheet for the EQIP

nrcs-eqip-factsheet-2025_February.pdf

NRCS Fact Sheet for the CSP

Is CSP Right for Me?

NRCS overview document for Fence - Practice 382

https://www.nrcs.usda.gov/sites/default/files/2022-09/Fence_382_NHCP_PO_2021.pdf

NRCS overview document Access Control – Practice 472

https://www.nrcs.usda.gov/sites/default/files/2022-08/Access_Control_472_Overview_Oct_2017.pdf

NRCS overview document for Riparian Herbaceous Cover – Practice 390

https://www.nrcs.usda.gov/sites/default/files/2022-11/390-NHCP-PO-Riparian-Herbaceous-Cover-2022.pdf

NRCS overview document for Riparian Forest Buffer – Practice 391

https://www.nrcs.usda.gov/sites/default/files/2022-09/Riparian_Forest_Buffer_391_Overview_10_2020.pdf

NRCS overview document for Watering Facility -Practice 614

Practice Overview for CPS Watering Facility (Code 614)

NRCS overview document for Water Well -Practice 642

Practice Overview for CPS Water Well (Code 642)

3.4 Non-governmental Conservation Organizations

Trout Unlimited (TU) works with partners such as the Forest Service and the Natural Resources Conservation Service to improve water quality and stream habitat. They have designated the Upper Potomac watershed a priority area for their work and have sponsored many restoration projects there with a focus on agricultural conservation. Restoration activities have included streambank stabilization, adding large woody debris habitat, tree planting, and fencing to exclude livestock from streams. Although they prioritize their work with respect to brook trout habitat quality improvement and range expansion, they also implement projects with restoration activities to improve conditions for non-trout aquatic life. More information available: https://prioritywaters.tu.org/west-virginia/

3.5 319 Program Incentives

The Clean Water Act Section 319 requires States to form a Nonpoint Source Program and authorizes Congress to provide funds through the EPA regions. In West Virginia the Section 319 Program is implemented by WVDEP's Watershed Improvement Branch.

Grants awarded through this program are used to fund staff, operating costs, outreach, and education activities, and are provided to several partner agencies to implement nonpoint source pollution projects. Additional grant opportunities are offered to watershed associations, agencies, and academic organizations. Grants must have a 40% match, the total reimbursement is 60% of the total cost, and there is a 20% limit for non-implementation activities such as monitoring, administration, and planning. More information is available on their website:

https://dep.wv.gov/WWE/Programs/nonptsource/Pages/319-Program-Guidelines.aspx

It is possible for interested parties to use this ARP document as a starting point in a quest for grant monies to install riparian fencing and pasture management BMPs.

3.6 West Virginia Conservation Agency (WVCA)

WVCA provides administrative, technical, and financial assistance to agricultural operators to address conservation concerns. The focus areas of this ARP are within the Potomac Valley Conservation District (PVCD) which offers rental equipment to cooperators and incentive programs for the installation of divisional and exclusion fencing and alternative watering systems. These practices are offered utilizing Chesapeake Bay Implementation Grant (CBIG) funds. Other practices may be offered as part of the Agricultural Enhancement Program (AgEP), a state funded program geared towards controlling erosion, conserving soil, and improving overall land and water quality, and natural resource sustainability. AgEP practices offered differ from district to district may change annually. For both programs, an application and required documentation must be submitted to the appropriate district during their open application period. For additional information, interested cooperators should contact the District.

Potomac Valley Conservation District
500 E Main Street
Romney, WV 26757
Phone: (304) 822-5174

4. Co-benefits of Pasture Management BMPs

This ARP is focused on water quality improvements that will improve biological conditions in local waterways. Management actions with that focus will provide additional benefits to agricultural producers and downstream waters.

4.1 Producer Benefits

For the agricultural producer, the implementation of BMPs to improve water quality can provide benefits of water supply quality and reliability and improved animal health. Healthier and more productive herds also translate to increased profit for the producer and certain practices also offer farm income from upfront program participation incentives and annual per-acre land rental payments.

Water supply reliability - The development of an alternative off-stream water supply is a necessary component of practices designed to exclude livestock from streams. Alternative water sources can provide reliable watering on a year-round basis and avoid the additional producer time and expense that may be needed to provide water during seasonal drought conditions.

Animal Health – a report by the Chesapeake Bay Commission titled Healthy Livestock, Healthy Streams - policy Actions to Promote Livestock Stream Exclusion published in May 2015 notes benefits to animal health: "*Agricultural producers who have installed fences along streams report improved herd health, decreased incidents of sores in cattle and decreased leg injuries. There is also an increase in calf survival. Providing alternative watering systems away from the streams also contributes to reduced cases of foot rot, bacterial inflammation, jaundice, fever, red nose, bovine virus diarrhea, tuberculosis and mastitis.*" https://www.chesbay.us/library/public/documents/Policy-Reports/Healthy-Livestock-Healthy-Streams.pdf

Water Supply Quality – Providing an alternative source of water not only avoids animals ingesting water from the stream that may contain microorganisms associated with many diseases, but studies have shown significant increases in water consumption by cattle that were provided a cool, clean alternative

source. Increased water consumption is linked with increased animal weight gain. Also from the Chesapeake Bay Commission report, "*For beef cattle, this can mean a gain of up to 25 additional pounds, or a five percent increase in weight, which translates to real money when an animal goes to market to be sold.*"

4.2 Downstream Nutrient and Sediment Water Quality Benefits

The Cacapon River and Little Cacapon River are tributaries of the Potomac River and ultimately the Chesapeake Bay. Actions to improve local water quality will contribute to improved water quality across the entire flow path. The restoration activities intended in this ARP are directly creditable with respect to the nutrient and sediment reduction goals of the Chesapeake Bay TMDL.

West Virginia has performed well with respect to established Chesapeake Bay TMDL targets and has committed to continued implementation to improve and maintain clean water. Pasture buffers and exclusion BMPs are among the most cost effective to implement and are a continued focus of West Virginia's CBP Watershed Implementation Plan (WIP).

Quantification of BMP Nutrient and Sediment Reduction Benefits

Pollutant loading and BMP efficiency information about nutrients (total nitrogen, total phosphorus) and sediment can be estimated by the Phase 6 Chesapeake Bay Watershed Model (CAST). The BMPs targeted for implementation in this ARP involve livestock exclusion with buffers. Within CAST, the associated pasture BMPs include Forest Buffer – Streamside with Exclusion Fencing, Grass Buffer – Streamside with Exclusion Fencing, Forest Buffer- Narrow with Exclusion Fencing, and Grass Buffer – Narrow with Exclusion Fencing. The CAST BMPs are described in a BMP Quick Reference Guide –

https://www.chesapeakebay.net/files/documents/BMP-Guide_Full.pdf

CAST predicts pollutant export reduction associated with the subject BMPs under three different mechanisms: landuse change, relocation of direct deposition, and upland pasture filtering.

All the available BMPs alter modeled export loads based upon land use change for the area of buffer implemented, i.e., the area between the livestock exclusion fence and the stream converts from pasture to forest for forest buffers, and from pasture to "agricultural open space" for grass buffers. This component reduction results from theoretical forest and agricultural open space land use loading rates that are lower than pasture loading rates. Table 3 displays average Chesapeake Bay watershed nutrient and sediment loading rates for the subject land uses.

Table 3. Chesapeake Bay Watershed average land use loading rates (Reference CAST P6 Model documentation)

Land Use	TN Loading Rate (pounds/ac/yr)	TP Loading Rate (pounds/ac/yr)	TSS Loading Rate (tons/ac/yr)
Pasture	11.78	0.81	0.08
Forest	1.68	0.08	0.07
Agricultural Open Space	5.07	0.81	0.08

All the available BMPS also alter modeled export loads based upon the exclusion of direct deposition of animal wastes to the stream and riparian corridor. CAST accounts for the animals present in the geography under consideration and the mass of manure and pollutants generated per animal and proportions waste deposition based upon the time animals spend in confinement, upland pastures, and riparian areas. Upon implementation of livestock exclusion BMPs, waste that would have been originally modeled as being deposited in streams/riparian areas is relocated to upland pastures. Modeled pollutant export is generally less from waste deposited upland instead of directly to the stream because loads are partially attenuated on the land surface.

Finally, standard width buffers (35 ft. or wider) are additionally provided a model component reduction based upon the buffers' filtering of upland pasture pollutant loads. Crediting for this component mechanism varies by pollutant, hydrogeomorphic region and buffer type with efficiency values displayed in Table A-13-1 of the Guide (link available above). Narrow width (10 ft.) buffers are not afforded the upland filtering credit.

As mentioned in the Guide, the net reductions in nitrogen, phosphorus and sediment for forest and grass buffers in the Watershed Model are significant, but not simple to estimate without the use of CAST. For the purposes of this plan, CAST was used to estimate average nutrient and sediment load reductions associated with implementation of the four pasture BMPs in the West Virginia Potomac Basin region. This was accomplished by using the Watershed Implementation Plan scenario established by the CBP (WIP3-CAST 2023 version) and its BMPs as the base condition, adding BMPs to create test scenarios for each of the four BMPs, and comparing edge of stream load changes between the base and test scenarios. Table 4 displays the results of this analysis and additional information regarding the analysis is provided in Appendix B.

Table 4. CAST estimated BMP nutrient and sediment reductions

Best Management Practice	Nitrogen Reduction (pounds/mile buffer/yr)	Phosphorus Reduction (pounds/mile buffer/yr)	Sediment Reduction (tons/mile buffer/yr)
Forest Buffer – Streamside with Exclusion Fencing	275	83	32
Grass Buffer – Streamside with Exclusion Fencing	238	79	32
Forest Buffer – Narrow with Exclusion Fencing	165	78	31
Grass Buffer – Narrow with Exclusion Fencing	161	77	31

In general, CAST predicts significant nutrient and sediment reductions for all of the evaluated practices. The reduction benefit for nitrogen is greater for forest buffers over grass buffers and for standard size buffers over narrow buffers. The phosphorus and sediment load reduction benefits are less varied across the BMPs.

4.3 Other Chesapeake Bay Program Benefits

The Vital Habitats goal of the CBP Watershed Agreement - https://www.chesapeakebay.net/what/what-guides-us/watershed-agreement includes a Stream Health outcome aimed at improving the health and function of freshwater streams across the watershed.

https://www.chesapeakebay.net/what/goals/vital-habitats#stream-health

If this ARP is successful, the documented biological improvement will support WV 303(d) delisting and may afford crediting under the CBP Stream Health outcome.

The CBP also works toward a watershed-wide forest buffer outcome in support of both habitat and water quality goals.

https://www.chesapeakebay.net/what/goals/vital-habitats#forest-buffers

More locally, the Cacapon Watershed Collaborative (www.cacapon.org) has established forested stream buffer goals for the Cacapon River watershed. Pasture management BMPs implemented with forested buffer vegetation will benefit both pursuits.

4.4 Local Bacteria Water Quality Benefits

This ARP specifically targets biological integrity impairments identified by WVDEP biological monitoring efforts. At some locations, WVDEP monitoring also identified co-occurring fecal coliform water quality criteria impairments. TMDLs to address fecal coliform impairments include prescribed reductions for pastures. The BMPs proposed for biological integrity impairment resolution are the same management practices intended to reduce fecal coliform. Specifically, prescribed fecal coliform reductions would be based upon implementing the livestock stream exclusion component on the riparian pastures to eliminate direct deposition of animal wastes in the riparian corridors and pasture buffers to further mitigate pollutant loadings in stormwater runoff from upland pastures.

Quantification of BMP Bacteria Reduction Co-benefits

The Total Maximum Daily Loads for the Cacapon River Watershed, West Virginia (under development) presents a fecal coliform bacteria TMDL for the Cacapon River upstream of its confluence with North River. Unmanaged riparian pastures have been identified as a significant contributing source of fecal coliform criteria nonattainment. The TMDL effectively addresses unmanaged riparian pastures in all watershed areas upstream of the North River confluence. Within the ARP project scope, specific fecal coliform bacteria TMDLs are also presented for Dillons Run, Gunbarrel Hollow, the headwater segment of Tear Coat Creek, Bearwallow Creek (tributary of Tear Coat Creek) and Kale Hollow.

In the model used by WVDEP to develop fecal coliform TMDLs in the Cacapon River watershed, baseline pollutant loadings are established for each pasture class displayed in Table 2, with magnitudes varying with potential impact. Under the successful TMDL allocation scenario, i.e., the scenario for which the model predicts fecal coliform criteria attainment, reduced pollutant loading is generally prescribed for the highest loading pasture landuse sources - riparian pastures, high runoff potential pastures and moderate runoff potential pastures. A component of the allocation process involves reducing the baseline loadings of those land uses to the calibrated loading rate of low runoff potential pastures under an expectation that such reductions can be achieved by implementing BMPs that provide stream access control and buffering. The WVDEP fecal coliform TMDL allocation approach is similar conceptually to mechanisms for nutrient and sediment reduction crediting in the CBP watershed model discussed in the previous section (i.e., land use conversion to a natural land use for pasture area within the riparian buffers, relocation of direct deposition to upland pasture area via exclusion fencing, and the filtering of stormwater runoff from upland pasture areas).

This allocation component is applied nearly universally in fecal coliform impaired waters with unmanaged riparian pastures and, alone, is predicted to result in fecal coliform water quality criteria attainment in most locations where unmanaged riparian pastures are the singular causative source of nonattainment. Examination of the baseline and allocated pasture loadings associated with qualified fecal coliform model subwatersheds can provide model-based estimates of the fecal coliform load reduction effect of the BMPs focused upon within this ARP. Table 5 provides example annual average per acre estimates of fecal coliform bacteria model-estimated load reductions associated with implementation of the livestock exclusion and buffer BMPs. The example displays are for subwatersheds within the ARP project scope for which pasture is the only modeled actionable source, pasture area is limited to riparian and moderate runoff potential land uses, and the allocation methodology component applied to those land uses resulted in model prediction of fecal coliform criteria attainment. In the simplest terms, implementation of livestock exclusion and buffer BMPs is predicted to significantly reduce fecal coliform export to receiving waters by more than an order of magnitude, with the average reduction in the three qualified subwatersheds approximately equal to 96 percent.

Table 5. Model estimates of fecal coliform load reduction expected under TMDL implementation

Stream Name	SWS	RP area (acres)	MRPP area (acres)	Total Pasture Area (acres)	Baseline Load (counts/yr)	Baseline Yield (counts/ac-yr)	Allocated Load (counts/yr)	Allocated Yield (counts/ac-yr)	FC Reduction (%)
Kale Hollow	2049	1.9	35.7	37.6	9.82E+12	2.61E+11	4.68E+11	1.25E+10	95.23
Gunbarrel Hollow	2030	5.2	79.3	84.5	2.22E+13	2.63E+11	1.02E+12	1.21E+10	95.41
Tear Coat Creek	4063	1.7	10	11.7	3.38E+12	2.89E+11	1.22E+11	1.04E+10	96.40
Three Churches Run	6038	3.8	16.6	20.4	6.94E+12	3.40E+11	2.23E+11	1.09E+10	96.79

4.5 Fishery/Habitat Benefits

In addition to buffer and exclusion BMPs, agricultural service providers may identify existing degraded stream bank and instream substrate conditions that warrant additional BMPs to accelerate recovery from past unmanaged conditions. Although BMPs to address streambed and streambank conditions are not the primary focus of this project, such actions will benefit local fish habitat conditions. Similar past efforts by TU, where the upland BMPs have been coupled with streambank and instream habitat restoration practices, have resulted in improved brook trout and other gamefish populations in targeted streams. An article in the publication Bay Journal reports that TU has helped to restore more than 100 miles of streams in five West Virginia eastern panhandle counties. To date, 400 farms have added BMPs, and 2,000 acres of streamside land have become riparian buffers. Results include restoring brook trout to streams where they had been extirpated, an overall increase in trout numbers in restored streams, and the persistence of large (15 inch) trout. https://www.bayjournal.com/news/wildlife_habitat/brook-trout-revival-in-west-virginia-bucks-the-trend/article_068da224-d809-11ef-a3b1-670ffb3dad3b.html

5. Implementation

5.1 ARP Partners and Upfront Outreach Activities

The success of this project rests upon the voluntary implementation of BMPs by the agricultural producers located within the project areas. Multiple state and federal agencies implement programs that provide technical and financial assistance to interested producers. Additional non-governmental organizations operate locally with clean water and sustainable agriculture goals that depend in part upon the implementation focus of this ARP. Targeted outreach by the local representatives of those entities was determined to be the most effective way to educate producers about available cost-shared practices and their multiple benefits and secure the producer participation that will lead to project success.

After determining that it would pursue this ARP, WVDEP initiated discussions with prospective partners about the ARP concept and its planned application in the Cacapon River and Little Cacapon River watersheds. A meeting was held on February 13, 2024, at the WVDA office in Moorefield during which information about project concepts, scope, actionable sources and desired BMPs was communicated. The importance of upfront and targeted outreach was expressed to partners that programmatically provide funding and/or technical services to agricultural producers. Other prospective partners that have working and/or personal relationships with producers within the project scope were encouraged to connect interested producers with local service providers. Following the meeting, WVDEP provided additional information and partners began outreach activities.

An ARP conference call was held on July 8, 2024, with participants including WVDEP, WV State Agriculture Department, and local conservation groups to gauge progress made in stakeholder engagement and BMP site selection. WVDEP also presented ARP concepts in a short presentation to the Cacapon Collaborative stakeholder workshop September 18, 2024.

Outreach Partners:

a. Natural Resources Conservation Service (NRCS) – USDA Service Center - Romney, WV
b. West Virginia Conservation Agency
c. West Virginia Department of Agriculture
d. Cacapon Watershed Collaborative
e. Trout Unlimited Mid-Atlantic Coldwater Habitat Program
f. Farm Service Agency (FSA) – USDA Service Center - Romney, WV

5.2 Amount of implementation needed

Many ARPs use a reference watershed approach to identify implementation targets. Under that approach, a nearby, similarly sized watershed containing limited pollutant sources and a stream that is attaining the water quality criterion is selected as the reference. The impaired and reference watersheds are modeled and the modeled loading of the reference watershed, normalized by watershed area, is used as the reduction target for the impaired watershed. Allocations are then prescribed for sources in the impaired watershed such that the model predicts attainment of the reduction target.

A reference watershed modeling approach was initially considered for this ARP (using land uses, nutrient and sediment loading rates and BMP efficiencies from the Chesapeake Bay Program Watershed Model) but was not pursued. WVDEP determined that non-attaining biological scores were not well correlated with the amount of unmanaged riparian pasture in the upstream watersheds. WVDEP determined a better correlation existed between the proximity of unmanaged pasture and observation stations with non-attaining biological scores. WVDEP concluded that unmanaged pastures in these watersheds adversely impact ***local*** biological condition, i.e., stream locations near the unmanaged pastures, but that biological condition often improves downstream as the streams flow through the natural forested environs that are common in these watersheds. It is important to recognize that WVDEP cannot perform biological monitoring at all stream locations due to limited resources and sampling protocols that limit the use of the IBI methodology at locations with small drainage areas. In practice, when executing a large-scale watershed monitoring plan like that of the Cacapon/Little Cacapon pre-TMDL effort, most biological monitoring stations are located near the mouths of tributary waters. BMP implementation remains important at pastures located remotely from near mouth stations because an associated, unmonitored biological impact may be present.

As such, the focus of this ARP is the implementation of pasture management BMPs on all identified unmanaged Riparian Pasture areas. In these settings, that classification primarily applies to riparian pasture areas at which livestock have uncontrolled stream access. Two classes of unmanaged riparian pastures have been identified with respect to future BMP implementation. Focus Pasture Category A are those close to biological monitoring stations at which biological impairment has been determined, and Focus Pasture Category B are those located farther away. This distinction is provided primarily to inform and guide decisions regarding appropriate times to reevaluate biological condition as discussed in Section 6.2 (Effectiveness Monitoring).

This ARP does not quantitatively relate reduction of specific pollutant loading to water quality improvement. The ARP recognizes that the implementation of available practices will lower the loading of multiple pollutants (nutrients, sediment, heat, bacteria) and also allow local improvement of physical impacts to biological communities (riffle/run habitat embeddedness) via natural attenuation. The combined effects from applied livestock exclusion and buffer BMPs are expected to provide biological lift sufficient to document water quality standard attainment. Practically, numerical quantification of load reduction does not add value to this effort, as the focus is simply the implementation of available BMPs. If the targeted BMPs are implemented, the intended result is likely to be attained.

5.3 Implementation Target Goals/Accounting

WVDEP source tracking efforts identified approximately 20 acres of riparian pasture associated with Focus Pasture Category A and 54 acres of riparian pasture associated with Focus Pasture Category B within all sub-areas of this project. Those areas are based upon an average 35-foot width and represent the total opportunity areas for implementation of the BMPs focused upon in this project. The RP opportunity areas have adjacent and associated Moderate Runoff Potential Pasture (MRPP) areas of approximately 200 and 860 acres of Category A and B, respectively. Table 6 summarizes the opportunity areas by project subarea. The RP and MRPP areas are also graphically displayed in Figures 1-7.

Table 6. Implementation Opportunity Areas

Watershed	Opportunity Areas					
	Category A RP Areas			Category B RP Areas		
	RP Area 35ft buffers (acres)	RP Area 10ft buffers (acres)	Associated MRPP Area (acres)	RP Area 35ft buffers (acres)	RP Area 10ft buffers (acres)	Associated MRPP Area (acres)
Kale Hollow	1.9	0.5	35.7	0	0	0
Gunbarrel Hollow	5.2	1.5	79.3	0	0	0
Dillons Run*	2.6	0.7	17.6	0	0	0
Old Man Run	6.3	1.8	49.2	4.8	1.4	38.9
Three Churches Run	3.8	1.1	16.6	0	0	0
Tear Coat Creek	0	0	0	48.5	13.9	820.3
Total	**19.8**	**5.6**	**198.4**	**53.5**	**15.2**	**859.2**

*Excluding Gunbarrel Hollow

To facilitate implementation planning and accounting, a tracking form has been developed and provided to partners to document outreach activity that has resulted in expressed interest by producers/landowners to pursue management actions. The Advance Restoration Plan Site Tracking Form V.1 is included as Appendix A in this document.

The updateable tracking form includes:

- nondescriptive tracking number
- Outreach partner/service provider (NRCS, FSA, etc.)
- Practice name/description (livestock stream access restriction (Y/N), buffer width (distance/avg or min), buffer vegetation (forest/low vegetation), flash grazing allowed (Y/N/description of requirements)
- Project status (general interest expressed, contract under development (date), contract signed (date), practice installation initiated (date), practice installation complete (date, signature of service provider?)
- project sub area
- riparian pasture area and category addressed
- upland pasture area addressed
- general comment box

This form is also intended to be updated by service providing partners as projects progress to completion. The information can be used by WVDEP to document implementation activities from beginning to end. The outreach partner would send WVDEP an updated form whenever a significant new status milestone is achieved. If no milestones were met in a project area, the service providing partner would update WVDEP on an annual basis.

6. Project Schedule – Potential Measurable Milestones

6.1 Documentation and Milestones

There is a need for formal documentation to track outreach efforts and develop measurable milestones for implementation for ongoing projects. Measurable milestones are the start-to-finish activities for Focus Pasture Category A and Category B areas. Milestones will vary depending on the nature of the practice implemented. Some milestones could include initial contact, signed agreement, practice start, practice completion, or a practice maintenance schedule if appropriate. Milestones will be tracked by Focus Pasture project area and not by stream or by watershed.

Initial outreach efforts by the outreach partner/service provider should be documented in a tracking form described in Section 5.3. Outreach partners will maintain landowner privacy by excluding sensitive information from tracking forms. Short and long-term milestones in 3-to-5-year increments can be established going forward from initial landowner contact. The outreach partner/service provider would provide documentation of completion for installed practices. Practice documentation would inform WVDEP when follow-up monitoring could be performed after the stream biota has responded and equilibrated to the new conditions.

6.2 Effectiveness Monitoring

The existing biological monitoring stations for which nonattainment of the biological integrity narrative water quality criterion has been identified are the primary locations at which WVDEP will reevaluate biological condition after BMP implementation is documented. The information generated by effectiveness monitoring will inform future water segment-specific Integrated Report determinations and may also guide the practice variants that should be pursued in future ARP projects.

A lag time between BMP implementation and measurable biological change is anticipated due to the time needed for practice maturity and biological recolonization. BMP implementation at Category A pastures is expected to result in improved biological condition at existing monitoring stations faster than implementation at Category B pastures due to Category A pasture proximity to stations, but the length of the lag time remains highly uncertain. Rather than prescribing specific, lagged, post-implementation dates for effectiveness monitoring, WVDEP will systematically conduct effectiveness monitoring in accordance with its workload organization under the five-year cycle of the State's Watershed Management Framework. The setting of this ARP is within Hydrologic Group E of the Framework, for which WVDEP stream monitoring activities are planned in 2025 and every five years thereafter.

When planning specific monitoring to be accomplished in Hydrologic Group E watersheds during the next monitoring year (2030), WVDEP will assess the BMP implementation that has been accomplished under this project and conduct monitoring every 5 years. When effectiveness monitoring is conducted, the biological community will be assessed using the same methodology under which impairment was identified and the measured change in biological condition will be documented. Where BMPs have been implemented at Category A pastures, biological condition will be reevaluated at the associated prior monitoring location. WVDEP will use professional judgement to decide if biological condition reevaluation should be conducted with respect to BMP implementation at Category B pastures. Existing station reevaluation may be performed, especially if BMP implementation has been documented at multiple upstream Category B pastures. Alternatively, WVDEP may consider deferring reassessment until

a later Framework monitoring year. Project-specific “before and after” biological assessment at new locations may also be considered.

Appendix A

Tracking Form

Tracking Number _____

Site Description	
Outreach partner (conservation group or govt. agency)	
Project Area (stream name, watershed)	
Riparian pasture acres (identified in ARP)	
Riparian pasture category (A or B as identified in ARP)	
Riparian pasture grazing intensity (seasonal/year-round)	
Pasture area upgradient of buffer (acres)	
Upgradient grazing intensity (seasonal/year-round)	
Practice Description	
Practice code (outreach partner-specific, if applicable)	
Livestock stream access restriction (Y/N)	
Buffer Acres (total area between fence and stream)	
Buffer width (distance/avg or min in feet)	
Buffer length (feet)	
Buffer vegetation (forest/grass/ low herbaceous)	
Flash grazing allowed (Y/N)	
Flash grazing description of requirements	
Project Status	
General interest expressed (date)	
Contract under development (date)	
Contract signed (date)	
Practice installation initiated (date)	
Practice installation complete (date)	
Outreach partner approval (date)	
General Comments	

Appendix B

CAST Scenarios

Appendix B. CAST Scenarios to Evaluate BMP Nitrogen Phosphorus and Sediment Reductions

The Chesapeake Assessment Scenario Tool (CAST) was exercised to estimate the nitrogen, phosphorus and sediment reductions of the pasture management Best Management Practices (BMPs) associated with the ARP. The official "WIP 3 CAST-2023 version" created by the Partnership was selected a baseline. Four additional scenarios were then created, one each for the four types of pasture buffer BMPs recognized in CAST, and the resultant loads from the test scenarios were compared to the baseline. The test scenarios are saved in CAST, and can be made available to interested CAST users. They are titled:

- WIP 3 CAST 2023 plus Forest Buffers on Fenced Pasture Corridor
- WIP 3 CAST 2023 plus Narrow Forest Buffers on Fenced Pasture Corridor
- WIP 3 CAST 2023 plus Grass Buffers on Fenced Pasture Corridor
- WIP 3 CAST 2023 plus Narrow Grass Buffers on Fenced Pasture Corridor

Each test scenario was developed using the same geography (Chesapeake Bay Watershed), base year (2025), landuse (Current Zoning), and wastewater (WIP3) specifications that were used in the WIP 3 CAST 2023 scenario and two miles (10,560 ft) of each respective BMP were added in each test scenario. The "Compare Scenarios" tool (CAST/Results/Compare Scenarios) was used to determine the Edge-of-Stream loading reductions of the scenario as compared to the WIP 3 CAST 2023 version baseline. The scale of this evaluation was the West Viginia Potomac, i.e. additional BMP distribution and load comparisons were made at the West Virginia Potomac watershed scale. Table A.1 provides the loads output from the base and test CAST scenarios and the calculated, scenario minus base, pollutant reductions with appropriate unit conversions.

Table A.1 CAST Nitrogen, Phosphorus and Sediment loads and reductions of tested BMPs

		TN	TN	TP	TP	SED	SED
		EOS	Reduction	EOS	Reduction	EOS	Reduction
CAST Scenario	BMPs applied	(pounds/yr)	(pounds/mi/yr)	(pounds/yr)	(pounds/mi/yr)	(pounds/yr)	(tons/mi/yr)
WIP3 CAST 2023 version	All Base BMPs	11385659		765825		1415382442	
WIP 3 CAST 2023 plus FBFPC	Base +10560 ft	11385109	-275	765660	-83	1415254785	-32
WIP 3 CAST 2023 plus GBFPC	Base +10560 ft	11385184	-238	765668	-79	1415254338	-32
WIP 3 CAST 2023 plus Narrow FBFPC	Base +10560 ft	11385330	-165	765669	-78	1415256834	-31
WIP 3 CAST 2023 plus Narrow GBFPC	Base +10560 ft	11385337	-161	765671	-77	1415256710	-31