West Virginia Nonpoint Source Program Annual Report 2019

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west virginia department of environmental protection

Division of Water and Waste Management
Watershed Improvement Branch
Nonpoint Source Program

Nonpoint Source Program Annual Report

Submitted March 27, 2020

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West Virginia's Nonpoint Source (NPS) Program is funded by a Clean Water Act §319 Grant administered by the U.S. Environmental Protection Agency (USEPA).

Report prepared by
Timothy Craddock, NPS Program Coordinator

Acknowledgements: *Watershed Improvement Branch* (WIB) §319 Program acknowledges the efforts of all staff, partners and multiple stakeholders that contributed information in this report, and those who have played roles in projects, monitoring, outreach etc. The names and organizations are too numerous to mention but if you would like to know more about organizations in your area contact: *timothy.d.craddock@wv.gov*.

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Tables and Figures

Photo credits and other contributors

Cover: Riparian tree planting along the main stem of Elks Run in Shenandoah Junction – Kristen Bisom, WV Conservation Agency (WVCA). Other photos within this document are courtesy of Danielle Stewart, Brian Hurley, Kristen Bisom, Kristin Mielcarek, Philip Pack, Alana Hartman, Martin Christ, Tomi Bergstrom, Jennifer Liddle, Malden Elementary and Jason Crowder.

Alana Hartman, Sebastian Donner, Danielle Stewart, Brian Hurley, Kristen Mielcarek, Dennis Burns, Philip Pack, Jeffery Bailey for the Muddy Creek story, Martin Christ and Jason Crowder.

The annual report is not possible without contributions from WIB staff and variety of partners through their semi-annual reports and other summaries/information requested by the NPS Coordinator. The cooperation from ALL is outstanding. Although many contributed to the report contents, I would like to specifically acknowledge the persons listed in the box for their contributions.

Executive summary

In 2019 West Virginia's NPS Program provided technical and financial support to 92 programs and projects ranging from general administration to outreach, planning, monitoring and a wide variety of implementation. Most of the projects focus on priority areas identified within our watershed based plans (WBPs), but other partners and stakeholders implement projects in non-priority areas using their required matching funds, or by taking advantage of *additional grant opportunities* (AGOs). *Table 1* provides a summary.

Table 1. §319 Program project categories.

FY	§319-NP	§319-WP	Complete
15	4/11	9	24
16	4/13	7	15
17	4/9	9	5
18	2/8	10	0
19	3/0	8	0

100% of the FY15 projects were completed on-time, and several were under budget. FY16 62% are complete; FY17 24% are complete; FY18 and 19 zero projects are complete. *Appendix 3* provides additional information.

Note: NP (Nonpoint); WP (Watershed projects). AGOs are included in the NP category.

Implementation

Best management practices (**BMPs**)

BMP implementation and NPS pollutant reduction are the major goals of our watershed projects. The efforts of our dedicated staff, partners and local stakeholders have made significant impacts in restoring and protecting our watersheds impacted and threatened by NPS pollution. In 2019 BMP implementation occurred in *24 different HUC12 watersheds*. The WV Conservation Agency (WVCA) contributed significantly due to their statewide *agriculture enhancement programs* (AgE). *Table 2* summaries 2019 BMP implementation. Additional details are provided on *Figure 2* and *Appendix 1*.

Table 2. 2019 BMP implementation.

BMP IMPLEMENTATION	Q	U
ALTERNATIVE WATER	5	IU
WATER WELL	6	IU
CONSERVATION EASEMENT	155	AC
FENCING	18,981	FT
HEAVY USE PROTECTION	1,000	SQFT
IRRIGRATION PIPLINE	1,084	FT
NUTRIENT MANAGEMENT	1,750	AC
PRESCRIBED GRAZING	504	AC
SEPTIC (NEW/EXSISTING)	24	IU
SEPTIC (PUMPOUT)	42	IU
STREAM RESTORATION	1,115	FT
OUTREACH/EDUCATION	6,732	IU

Q (quantity), U ((units), IU (individual unit), AC (acres), FT (feet), SQFT (square-feet)

Septic systems include new installation, repairs and pumping. Fencing includes pasture, division and streamside. Nutrient management often includes a wide variety of practices specific to the situation. Water systems include a variety of alternate water options and their components such as piping, trenches and wells. More specifics can be found in the appendices of this report and in USEPA's Grant Record Tracking System (GRTS).

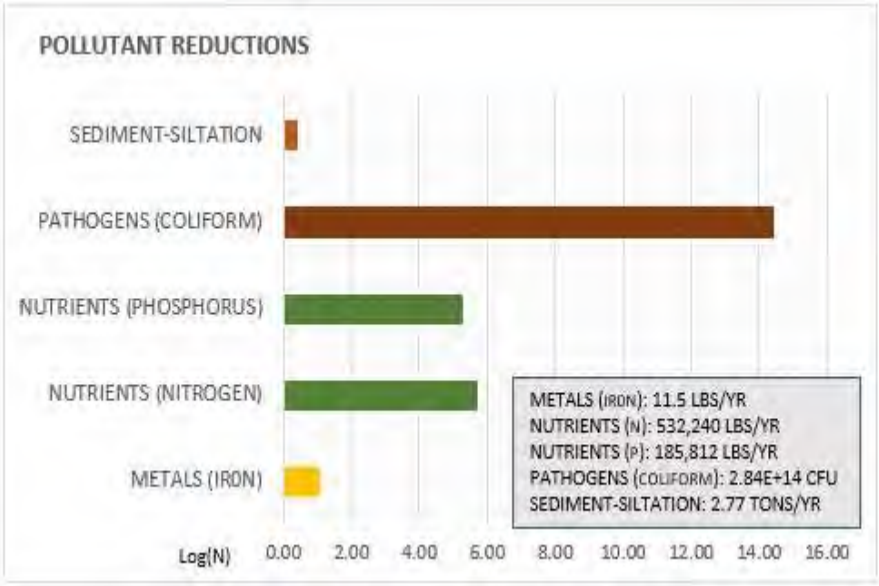
Pollutant load reductions

In West Virginia bacteria and pollutants associated with AMD are the two largest contributors of nonpoint sources accounting for approximately 70 percent of the impairments.

Most of the bacteria loads come from agriculture and failing septic, whereas the AMD pollutants (acidity and heavy metals etc.) are associated with abandoned mining. Note: WV did not report any AMD related reductions in 2019. In addition to the West Virginia priorities, EPA's National §319 Program promotes the reduction of nutrients and sediment, which are the leading causes of NPS impairment nationwide. Although nutrients and sediment are not our primary focus, we have exceeded our 2014 Management Plan goals. Note: West Virginia's NPS Management Plan was revised in 2019. Learn more on *page 25*.

Figure 1 provides a snapshot of §319 and AgE pollutant reductions from projects completed in 2019. The bar graph compares the amount of reduction from each major category. A log conversion was used to normalize the data for the graphical comparison.

Figure 1. Pollutant reductions that occurred in 2019.



These reductions are a result of projects implemented in 24 HUC12 watersheds. WVCA's AgE Program provided a significant contribution in the nutrient sector. Log conversion was used so that the numbers could be compared graphically. The method does not reflect real-differences due to units.

Figure 2 provides a map of the HUC12 watersheds where BMPs were implemented and pollution reductions occurred. *Appendix 2* provides additional details.

Chesapeake Bay Program

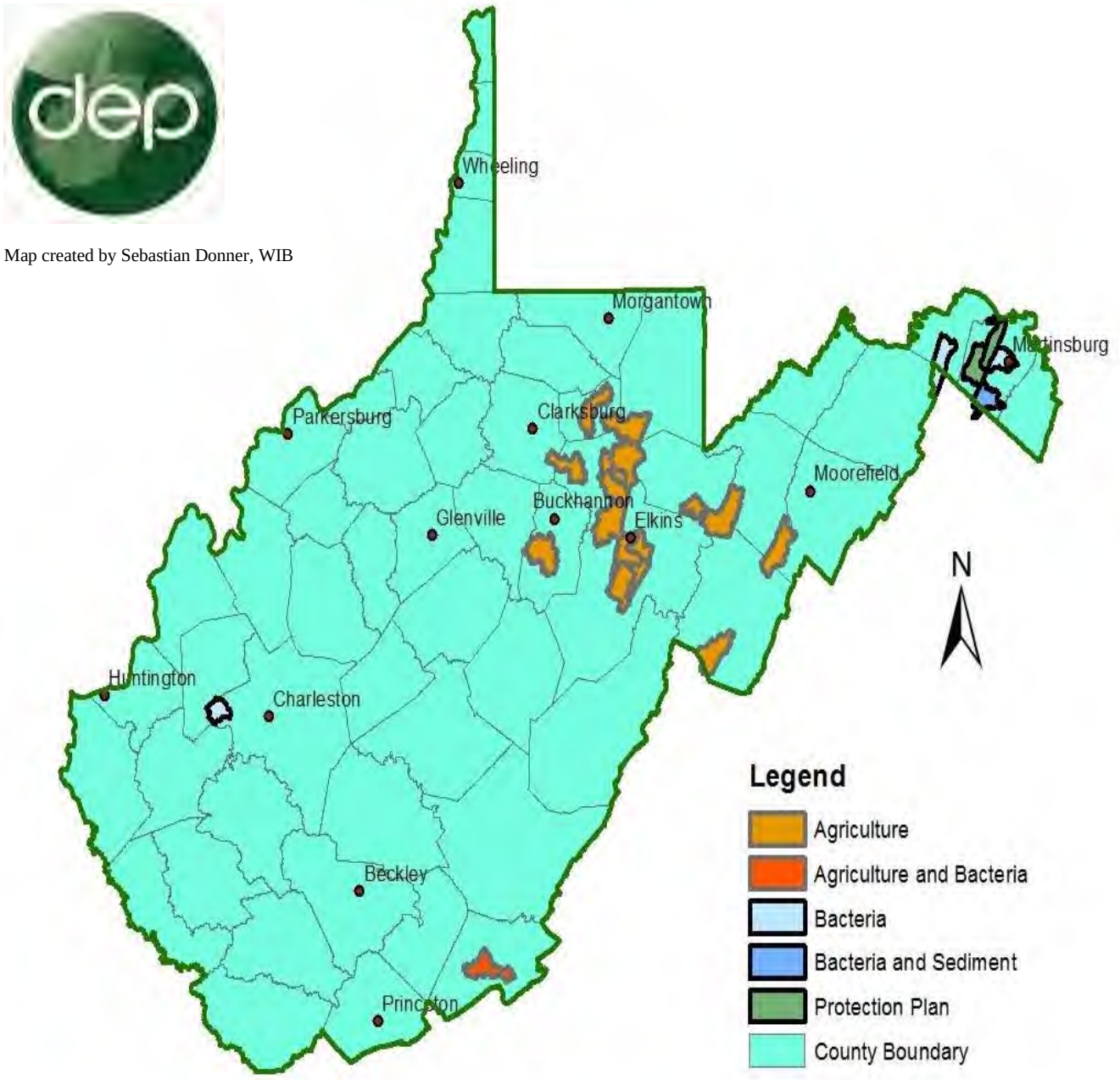
Nutrient reductions are important for restoration of the Chesapeake Bay (CB) watershed, and West Virginia is on track to meet the goals and objectives of its *Watershed Implementation Plan* (WIP). In 2019 West Virginia completed Phase III of the WIP, which includes program and practice goals needed by 2025 in order to meet the CB TMDL.

Table 3. Progress towards reducing CB pollutants goals.

Pollutant	Category	Progress (Baseline)	Progress 2018	Progress 2019	WV WIP3
Nitrogen	Agriculture	3.22	3.13	3.14	not specified
	Urban Runoff	1.21	1.21	1.21	
	Wastewater+CSO	0.7	0.5	0.52	
	Septic	0.33	0.33	0.33	
	Natural+Deposition	2.6	2.56	2.57	
	All Sources	**8.06**	**7.72**	**7.77**	**7.5**
Phosphorus	Agriculture	0.13	0.12	0.13	not specified
	Urban Runoff	0.06	0.06	0.06	
	Wastewater+CSO	0.14	0.04	0.04	
	Septic	0	0	0	
	Natural+Deposition	0.21	0.2	0.2	
	All Sources	**0.56**	**0.43**	**0.43**	**0.38**

Table 3 shows historic, recent and WIP3 loads of nutrient pollutants. WVDEP attributes the increase in modeled wastewater loads to the heavy rain events, which caused more than the typical number of Combined Sewer Overflow events. Progress is ongoing in the other sectors but appears to be dampened in the model due to the expiration of some previously-reported practices over time. CB partners are renewing efforts to verify and maintain these older practices in order to keep them active in the model.

Figure 2. BMPs and load reductions in HUC12 basins.



Map created by Sebastian Donner, WIB

See *Appendix 1* and *Appendix 2* for more details.

Partnerships

Partners, staff, local landowners and many other stakeholders are the KEY to past, current and future success of West Virginia's Nonpoint Source Program. Without their dedication the majority of project implementation is not possible. *Table 4* provides a list of partners by fiscal year (FY) active in 2019, alphabetized in each FY.

To learn more about a particular group, contact the *NPS Coordinator*.

Table 4. Partners active in 2019.

FY 15 projects	Type
Buckhannon River Watershed Association BRWA	WG
Canaan Valley Institute CVI	NGO
Elks Run Watershed Association ERWA	WG
Experience Learning	NGO
Friends of Hughes River FOHR	WG
Friends of the Cheat FOC	WG
Local landowners	WG
Piney Creek Watershed Association PCWA	LO
US Environmental Protection Agency USEPA	WG
WV Conservation Agency WVCA	AG
WVDEP-Watershed Improvement Branch WIB	AG
National Mineland Reclamation Center NMLRC	CO
FY 17 projects	**Type**
Friends of Blackwater FOB	WG
Friends of Deckers Creek FODC	WG
Friends of the Cheat FOC	WG
Guardians of the West Fork GWF	WG
Local landowners	WG
Morris Creek Watershed Association MCWA	LO
Piney Creek Watershed Association PCWA	WG
US Environmental Protection Agency USEPA	WG
WV Conservation Agency WVCA	AG
WV Rivers Coalition WVRC	AG
WVDEP-Office of Abandoned Minelands OAML	NGO
WVDEP-Office of Special Reclamation OSR	AG
WVDEP-Watershed Improvement Branch WIB	AG
National Mineland Reclamation Center NMLRC	AG
FY 19 projects	**Type**
Buckhannon River Watershed Association BRWA	WG
Friends of Deckers Creek FODC	WG
Friends of the Cheat FOC	WG
Local landowners	LO
Piney Creek Watershed Association PCWA	AG
Save the Tygart Watershed Association STTWA	WG
US Environmental Protection Agency USEPA	AG
WV Conservation Agency WVCA	AG
WV Rivers Coalition WVRC	NGO
WVDEP-Watershed Improvement Branch WIB	AG
National Mineland Reclamation Center NMLRC	CO

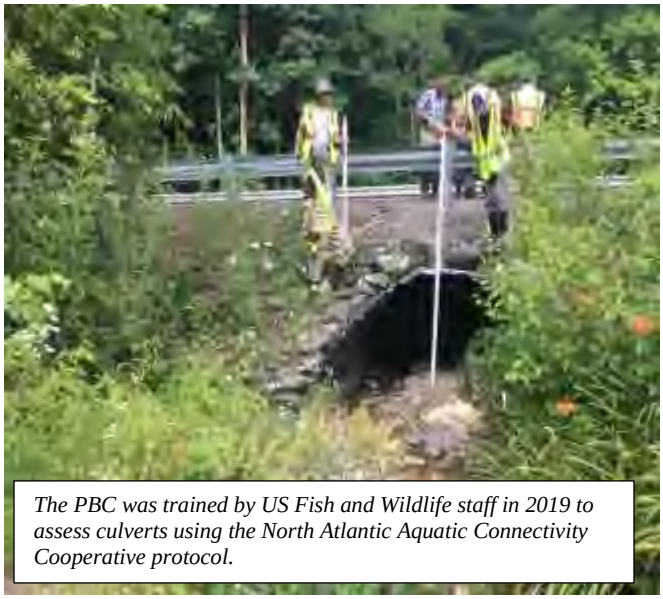
FY 16 projects	Type
Blue Heron Environmental Network BHEN	WG
Canaan Valley Institute CVI	NGO
City of Charleston Stormwater Dept.	TO
Coal River Group CRG	WG
Friends of Blackwater FOB	WG
Friends of Deckers Creek FODC	WG
Friends of the Cheat FOC	WG
Goodnews Mountaineer Garage	BU
Local landowners	LO
Save the Tygart Watershed Association STTWA	WG
Sleepy Creek Watershed Association SCWA	WG
US Environmental Protection Agency USEPA	AG
WV Conservation Agency WVCA	AG
WVDEP-Watershed Improvement Branch WIB	AG
WV Rivers Coalition WVRC	NGO
FY 18 projects	**Type**
Blue Heron Environmental Network BHEN	WG
Coal River Group CRG	WG
Experience Learning	NGO
Friends of Blackwater FOB	WG
Friends of Deckers Creek FODC	WG
Friends of the Cheat FOC	WG
Local landowners	LO
Piney Creek Watershed Association PCWA	WG
Save the Tygart Watershed Association STTWA	WG
US Environmental Protection Agency USEPA	AG
WV Conservation Agency WVCA	AG
WV Rivers Coalition WVRC	NGO
WVDEP-Office of Abandoned Minelands OAML	AG
WVDEP-Office of Special Reclamation OSR	AG
WVDEP-Watershed Improvement Branch WIB	AG
National Mineland Reclamation Center NMLRC	CO

Legend (types)
AG: Agency (State/Federal), **BU**: Business, **CO**: Colleges/University, **LO**: Local landowners, **NGO**: Nongovernmental organization, **TO**: City/Town, and **WG**: Watershed groups

Click-Here to learn more

WIB and WVCA highlights

Potomac Basin



The PBC was trained by US Fish and Wildlife staff in 2019 to assess culverts using the North Atlantic Aquatic Connectivity Cooperative protocol.

WIB's *Potomac Basin Coordinator* (PBC) supervised a summer intern who assessed eroding streambanks and other aspects of the two remaining major tributaries of Back Creek, completing this task as identified in the Back Creek Protection Plan. The PBC continued to co-facilitate Tuscarora Creek project meetings and was a technical lead for a CB-funded culvert analysis project in Tuscarora and Mill Creek watersheds, where Cacapon Institute prioritized those where improvements would benefit fish and reduce sediment loads. She served as a project liaison for a spring tree planting event and an intensive Green Infrastructure analysis and charette in the Town of Romney. She taught students about aquatic organisms and water chemistry at Hampshire County 4-H camp, a kindergarten field trip, a homeschool field trip with Save Our Streams, and two Envirothon training sessions. The PBC continued to facilitate meetings of the CB Tributary Team and to submit BMP data from various sources to the CB Program. This year, the PBC coordinated the responses to public comments for the Phase 3 Watershed Implementation Plan. The PBC also presented details of Cacapon River's algae impairment at a local workgroup meeting hosted by the Natural Resources Conservation Service staff in Moorefield, WV.

Northern Basin

Friends of Blackwater measures flow in Sand Run in order to convert fecal counts into a pollutant load.

WIB's *Northern Basin Coordinator* (NBC) continued to support several Non-Governmental Organization partners in carrying out the work of eliminating nonpoint source pollution. He invited Somerset Environmental Services to visit a site of interest to the Guardians of the West Fork to experiment with an aeration system that might help treat their mine drainage. He supported the Friends of the Cheat by attending a pre-proposal visit to their Dream Mountain project for potential project design engineers. He met with Friends of Deckers Creek and one of their project engineers for a final walk-through and calibration of the Valley Highwall #3 project. He assisted Save the Tygart Watershed Association as they monitored Beaver Creek of the Tygart with limestone sand. He led a monitoring trip to Swamp Run of the Buckhannon River to confirm that one of the Buckhannon River Watershed Association's projects will address the only remaining untreated mine-drainage impaired tributary. He helped Friends of Blackwater monitor for fecal coliform pollution in Sand Run of the North Fork of the Blackwater.

In addition to field work, the NBC continuously advised all these groups on carrying out their projects to eliminate nonpoint source pollution. The work included reviewing and editing project proposals, quality assurance project plans, and watershed-based plans. The work also included attending problem-solving meetings, phone calls, and emails as groups encountered problems such as high contractor bids and very long permit reviews. The NBC also helped maintain information in the GRTS database and transferred information from projects to the WQX-Web database.

Friends of Deckers Creek and the NBC met with the engineer to learn the operation of the Valley Highwall #3 site.

Western Basin

Stream structures after their installation on Morris Creek.

The *Western Basin Coordinator* (WBC) worked with Friends of the Hughes River Watershed to complete their baseline water quality monitoring project above their drinking water intake on the North Fork of the Hughes River. She assisted Morris Creek Watershed Association with reporting on their lavender planting project and the installation of structures and trees to reduce erosion along Morris Creek. She worked with Coal River Group to submit an additional proposal for their successful Browns Creek Septic Remediation Project. The project has pumped out several tanks and replaced 14 failing septic systems, ongoing monitoring is already showing a reduction of fecal coliforms. The WBC worked with several partners on the Cane Fork Acid Mine Drainage project to amend the proposal and deploy two sondes. She supervises an assistant that has been involved with routinely retrieving data from the sondes. Her assistant is also working with Fourpole Creek Watershed Association to form a project committee for the Fourpole Creek WBP.

The WBC and her assistant are involved in dozens of outreach events across the state. They presented at and helped organize 15 water festivals, discussed water monitoring at two summer camps, spoke on stormwater pollution at MS4 outreach events, and taught flow, macroinvertebrate sampling, and ecology at two Trout Unlimited 'STREAM GIRLS' badges with the Black Diamond Girl Scouts. Partnering with the City of Charleston Stormwater Department, the WBC worked with the Watershed Improvement Branch to sponsor a FestivALL event as a single-use plastic free event to highlight plastic and stormwater pollution, set up booths at the children's art fair and provide information at the Water Dance. She also hosted five rain barrel workshops, sharing stormwater education with over 100 citizens of the Kanawha Valley. Additionally, her assistant initiated a Rain Barrel in Schools program, the rain barrels are scheduled to be installed in the spring of 2020.

Successful septic replacements – Browns Creek

Southern Basin

WVDEP WIB, OSR and OAMLR partner to provide on-going monitoring for the Summerlee project.

There are many watershed group and Agency funded §319 projects in the southern basin. The *Southern Basin Coordinator* (SBC) worked with Piney Creek Watershed Association (PCWA) and Plateau Action Network (PAN). I have worked with PAN on Summerlee Phase 3 monitoring for the next design phase conducting monthly sampling. WVDEP's AML program is going to take on this project and I am the point of contact between AML and Special Reclamation who is also advising on sampling protocols and design treatment options. The PCWA closed out one of their 319 projects and has transitioned to a new Executive Director.

Working with Project WET Coordinator, four Water Festivals in the Southern Basin reached over 1000 5th grade students. I worked closely with Friends of the Second Creek Watershed Association (FOTSC) helping with grant applications for them to hold the Monroe County Water Festival in 2020. The Greenbrier County Water Festival is being coordinated with the Greenbrier River Watershed Association and the Fish and Wildlife Service Fish Hatchery in White Sulphur Springs and has been well received by the Board of Education already approving the transportation funds for the students to attend Earth Day 2020.

Training: Project WOW, Project WET, Project Learning Tree, Project Little Feet, SOS Certified; attended Rain barrel workshop; WVRAM training, AMD treatment with Special Reclamation; Partnering with In Lieu Fee program on stream restoration project in Huff Creek and taking opportunities to learn from their current construction projects, observed pipeline stormwater inspection.

Project Wet

The West Virginia *Project WET Coordinator* had a productive year attending over 26 outreach events and reaching around 1,900 West Virginians across the state. She hosted, organized, and presented with her partners at 15 water festivals which were focused in Kanawha, Cabell, Nicholas, Ritchie, Fayette, Wetzel, Pocahontas, Wyoming, and Raleigh counties and reached over 3,400 students. Project WET K-12 Educator, Pre-K – 2 Getting Little Feet Wet, and K-12 WOW! The Wonders of Wetlands workshops were held in 14 different counties, certifying 324 educators age

appropriate guidebooks to teach water education. The coordinator also presented at the West Virginia Science Teachers Conference.

Wetzel County Water Festival students and Make A Splash in Kanawha County Water Festival, these two events reached over 500 students. Students learned about nonpoint source pollution, water conservation, stream ecology, acid rain, the water cycle, and more.

Stormwater Assistance

The *Stormwater Specialist* works with other state agencies, local government, developers, engineers, Home Owner Associations, and interested parties on implementing BMPs to reduce and treat stormwater runoff. The goal is to improve the water quality in our streams by reducing pollutants and the quantity of developed lands runoff. While assisting statewide, his primary service area is the Potomac watershed. Goals of the Chesapeake Bay grants and §319 funding overlap in a number of aspects. Whenever possible the SWS tries to direct projects to Bay funding instead of the more limited §319 funds. Being funded through the Chesapeake Bay program, he tries to leverage local investments with Chesapeake Bay grant funding for implementation efforts in the Potomac watershed.

SOS mentors school groups across the state, Here the Coordinator is with Malden Elementary who's students have worked on projects in Morris Creek for many years.

Save Our Streams

WVDEP's *Save Our Streams Coordinator* (SOS) has been a part of a variety of events promoting the WIB mission statement. There is a truly meaningful word within our mission statement of being empower. One is not truly empowered without knowledge. SOS rises to this challenge in a way that is needed. To empower is a gift, one in which SOS does not falter in giving.

Over 18 workshops were conducted ranging from watershed groups, academia of all ages, and agency partnerships. Beyond that over a dozen water festivals were attended reaching 100's of WV students, all part of assisting Basin Coordinators. Also, in assisting Basin Coordinators, benthic classes and chemistry presentations have been conducted. SOS has a great relationship with Trout Unlimited (TU), assisting and leading trips regarding Trout in the Classroom and project management statewide. 2020 is shaping up to be a busy year. Projects lie waiting for sample season with WV watershed groups, TU, WVCA, WVDNR's Master Naturalist, Envirothon, Project Healing Waters, Rivers of Recovery, Mayfly Project, and of course multiple SOS projects. This year will see the start of Stream Stories, a place to tell our stream's story.

WV Conservation Agency

WVCA provides a significant amount of services to agricultural (Ag) communities, watershed groups, academia and the public through AgE programs, outreach and §319 project management. 2019 highlights are provided here.

1. AgE programs are a major tool for improving agricultural landscapes and providing technical assistance statewide. AgE efforts are managed through local Conservation Districts. AgE programs helped producers implement a variety of BMPs - the major focus to improve nutrient management. AgE specialist also provided technical assistance. A total of 964 producers were assisted. These activities are the primary source of state match for WVCA's annual §319 request, which is part of WVDEP's Nonpoint Program grant.
2. WVCA commits significant time and effort to outreach/education focusing on sustainable and high-quality Ag programs, nonpoint source information, water quality etc. In 2019 28 outreach programs occurred providing education to > 6,500 participants. This included presentations, school activities, special events/programs, camps, Envirothon, Ag field days, Soil Tunnel demonstrations etc. WVCA partners with WVDEP and other agencies and NGOs to support the *Stream Partners* Program. WVCA also participated in planning and organizing workshops for West Virginia's annual Construction EXPO.
3. WVCA is dedicated to improving watersheds impacted by Ag-related NPS pollution. In 2019 WVCA specialists provided project management support for 13 §319 watershed projects. These activities include planning, developing and writing project proposals and WBPs, technical assistance, right-of-entry agreements, contracts/bids, tracking, reporting, monitoring and more.

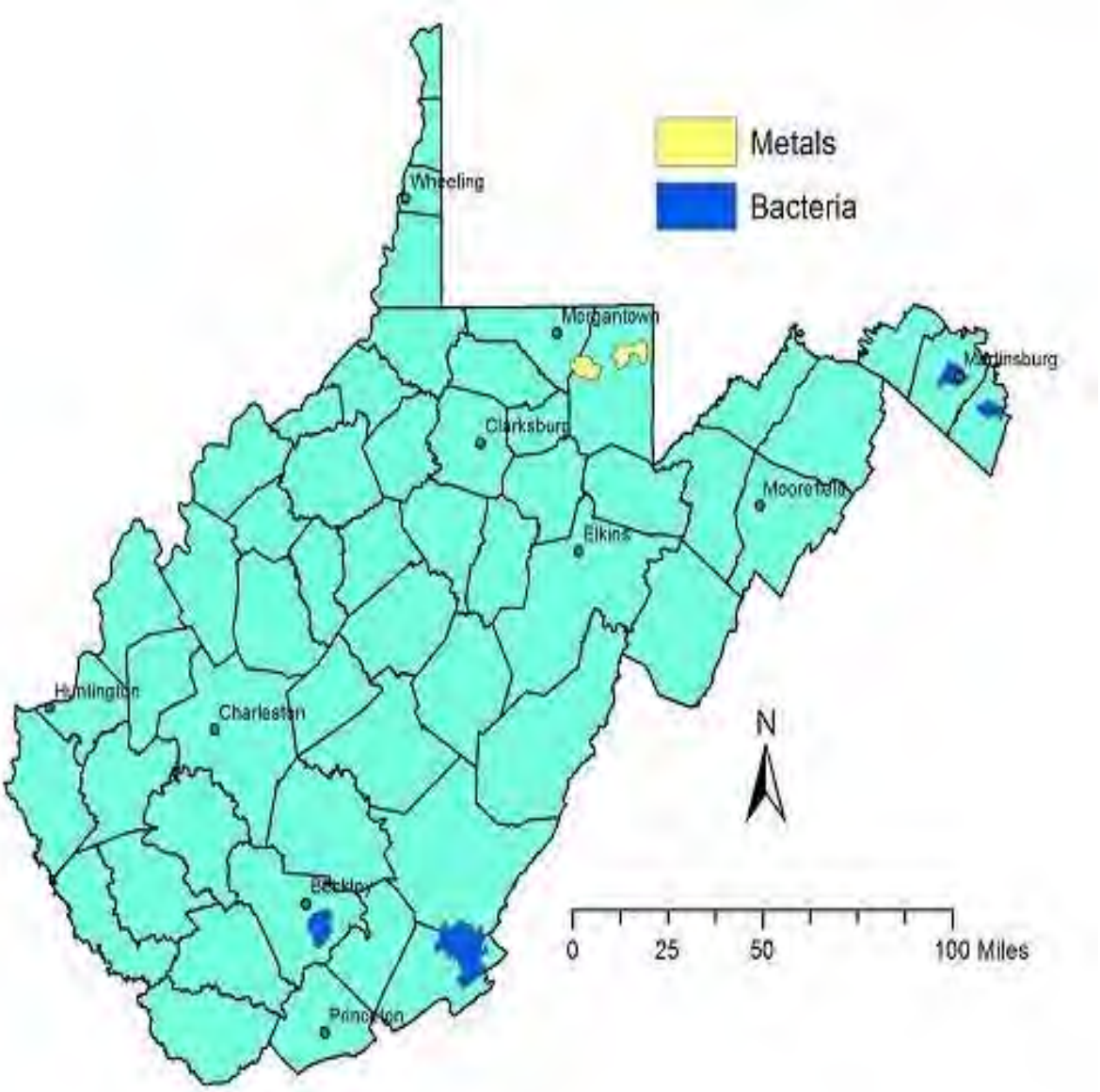
To learn more visit: *http://www.wvca.us/*

Heavy use protection BMPs in Berkeley County - Before and after photos.

Watershed project highlights

In 2019 10 watershed, six AGO and eight nonpoint projects were completed. This next section will highlight three completed projects. Final project summaries from the other categories (i.e. AGOs) are available upon request. Additional project information is available from USEPA's GRTS *public access portal*.

See *Appendix 3* for a project list and status update.



The map above provides the locations of the watershed projects, watershed plans and success stories highlighted in the next sections of this report. Map is courtesy of *Sebastian Donner*, WVDEP's stormwater specialist.

YMCA Barren Lands

Piney Creek Watershed Association (PCWA)
Contact(s): *Danielle Stewart* and *Jennifer Liddle*

Watershed information

HUC8	05050004 – Lower New River	
HUC12	050500040102 – Headwaters Piney Creek	
Stream code	WVKN-26	*GRTS #7*

Introduction

Figure 3. Google map showing YMCA project area.

Piney Creek is in the northwestern portion of the New River watershed in Raleigh County, West Virginia and drains approximately 136 square miles. Its basin includes three HUC12's: Headwaters of Piney Creek, Beaver Creek and Outlet of Piney Creek. The *Piney Creek WBP* was approved in 2012 to address impairments for iron, fecal coliform and sedimentation. The YMCA project targeted sediment and iron runoff from barren lands adjacent to the YMCA soccer fields.

Project highlights

The project involved landscape grading that emphasizes new and improved drainage features, wetland creation, re-vegetating barren areas and trail construction with signage to highlight the project. YMCA of Beckley and PCWA have a maintenance agreement to maintain and evaluate the site. Additional notable highlights include:

1. Coordination with the City of Beckley and YMCA to find and spread the best top soil for quick and healthy vegetation coverage.
2. PCWA contracted with the Southern Conservation District to help with most of the project management, as well as project construction. This partnership saved a significant amount of funds.
3. PCWA and volunteers partnered with WVDEP's REAP program and completed multiple site clean-ups. 50 abandoned tires and a significant amount of debris were removed from the site.
4. PCWA and local volunteers created a butterfly garden on-site; and
5. An extensive trail network on the perimeter of the site and into the Piney Creek gorge was created.

Results

Pollutant	LR actual	LR estimates
Sediment	0.25 tons/yr	0.27 tons/yr
Iron	11.5 lbs/yr	(None)

Table 5. YMCA barren lands project - load reduction actual v estimated.

Implemented BMPs reduced sediment from the site, which was deposited in the detention pond. The pond undergoes periodic maintenance per an MOU agreement with YMCA

Pre-monitoring photos below showed the amount of sediment leaving the site before it was vegetated. Land re-shaping, re-grading and vegetation made a huge difference. Although no photo evidence is shown here the amount of sediment in the detention pond barely registered above zero following BMP implementation.

Project site March 2016

Project site August 2019

Partners and funding

Partners, such as work of the Southern Conservation District, in-kind volunteer efforts from PCWA and local volunteers through the multiple clean-ups, trail building, maintenance etc. and commitments from the local landowner (YMCA) resulted in significant dollar contributions.

Table 6. YMCA project financial contribution from partners and §319.

Partners		§319
Southern Conservation District	$25,189	$20,139
YMCA of Beckley	$36,529	
PCWA volunteer in-kind	$2,850	
Sub-total	$64,568	$20,139
Overall total	**$84,707**	

Valley Highwall Phase 3

Friends of Deckers Creek (FODC)
Contact(s): *Brian Hurley* and *Martin Christ*

Watershed information

HUC8	05020003 – Upper Monongahela	
HUC12	050200030201 – Headwaters Deckers Creek	
Stream code	WVM-8I-0.9	*GRTS #12*

Introduction

The Deckers Creek watershed drains approximately 64 square miles within the Monongahela Watershed throughout Monongalia and Preston Counties in north-central West Virginia. Deckers Creek and its tributary, Kanes Creek, are both on West Virginia's 303(d) list due to impairment by pH, iron, manganese, and aluminum resulting from acid mine drainage (AMD) from abandoned coal mines. The *Deckers Creek WBP* was approved in 2015.

FODC completed the Valley Highwall #3 (VH3) project in 2011. The system utilized active calcium hydroxide dosing to treat an unnamed tributary to Kanes Creek. As a consequence of delivering calcium hydroxide with a tipping bucket doser, incomplete mixing and accumulation of metal sludge precipitated along the effluent stream channel. This caused issues for landowners and as a result, the doser was taken offline until a means to more efficiently treat the acid water and prevent precipitates was established. FODC received 2015 §319 funding to upgrade the VH3 site by installing BMPs that will improve the reaction of the lime with AMD while simultaneously creating a space to separate and manage the metal precipitates.

Figure 4. Kanes Creek location within the larger Deckers Creek watershed.

Project highlights

This project was designed so that the flow from the mine first deposits into a siphon pool, when the pool fills, it triggers the bell siphon effectively emptying the bay for treatment. The water goes through a tromp creating air to power the mixing well. Water then flows through the dosing silo and triggers the tipping bucket which distributes hydrated lime. It is then piped to the mixing well and stirred to create even lime dissolution. After treatment, the water moves into multiple settling ponds that provide additional time and treatment, before exiting the system into the unnamed tributary (UNT) to Kanes Creek.

The site also features a large sludge collection pond so that settling ponds can be pumped often thus increasing retention time. The metals precipitated are contained to the site and not suspending in clean water exiting the system.

Results

FODC have yet to collect data from the outfall of the active system. When the system has been calibrated FODC will provide WVDEP with follow up data. Initial inspections and tests of the site shows that the system will work as intended. The upgrade is expected to eliminate approximately 90% of the AMD loads resulting in a potential decrease of acidity by 23,182 lbs/year, aluminum by 1,121 lbs/year and iron by 2,386 lbs/year.

Figure 5. Photos of VH3 upgraded settling ponds.

VH3 settling pond #2

VH3 settling pond #1 and mixer

Partners and funding

The Valley Highwall #3 active treatment site was completed in September of 2019 through the cooperative efforts of FODC, WVDEP-WIB, and Office of Surface Mining's Watershed Cooperative Agreement Program (WCAP). WCAP funds and in kind contributions from FODC covered construction costs and match. Table X provides a breakdown of the final costs.

Table 7. VH3 final expenditures.

Funding source	Projected	Actual
§319	$170,500	$170,500
WCAP	$ 93,600	$93,600
FODC and in-kind	$19,833	$28,450
Total	$283,933	$292,550

Mill Creek (Opequon) Implementation

Canaan Valley Institute (CVI)
Contact(s): *Kristen Mielcarek* and *Alana Hartman*

Watershed information

HUC8	02070004 – Conococheague-Opequon	
HUC12	050700040907 – Mill Creek	
Stream code	WVP-4-M	*GRTS #6*

Introduction

Figure 6. Mill Creek (Opequon) watershed.

USEPA approved the *Mill Creek WBP* in 2008. The plan focuses on nonpoint sources of pollutants identified in the 2008 Potomac Direct Drains TMDL, which include fecal coliform, sedimentation and biological impairments.

Project highlights/results

This project's original focus was fecal coliform reductions from repair/replacement of failing septic systems, pumping systems that required that maintenance, outreach and education, and monitoring. The major goals were not met due to lack of interest in the community. Thus, a shift in goals and spending was needed to move the project forward. Although the original load reduction goals were not met the changes implemented resulted in a successful project. These adjustments are described in *Table 8*.

Table 8. Mill Creek workplan adjustments.

Original workplan	*Revised workplan*
Upgrade/replace 10 septic systems in the western portion of the basin, which was identified as a priority in the WBP. Two septics were upgraded.	CVI used the remaining funds to complete a design for a future 800 ft stream restoration project. The projected sediment reduction is 52 tons/year.
25 coupons were advertised that provided 50% discount from the cost of septic system pumping. 10 systems were pumped.	CVI used the remaining funds for a riparian buffer enhancement. CVI coordinated with WVDOF and volunteers to plant trees/shrubs along two acres of riparian corridor.

Table 8 continued:

Original workplan	*Revised workplan*
Monitoring was planned to occur downstream of septic repairs/replacements at six month and one-year timeframes.	This task was not completed due to the low number of septic system repairs and pumping, as well as their locations in the watershed.

Repairs were made to a phase-1 project on the Conley property. Approximately 600 feet of eroding streambanks in the downstream section of a previously completed streambank stabilization project was repaired to meet original design and sediment reduction goals. The bed, riffles and pools were raised to the proper elevation to reduce channel entrenchment and increase access to the floodplain. Log vanes and in-stream structures were modified to function properly at the new bed elevations and deflect high flows from fragile banks. Native riparian vegetation, including trees, shrubs and bioengineering materials were planted to protect fragile banks.

***Two Watershed celebration events were conducted*.** Working with Opequon Creek Project Team (OCPT), Eastern Panhandle Conservation District (EPCD), WV Division of Forestry (WVDF), Cacapon Institute (CI), WVDEP-WIB, Berkeley County Health Dept. (BCHD), and CVI coordinated two watershed celebration events focused on informing local citizens on stormwater and wastewater management practices. Topics included: effects of wastewater pollution on a watershed, proper maintenance and care of septic systems, alternative options to traditional wastewater systems, available financial assistance, rain barrel and stormwater management demonstrations, and benthic macroinvertebrate sampling and identification.

Pollutant reductions from the Mill Creek project are provided in *Table 9*.

Table 9. Mill Creek (Opequon) load reductions.

Practices	Q	Goal	Result	LR-goal	LR-result	Units
Septic upgrades	IU	25	2	5.90E+13	1.18E+13	CFU/100 mL
Riparian buffer	AC	NA	2	-	1.92E+10	CFU/100 mL
Load reduction totals:					**1.18E+13**	CFU/100 mL

Partners and funding

WVDEP/USEPA provides funding and technical support regarding grant management etc. **OCPT**, the local nonprofit watershed group was actively engaged in activities throughout Tuscarora and Mill Creek watersheds. **CI and others** partnered with CVI on planning and watershed celebration events. **BCHD** informed citizens of septic pumping, repair and replacement programs in eligible areas, and provided information about the Onsite Loan Program (OSLP). **WV Housing Development Fund's** OSLP was offered to assist landowners in funding septic upgrades that are not covered by the grant. BCHD staff also provided technical support and oversight of contractors who installed/repaired septic systems.

Table 10. Mill Creek expenditure comparison

Practice	§319 expenditures		
	Actual	Invoiced	Difference
Septic upgrade/pumping	$49,844	$26,214	$23,630
Stream repair (Conley)	$64,633	$66,197	-$1,564
Watershed celebration	$2,463	$1,566	$897
Fecal monitoring	$3,450	$0	$3,450
Stream restoration design	$15,295	$9,947	$5,348
Buffer planting	$5,527	$3,426	$2,101
Project management	$3,489	$3,194	$295
Totals	**$144,701**	**$110,544**	**$34,157**

Watershed plan highlights

2019 was another active year for watershed based plan (WBP) development. Six WBPs were submitted to USEPA, and all but one has been approved (*Table 7*). In this report Elks Run, Second Creek and Tuscarora Creek WBPs are highlighted.

Table 11. 2019 WBP development.

Watershed plan	HUC12	HUC12_name	HUC8_name	Pollutant	Org
Anderson Run	020700010602	Anderson Run	South Branch Potomac	Bacteria/sediment	WVCA
Beaver Creek	050200040202	Middle Blackwater River	Cheat River	Metals/pH	FOB
Big Sandy Creek	050200040604	Beaver Creek - Little Sandy Creek	Cheat River	Metals/pH	FOC
	050200040604	Middle Big Sandy Creek	Cheat River	Metals/pH	FOC
	050200040605	Lower Big Sandy Creek	Cheat River	Metals/pH	FOC
Muddy Creek	050200040703	Muddy Creek	Cheat River	Metals/pH	FOC
North Fork Greens Run	050200040705	Greens Run - Cheat River	Cheat River	Metals/pH	FOC
Anthony Creek	050500030502	North Fork Anthony Creek	Greenbrier River	Bacteria	WVCA
	050500030503	Upper Anthony Creek	Greenbrier River	Bacteria	WVCA
	050500030504	Middle Anthony Creek	Greenbrier River	Bacteria	WVCA
	050500030505	Lower Anthony Creek	Greenbrier River	Bacteria	WVCA
Six WBPs submitted (11-HUC12s) Five received EPA approval			WBP website	Under development	
				Active	

Table 12. 2019 §319-NWQI Indian Creek implementation.

HUC name	BMP	#	Unit	Date	Program
Indian Creek	Alternative Water	1		Mar-19	NWQI
Indian Creek	Alternative Water	1		Sep-19	§319
Indian Creek	Alternative Water	2		Sep-19	NWQI
Indian Creek	Alternative Water	1		Sep-19	§319
Upper Indian Creek	Fencing	5,722	FT	Sep-19	NWQI
Upper Indian Creek	Fencing	5,700	FT	Sep-19	§319
Upper Indian Creek	Fencing	795	FT	Sep-19	NWQI
Upper Indian Creek	Fencing	1,144	FT	Sep-19	§319
Upper Indian Creek	Heavy Use Protection	500	SQFT	Sep-19	NWQI
Upper Indian Creek	Heavy Use Protection	500	SQFT	Sep-19	§319
Upper Indian Creek	Irrigation Pipeline	850	FT	Sep-19	NWQI
Upper Indian Creek	Irrigation Pipeline	234	FT	Sep-19	§319
Upper Indian Creek	Prescribed Grazing	214	AC	Sep-19	§319
Upper Indian Creek	Prescribed Grazing	290	AC	Sep-19	§319
Upper Indian Creek	Water Well	1	IU	Sep-19	NWQI
Upper Indian Creek	Water Well	1	IU	Sep-19	§319
Upper Indian Creek	Water Well	2	IU	Mar-19	§319
Upper Indian Creek	Water Well	1	IU	Sep-19	§319

NRCS has continued to support the National Water Quality Initiative (NWQI). In West Virginia the effort has moved from Knapp Creek to Indian Creek. A significant amount of implementation occurred in 2019 taking advantage of NWQI and §319 funding.

Several local project teams (PTs) are working to revise WBPs. In the Eastern Panhandle PTs are making progress towards the first WBP-Source Water Protection Plan (SWPP) integration. Multiple meetings have occurred in the and project teams have developed a matrix that compares the goals from WBP-SWPP to determine where the overlaps are, and which goals are more appropriate for the integration.

The project team have also developed a list of implementation projects that can be accomplished in the short-term, prior to the final document's development.

Elks Run watershed plan

Watershed information

HUC8: 02070004 – Conococheague-Opequon
HUC12: 020700041107 – Elks Run
Sponsor: WV Conservation Agency, Elks Run Watershed Association

Watershed description

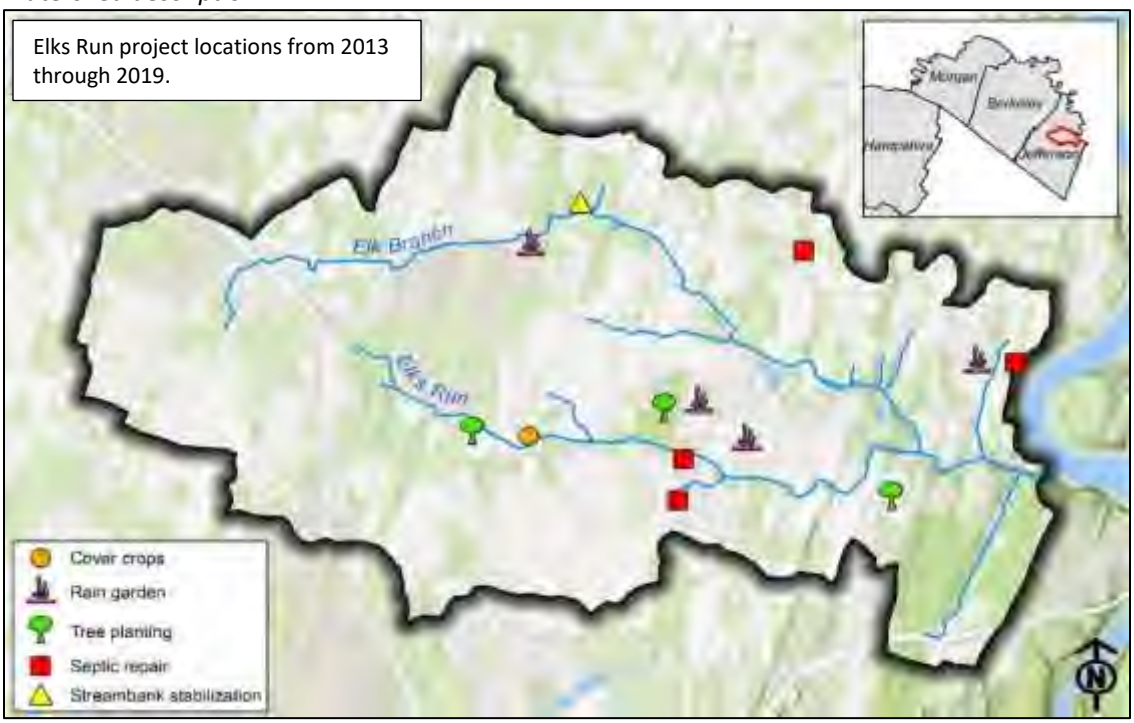


Figure 7. Elks Run watershed project locations.

The Elks Run watershed, located in Jefferson County, WV, is part of the Potomac Direct Drains and Chesapeake Bay watersheds. It drains approximately 18 square miles consisting mostly of grasslands (both agricultural and residential) and forests. Urban pervious and impervious are also significant land uses due to increasing development in the area. There are scattered areas of high population density within the watershed that rely on private septic systems. Elks Run serves as the drinking water source for the towns of Harpers Ferry and Bolivar.

Goals

The 2008 TMDL developed for Elks Run identifies fecal coliform bacteria and biological criteria as the major impairments for Elks Run and its major tributary Elk Branch. The biological criteria are linked to sedimentation and organic enrichment, for which fecal coliform levels serve as a surrogate. Approved in 2013, the *Elks Run WBP* identifies major sources of fecal coliform bacteria and sediment and proposes practices that will reduce the levels of these pollutants in the watershed.

Project highlights

Under the Phase I and Phase II 319 projects, four septic systems were repaired, an eroding streambank on Elk Branch was stabilized, 6.85 acres of trees were planted, and 100 acres of cover crops were planted. Additional activities under these projects included the refinement of a septic risk model for the watershed, an assessment of streambank erosion for Elks Run and Elk Branch, a pet waste campaign, a septic installers workshop, and monitoring that included molecular source tracking.

Visually the improvement to the streambank's condition is obvious. However, the results have not yet been quantified as the project needs time to mature. The habitat and biological response will be evaluated in the near future.

Before and after streambank stabilization on Elk Branch.

Table 13. Reductions from Elks Run Phase I-II implementation.

Practice	Units	Fecal coliform (CFU/100 ml)	Sediment (tons/yr)
Septic system repair	4 systems	6.27E+13	n/a
Streambank stabilization	57 ft	-	1.5
Forest buffer planting	2.75 ac	3.80E+10	2.9
Urban tree planting	4.1 ac	5.63E+10	4.3
Cover crops	100 ac	n/a	32.6
Total reductions		6.28E+13	41.3

Under the CBIG project, two demonstration rain gardens and two residential rain gardens treating 4.5 acres were installed. A rain barrel workshop was held and three videos highlighting rain barrels, rain gardens, and septic systems were created to assist with homeowner education. Future projects in the watershed will utilize the septic risk model, streambank assessment, and water monitoring results to prioritize practice implementation. WVRC *Safe Waters* Harpers Ferry initiative will also be used as a guide to target practices that will achieve the goals of both the WBP and the SWPP. Thus far, watershed projects have reduced approximately 1.7% of the fecal load and 1.3% of the sediment load. See *Appendix 5* for details.

Partnerships and funding

WVCA and WVDEP have partnered with the Elks Run Watershed Group (ERWG), which includes the utility Harpers Ferry Water Works, and private landowners to implement the WBP. Since its approval in 2013, two §319 projects and one Chesapeake Bay Implementation Grant (CBIG) project have been completed. These projects were matched with local funds and in-kind contributions in addition to WVCA state funds, including the Jefferson County Water Quality Improvement Project, which offers livestock exclusion and septic pumping cost-share programs to county residents. WVCA's AgE and USDA Farm Bill Programs are also implemented throughout the watershed.

Table 14. Elks Run §319-CBIG project expenditures.

Elks Run projects	§319	Match
Phase 1 (FY13)	$32,326 ($22,674)	$16,976
Phase 2 (FY16)	$64,019 ($981)	$48,377
CBIG	$109,273	$101,826
Totals	**$205, 618** ($23,655)	**$167,179**

Un-spent: §319 phase-1 experienced difficulty with septic program sign-ups but this improved dramatically during phase-2.

Second Creek watershed plan

Watershed information

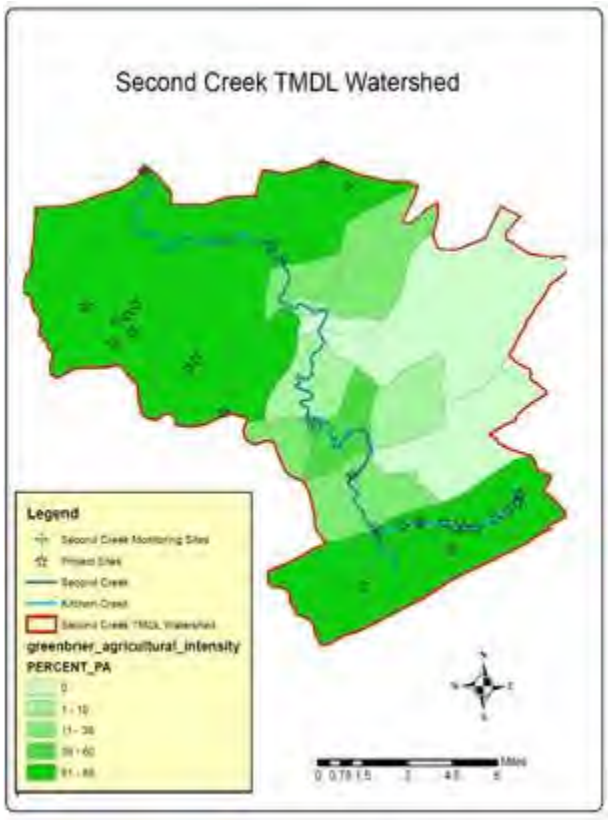
HUC8: 05050003 – Greenbrier River

HUC12: 050500030701 – Upper Second Creek, 050500030702 – Middle Second Creek, 050500030703 – Lower Second Creek

Sponsor: WV Conservation Agency

Introduction

Figure 8. Second Creek watershed.



Second Creek (WVKNG-23) is located in the southern portion of the Greenbrier River watershed in Monroe County (89%) and Greenbrier County (11%). The drainage area is approximately 124 square miles, 79,346 acres. Dominant land use in the watershed consists of 59% forest, 5% grassland, and 4% pasture, 26% karst pasture, and 5% karst cropland. Less than 1% of the watershed is urban. According to the Greenbrier River Watershed TMDL, impaired streams located in the Second Creek sub-watershed demonstrated the highest levels of fecal coliform as compared to other sub-watersheds, Upon approval of the 2009 WBP, work began on an upstream tributary known as Kitchen Creek. This area had the highest agricultural intensity directly on the stream and the highest concentrations of fecal coliform according to the TMDL.

Project highlights

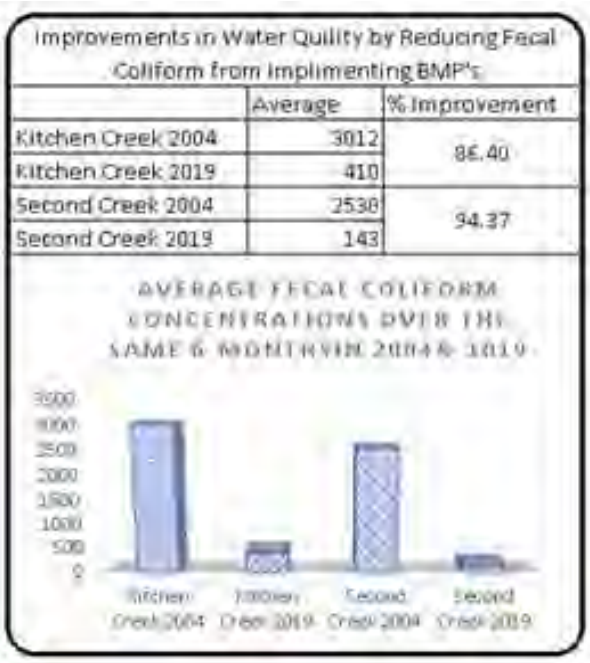
Between 2009 and 2014, 11 alternative livestock watering systems were put in place to allow for the development of over 100 acres of riparian buffer along six miles of stream.

In 2013 work began downstream along the mainstem of Second Creek. This included exclusion fence along six miles of stream for more than 100 acres of buffer, 11 alternative livestock watering systems, three waste storage facilities, and an alternative livestock feeding facility. Downstream along the mainstem of Second Creek an additional alternative livestock feeding facility, two alternative livestock watering systems, and 25+ acres riparian buffer were installed.

The karst area of the watershed was addressed beginning in 2014. These projects included many of the same practices with a focus on managed grazing systems and nutrient management to prevent bacteria-laden runoff from concentrating in sinkholes, caves, and other karst features. While these areas do not have open surface water running through the farms, continuously moving livestock to new grazing units prevents concentration of nutrients and bacteria from running off into the karst system. Two of the farms in these project areas were awarded 2016 and 2018 *Conservation Farm of the Year*.

Other practices implemented throughout the years included stabilized stream crossings, tree planting, pond and spring developments, solar and wind powered water pumping systems, livestock waste storage facilities, livestock exclusion and pasture division fencing. Additionally, other programs such as the United States Department of Agriculture's Conservation Reserve Enhancement Program (CREP) and Environmental Quality Incentive Program (EQIP), and WVCA's AgE Program were also used to help fund best management practices installed in the watershed.

Figure 9. WQ improvements in Second Creek



Results

While water quality data along Kitchen and Second Creek has been collected throughout the implementation phase of the plan, consistent monthly sampling began in the spring of 2019. Preliminary results from this sampling indicate a significant reduction in fecal coliform bacteria concentrations along both streams. Compared to the water quality data collected for the TMDL development in 2004, the 2019 data suggest an 86.4% reduction in fecal coliform bacteria along Kitchen Creek and a 94.4% reduction in fecal coliform bacteria along Second Creek. Details are provided in *Appendix 4*.

Partners and funding

Funding for these projects have totaled $1,132,088.00 of §319 funds over the past 10 years. In 2020, the *Second Creek WBP* will be revised so that progress can continue within the basin.

Table 15. Second Creek WBP funding summary.

§319 projects	§319 funds	Fiscal year funded
Kitchen Creek/Second Creek	$108,523	2009
Back Creek agricultural BMPs	$145,428	2010
Kitchen Creek 2	$49,520	2011
Kitchen Creek 3: Phase 1	$130,000	2010
Kitchen Creek 3: Phase 2	$98,000	2010
Kitchen Creek 3	$70,517	2012
Second Creek - Karnes	$182,000	2014
Kitchen Creek 4	$100,000	2013
Second Creek agricultural BMPs	$120,500	2015
Second Creek Karst	$$127,600	2016
§319: $1,132,088	Match: $754,726	
Total funds	**$1,886,814**	

Kitchen Creek riparian buffer.

Tuscarora Creek watershed plan

Watershed information

HUC8: 02070004 – Conococheague-Opequon
HUC12: 020700040907 – Tuscarora Creek
Sponsor: Canaan Valley Institute

Watershed description

Figure 10. Tuscarora Creek watershed

Tuscarora Creek, a tributary of Opequon Creek, is located in Berkeley County in the Potomac Direct Drains Watershed of West Virginia (*Figure 10*). It drains approximately 26 square miles and is approximately 11.7 miles long. Its major tributary, Dry Run, is 5 miles long. It is part of the Ridge and Valley physiographic province. It is characterized by karst terrain, so springs, sinkholes, and discontinuous drainage patterns are common. Kilmer Spring, occurring very close to the Tuscarora Creek mainstem, is a significant source of drinking water for the City of Martinsburg.

Goals

The 2008 TMDL developed for Tuscarora Creek identifies fecal coliform bacteria and biological criteria as the major impairments for Tuscarora Creek and its major tributary Dry Run. The biological criteria are linked to sedimentation and organic enrichment, for which fecal coliform levels serve as a surrogate. Approved in 2013, the *Tuscarora Creek WBP* identifies major sources of fecal coliform bacteria and sediment and proposes practices that will reduce the levels of these pollutants in the watershed.

Project highlights

The Tuscarora Creek project was developed to reduce a portion of the fecal coliform loads primarily through septic system upgrades and incentives for pumping septic systems. During the grant period, 13 septic systems were pumped and 3 failing systems were replaced or repaired, accounting for a reduction in fecal coliform of 1.88E+13 cfu/year. In addition, a Norweco Singulair Denitrifying Septic System was installed at Poor House Farm Park near the headwaters of Tuscarora Creek. This project replaced the traditional septic system at the facility with a more advanced system that added nitrogen removal capabilities. The project helps achieve the WIP goal of 100 denitrifying septic systems in West Virginia's Chesapeake Bay drainage. This project also serves as an education and outreach opportunity on BMPs for bacteria and nutrient reductions to our waterways.

The natural stream design of a 950-foot section of the stream experiencing high levels of erosion was completed which included the re-routing of the stream around an existing dam which acted as a fish passage barrier. This site was dominated by streambanks with moderate Bank Erosion Hazard Index (BEHI) scores. Restoration of this site reduced sediment loads to the creek by 19 tons/year. Thus far, watershed projects have reduced approximately 1.3% of the fecal load and 2.6% of the sediment load. See *Appendix 5* for details.

Figure 11. Before and after photos of the Tuscarora Creek stream restoration.

Eroding banks and dam at the stream restoration project site pre-construction.

Stream restoration project site post-construction.

The restoration/dam removal project is maturing, but habitat response is too soon to ascertain. Habitat and BEHI will be evaluated in the near future. The benthic community has responded positively to the improvements. The §319 Tuscarora Creek *Success Story* provides additional details.

Partners and funding

Implementation	§319	Match
Phase 1	$46,229	$25,451
Phase 2	$42,991	$37,776
§319 totals	**$89,220**	**$63,227**
CBIG	$109,225	$13,387
NFWF	$184,101	$60,584
Overall totals	**$382,546**	**$137,198**

Table 16. Tuscarora Creek expenditures (all sources)

CVI partnered with multiple organizations/agencies on the §319 and CBIG projects. Project partners included WVDEP, WVDF, BCHD, EPCD, and the OCPT. Additional tree plantings were funded by other programs such as the CommuniTree Program. CVI secured a National Fish & Wildlife Foundation (NFWF) Small Watershed Grant to complete the construction of a natural stream design and dam removal, which was a barrier to aquatic organism movement.

Volunteers from OCPT, city of Martinsburg and county partners assessed Dry Run for future opportunities to install sediment and stormwater. Once compiled, the information will be available for future implementation opportunities.

Management Plan updates

Clean Water Act (CWA) *§319 guidelines* require that all State NPS Programs revise their management plan every five-years. West Virginia's NPS Management Plan (WVMP) was revised and submitted in late spring 2019. After several iterations it was *approved* in December 2019.

The 2019 WVMP document can be downloaded *HERE*.

WVMP provides an overview of NPS programs, partners and the tools the program uses to continue to reduce the threats from nonpoint sources of pollution. In addition to CWA requirement, the document provides the public and partners a clear vision of West Virginia's NPS future goals and objectives.

West Virginia's 2014 management plan was the first in quite some time. It was a labor of love and required an extensive amount of time and partner involvement. Feedback from USEPA, partner agencies, WVDEP programs, watershed groups and others were critical to its success; and it was successful.

Short term goals and objectives are provided to USEAP with each §319 workplan and have remained consistent for multiple years, other than some minor changes that describe specifics in each grant year. West Virginia has been and continues to be successful in meeting these administrative goals.

Long-term goals for the previous WVMP were based on an analysis of past program trends in implementation, pollutant reductions etc. Over the past five-years, West Virginia's §319 Program continues to provide results that exceed expectations. For example, the 2014 WVMP exceeded pollution reduction goals by an average of 25.7 percent. *Table 17* compares pollutant reduction progress of the 2014 WVMP.

Table 17. WVMP load reduction progress 2014-2018.

Pollutants:		Acidity	Metals (total)	Nitrogen	Phosphorus	Sediment	Fecal coliform	
2014 WVMP load reduction goals		tons/yr	lbs/yr	lbs/yr	lbs/yr	tons/yr	cfu	
		300	140,000	280,000	220,000	6,000	1.70E+15	
Resutls	2014	46.5	25,042	262,963	129,369	7,803	2.28E+15	
	2015	97.4	49,017	397,811	381,282	7,878	9.64E+13	
	2016	161	102,667	853,890	344,793	11,287	6.20E+13	
	2017	27.8	20,689	141,217	17,654	2,963	1.07E+13	
	2018	22.3	24,046	120,902	43,777	3,340	8.82E+15	
Cumulative:		**355**	**221,461**	**1,776,783**	**916,875**	**33,271**	**1.13E+16**	Av. %Diff
% Difference:		4.2	11.3	36.4	30.7	34.7	36.9	25.7

Success Stories

Included here is an update on the Muddy Creek restoration efforts and WIB's most recent §319 approved Success Story.

Introduction

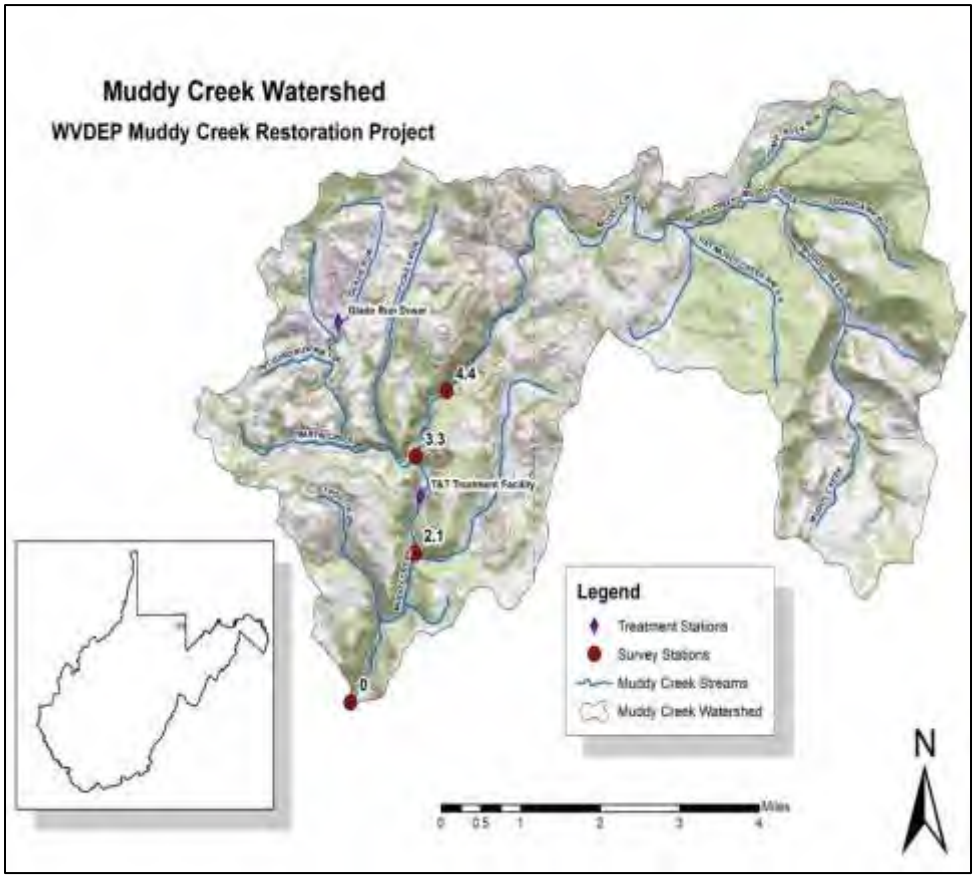
For decades, acid mine drainage (AMD) from pre- and post-law mining practices has negatively affected water quality in Muddy Creek. Water associated with past mining activities within the lower portion of the watershed severely degraded the biological community within the mainstem. This was especially apparent below the confluence of Martin Creek, which provides a significant source of AMD to Muddy Creek. The process of mining opens rock strata containing several constituents that when exposed to oxygen and water, creates a highly toxic effluent. This highly acidic effluent contains metals such as iron and aluminum that have deleterious effects on biological organisms.

To improve water quality, a sophisticated AMD treatment facility was built along Muddy Creek to treat multiple sources of AMD. The treatment facility began operating in March of 2018. This brief summary focuses on a few aspects of pre- and post-treatment data collected on the Muddy Creek mainstem by Watershed Assessment Branch (WAB) staff of the West Virginia Dept. of Environmental protection (WVDEP). The comprehensive report on the Muddy Creek restoration project is available *HERE*.

Project study area

Figure 12. Muddy Creek restoration project map.

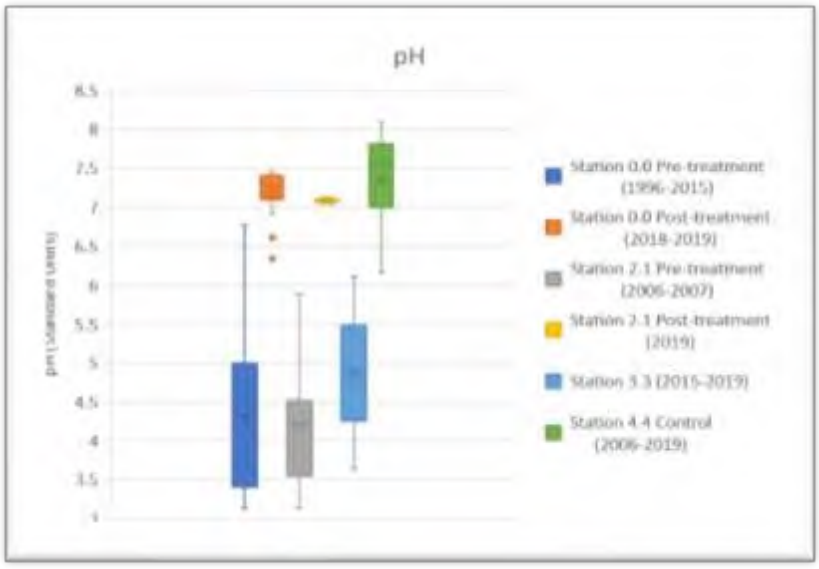
The Muddy Creek watershed spans 21,487 acres in West Virginia. Beginning near the community of Afton, WV, the creek flows to its confluence with the Cheat River near Albright, WV. Members of the WAB set up multiple assessment stations in the lower reaches of Muddy Creek to monitor biological conditions and their response to AMD treatment. These stations are 0.0, 2.1, 3.3, and 4.4. Stations 0.0, 2.1, and 3.3 were placed below AMD impacts. Station 4.4 was placed above the impacts to act as a control station. *Figure 11* is a watershed map that contains the locations of sample stations and AMD treatment stations.



Results

Water Quality

Figure 13. Pre- and post-treatment pH results.



WAB staff has collected 119 individual samples among the survey stations. These samples vary from simple field parameter discrete readings to comprehensive lab water quality analyses. Overall, water quality has been greatly improved by the installation and operation of the treatment system. A significant improvement in pH has occurred at stations 0.0 and 2.1 following the onset of treatment. Post-treatment pH values at stations 0.0 and 2.1 closely resemble station 4.4 values. Median pre-treatment pH values at station 0.0 were 4.32. Station 2.1 showed a pre-treatment pH median of 4.2. Post-treatment pH medians at these stations were significantly higher. Station 0.0 and 2.1 median pH values were 7.3 and 7.1, respectively. In comparison, station 4.4 pH median was 7.6. *Figure 12* is a box and whisker plot which shows the differences between pre-and post-treatment pH values. These higher pH values have in turn reduced the amount of metals present in the water like iron and aluminum. The improvement in pH and reduction of metals has greatly increased the ability for aquatic life to live within Muddy Creek.

Benthic Macroinvertebrates

Figure 14. Pre- and post-treatment WVSCI scores.

WAB uses the West Virginia Stream Condition Index (WVSCI) to assess the biological condition of streams. The WVSCI (range 0-100) summarizes family level identifications of benthic macro-invertebrate assemblages to assess the biological condition of wadeable streams with riffle/run habitats. This index includes six biological metrics that represent elements of the structure and composition of benthic macroinvertebrate communities. Because larval macroinvertebrates are relatively stationary, they are susceptible to changes in water quality. This makes them an excellent indicator for stream health. It is important to note that benthic communities are very complex and are susceptible to many environmental factors including stream discharge, stream habitat in relation to sedimentation, localized disturbances, and even life history strategies of different families.

Figure 13 shows WVSCI Index Scores from the sample stations. The impairment threshold for WVSCI is 72. This means that any score less than 72 is considered impaired, and sites scoring over 72 are considered unimpaired. At station 0.0, the WVSCI score improved from a pre-treatment median score of 22.7 to a post-treatment score of 64.9. Lower scores, like 22.7 for example, are considered severely impaired. The station 2.1 post treatment WVSCI score was 64.3. The sample median WVSCI score for station 4.4 was 77.7. It is important to note that pre-treatment WVSCI scores from stations 0.0, 3.3, and post-treatment scores from station 2.1 had benthic densities below 100 organisms, a result of severe impacts by AMD. The WVSCI requires samples to have at least 100 organisms for accurate scoring. Although displayed within this summary, WVSCI scores at stations with less than 100 organisms may score higher than expected, and likely do not fully represent the severity of impact by AMD.

Fish communities

Six fish community surveys have been completed between the Muddy Creek sample stations. Two surveys at station 0.0, one survey at station 2.1, one survey at station 3.3 and two surveys at 4.4. A pre-treatment survey was not taken at station 2.1 and a post-treatment survey was not taken at station 3.3 due to site relocation.

Table 18. Pre- and post-treatment fish community survey results.

Muddy Creek Fish Community Comparison Pre-treatment (2015) vs Post-treatment (2019)							
Mile Point	**0**		**2.1**		**3.3**	**4.4**	
Sample Year	**2015**	**2019**	**2015**	**2019**	**2015**	**2015**	**2019**
River Chub	No Fish Collected	111	Did Not Survey		No Fish Collected		
Smallmouth Bass		12					
Rock Bass		2					
Rosyside Dace		1					
Green Sunfish		3		12			
Mottled Sculpin		1		3		225	653
Spotfin Shiner		1					
Stonecat		2					
Rosyface Shiner		10					
Creek Chub				10		301	191
Western Blacknose Dace						461	485
White Sucker						22	82
Longnose Dace						26	27
Brown Trout						6	1
Rainbow Trout				1			2
Total Species	**0**	**9**	**0**	**4**	**0**	**6**	**7**
Total Collected	**0**	**143**	**0**	**26**	**0**	**1041**	**1441**
Fish/meter	**0.00**	**0.48**	**0.00**	**0.09**	**0.00**	**3.79**	**5.24**

Pre-treatment surveys taken at mile 0.0 and 3.3 yielded no fish due to extensive AMD impacts. After treatment began, water quality conditions became favorable for fish passage into the Muddy Creek mainstem. In 2019, the fish community survey at station 0.0 collected 143 individual fish comprised of 9 unique species. The fish community survey at station 2.1 collected only 26 individual fish comprised of 4 unique species. In comparison, station 4.4 surveys collected 1,041 individual fish of six different species in 2015. In 2019, the survey collected 1,441 individuals of seven different species. It is important to note two interesting occurrences during the 2019 surveys at 0.0 and 2.1. Mottled sculpin was collected at each of these stations, one individual at 0.0 and three at station 2.1. Mottled sculpin thrives in cool and cold-water systems and are considered to be moderately sensitive to certain types of pollution. Collecting this species in the lower reaches of Muddy Creek is a positive sign that conditions are improving. Another sign of improvement is the presence of trout in Muddy Creek. The survey at station 2.1 collected one rainbow trout in 2019. Like mottled sculpin, rainbow trout occupy cool and cold-water streams and are moderately sensitive to pollution and temperature. It is remarkable that trout are now able to utilize the mainstem of lower Muddy Creek. Trout were present during the surveys of station 4.4 as well. *Table 18* shows results from the fish community surveys.

WAB often displays a fish per meter (fish/m) metric when describing fish communities. This is a coarse measure of abundance and can be informative in determining the effectiveness of treatment in acid mine drainage streams where fish numbers are often diminished. Pre-treatment fish/m scores at stations 0.0 and 3.3 were zero because no fish were collected. In 2019, post-treatment surveys of stations 0.0 and 2.1 yielded metric scores of 0.48 and 0.09, respectively. Station 4.4 results were much higher. In 2015, station 4.4 had a metric score of 3.71 fish/m, and in 2019 the score was even higher with 5.24 fish/m. While stations 0.0 and 2.1 had relatively low metric scores compared to station 4.4, a positive outcome was realized.

Conclusion

Based on the findings of this study, the conditions in the lower reaches of Muddy Creek have improved substantially since the onset of AMD treatment. Notable increases in physiochemical properties like pH combined with decreases in total and dissolved metals have been observed.

A benthic macroinvertebrate sample collected at station 0.0 showed a notable increase in WVSCI score following the onset of AMD treatment. Although there was no pre-treatment score for comparing to post-treatment, the WVSCI at station 2.1 was similar to station 0.0. While some improvements were observed, neither station had WVSCI scores exceeding the unimpaired threshold. Therefore, full recovery of the benthic community has not been realized yet.

The fish community response to AMD treatment was positive. No fish were collected in the mainstem of Muddy Creek downstream of Martin Creek prior to treatment. Post-treatment surveys revealed an increase in species richness and abundance, most notably at station 0.0. Although station 2.1 did not show high richness or abundance, it did have a positive outcome. Mottled sculpin and rainbow trout were collected at this station. Seeing these moderately sensitive fish species returning to the lower reaches of Muddy Creek is significant.

Muddy Creek at Station 0.0 before AMD treatment (2015). Note the turbidity due to suspended metals.

Muddy Creek at Station 0.0 after AMD treatment (2019). The water is now clear due to upstream AMD treatment.

Report written by: Philip Pack, WVDEP's Watershed Assessment Branch

Reclamation and AMD treatment improves Deckers Creek

Figure 15. Deckers Creek projects

As early as 1951, AMD from coal mines polluted Deckers Creek, a section of which is a well-known whitewater paddling destination. WVDEP added Deckers Creek to CWA section 303(d) list of impaired streams in 1996. Friends of Deckers Creek (FODC) and several agencies partnered on land reclamation and water treatment projects in the watershed. Over the years, water quality has significantly improved, particularly aluminum and iron. Biological conditions have also improved. Brown trout now survive in *upper portions* of the watershed.

The 2019 Deckers Creek *Success Story* is told on pages 30-31.

NONPOINT SOURCE SUCCESS STORY

West Virginia

Implementing Mine Land Reclamation and Water Treatment Projects Improved Deckers Creek

Waterbody Improved

As early as 1951, acid mine drainage (AMD) from coal mines polluted Deckers Creek, a section of which is a well-known whitewater paddling destination. The West Virginia Department of Environmental Protection (WVDEP) added Deckers Creek to the Clean Water Act (CWA) section 303(d) list of impaired streams in 1996. Friends of Deckers Creek (FODC), a nonprofit organization, and several agencies partnered on land reclamation and water treatment projects in the watershed. Water quality has significantly improved in Deckers Creek—particularly for aluminum, iron and pH. Biological conditions have also improved; for example, stocked brown trout now survive year-round in the creek.

Problem

Deckers Creek flows into the Monongahela River in Morgantown, West Virginia (Figure 1). The watershed covers approximately 64 square miles and offers whitewater paddling and recreational fishing opportunities.

Coal mines abandoned before passage of the Surface Mining Control and Reclamation Act in 1977 discharge polluted water into Deckers Creek. Data collected in 1976 showed the creek violated standards for iron, manganese, aluminum and pH. WVDEP added Deckers Creek to the list of impaired streams in 1996. Fecal coliform bacteria and sediment pollution sources exist throughout the watershed.

The mines exploited the pyrite-rich Upper Freeport coal seam. When the pyrite is exposed to air and water, it generates iron and sulfuric acid. The acid also dissolves aluminum from nearby minerals. West Virginia's standards call for pH to remain between 6 and 9, and for dissolved aluminum and total iron to remain below 0.75 and 1.5 milligrams per liter (mg/L), respectively.

Low pH and high aluminum concentrations in Deckers Creek excluded fish from much of the mainstem and several tributaries for many years. Precipitation of iron on the bottom of the streams excluded all but the most tolerant of benthic invertebrates. The pollution is prodigious. One single mine adds up to two tons of acidity and 800 pounds per day of iron to the creek.

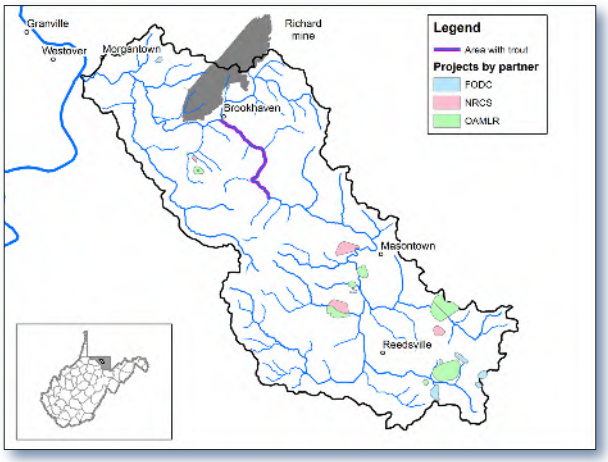


Figure 1. Multiple projects have been implemented in Deckers Creek in northern West Virginia.

Story Highlights

In the mid-1990s, FODC formed to improve the natural qualities of, increase public concern for, and promote the enjoyment of the Deckers Creek watershed. FODC published a water quality inventory for the Deckers Creek watershed in 1996. FODC also petitioned WVDEP to prioritize the total maximum daily load (TMDL) for Deckers Creek; WVDEP completed the TMDL in 2002. WVDEP and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) made an agreement to reclaim 13 of the mine sites, each pitching in $5 million. Under that agreement the two agencies have implemented best management practices (BMPs) at nine of the 13 abandoned coal mine sites.

FODC completed a watershed-based plan in 2006 and used funding from CWA section 319 and the U.S. Office of Surface Mining, Reclamation, and Enforcement's (OSMRE's) Watershed Cooperative Agreement Program to install eight mine drainage treatment projects. FODC operates nine AMD treatment sites throughout the watershed, including five along the tributary of Kanes Creek (for more information on these projects see the 2015 NPS Success Story, *Treating Acid Mine Drainage Allows Aquatic Life to Rebound in Kanes Creek*.) Multiple BMPs have been implemented at the nine project sites, including sulfate-reducing bioreactors, water-powered lime dosing devices, limestone leachbeds, anaerobic vertical flow wetlands, and settling ponds (see Figure 1 for project locations). These projects have removed dissolved metals and neutralized the water's pH over the years. The WVDEP's Office of Abandoned Mine Lands and Reclamation (OAMLR) operates additional AMD treatment projects within the Deckers Creek watershed (see Figure 1) that are outside the scope of work described here.

FODC monitors 13 sites throughout the watershed through its Clean Creek Program, which is supplemented by data gathered by FODC's Citizen Scientist Program (more than tripling the amount of sites monitored overall). Citizen Scientists sample monthly for water quality and allow FODC to have eyes and ears on the ground, enabling early detection for issues in Deckers Creek. Citizen Scientist data is compiled and used to track trends.

Results

Since 2002 water quality has significantly improved in Deckers Creek. Average pH has increased from 6.5 to 7.19, iron has been reduced from 1.4 mg/L to 0.6 mg/L, and aluminum has decreased from 1.00 mg/L to 0.4 mg/L (Figure 2). Brown trout have been stocked in Deckers Creek since 2011, after monitoring in the mainstem showed steadily good water quality. Fish surveys found trout in 2012, 2014, 2016 and 2017. Different size classes of trout indicate survival through the entire year. The presence of other wildlife further illustrates improvement in the creek's health. Much of the improvement in Deckers Creek was caused by removing pollutant loads from its tributary Kanes Creek, which has undergone a visible transformation as its iron loads have decreased (Figure 3).

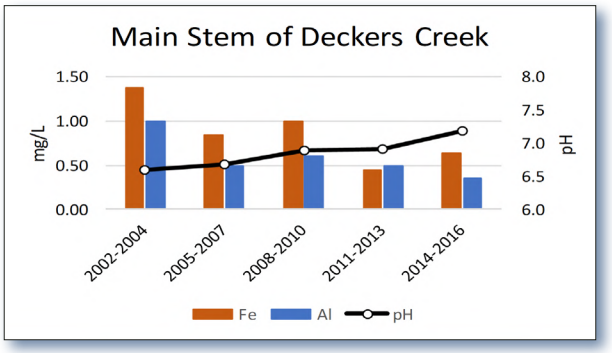


Figure 2. Decker Creek data show reductions in iron and aluminum and increases in pH levels.

Figure 3. Kanes Creek, before and after restoration.

Partners and Funding

Many agencies, organizations, and individuals have carried out the Deckers Creek restoration work. WVDEP has supplied $2.77 million in CWA section 319 watershed project funding to FODC for their work. FODC has obtained $1.28 million from OSMRE's Watershed Cooperative Agreement Program. The U.S. Environmental Protection Agency's Brownfields program funded the engineering design of three of FODC's AMD treatment projects. WVDEP and the USDA NRCS partnered in an agreement through Public Law 566 to restore the watershed through abandoned mine reclamation. WVDEP spent $3.85 million through OAMLR, while NRCS spent $2.26 million through its Public Law 566 Small Watershed Program.

U.S. Environmental Protection Agency
Office of Water
Washington, DC

EPA 841-F-19-001RR
November 2019

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https://deckerscreek.org/clean-creek-program/

Appendix 1. BMP Implementation

HUC name	BMP	Q	Unit	Date	Program
Indian Creek	Alternative Water	1	IU	Mar-19	NWQI
Indian Creek	Alternative Water	1	IU	Sep-19	§319
Indian Creek	Alternative Water	2	IU	Sep-19	NWQI
Indian Creek	Alternative Water	1	IU	Sep-19	§319
Elk Branch-Back Creek	Conservation Easements	60	AC	Sep-19	§319
Elk Branch-Back Creek	Conservation Easements	95	AC	Sep-19	§319
Upper Indian Creek	Fencing	5,620	FT	Sep-19	§319
Upper Indian Creek	Fencing	5,722	FT	Sep-19	NWQI
Upper Indian Creek	Fencing	5,700	FT	Sep-19	§319
Upper Indian Creek	Fencing	795	FT	Sep-19	NWQI
Upper Indian Creek	Fencing	1,144	FT	Sep-19	§319
Upper Indian Creek	Heavy Use Protection	500	SQFT	Sep-19	NWQI
Upper Indian Creek	Heavy Use Protection	500	SQFT	Sep-19	§319
Upper Indian Creek	Irrigation Pipeline	850	FT	Sep-19	NWQI
Upper Indian Creek	Irrigation Pipeline	234	FT	Sep-19	§319
Outlet Back Creek	Natural Channel Restoration	915	FT	Nov-19	§319
Mill Creek	Stream Channel Stabilization	200	FT	Jun-19	§319
Big Run-Dry Fork	Nutrient Management	39	AC	Apr-19	AgE
East Dry Run-South Branch	Nutrient Management	187	AC	Apr-19	AgE
French Creek	Nutrient Management	23	AC	Apr-19	AgE
South Mill Creek	Nutrient Management	469	AC	Apr-19	AgE
Sugar Creek	Nutrient Management	101	AC	Apr-19	AgE
Teter Creek	Nutrient Management	95	AC	Apr-19	AgE
Beaver Creek-Tygart Valley River	Nutrient Management	106	AC	Oct-19	AgE
Chenoweth Creek	Nutrient Management	47	AC	Oct-19	AgE
Files Creek	Nutrient Management	49	AC	Oct-19	AgE
Headwaters Elk Creek	Nutrient Management	36	AC	Oct-19	AgE
Laurel Creek	Nutrient Management	381	AC	Oct-19	AgE
Left Fork-Sandy Creek	Nutrient Management	44	AC	Oct-19	AgE
Mill Creek-Tygart Valley River	Nutrient Management	36	AC	Oct-19	AgE
Red Creek	Nutrient Management	29	AC	Oct-19	AgE
Shavers Run-Tygart Valley River	Nutrient Management	58	AC	Oct-19	AgE
Wickwire Run-Tygart Valley River	Nutrient Management	51	AC	Oct-19	AgE
Upper Indian Creek	Prescribed Grazing	214	AC	Sep-19	§319
Upper Indian Creek	Prescribed Grazing	290	AC	Sep-19	§319
Tuscarora Creek	Septic (New/Existing)	6	IU	Oct-19	§319
Browns Creek-Coal River	Septic (New/Existing)	11	IU	Sep-19	§319
Upper Sleepy Creek	Septic (New/Existing)	7	IU	Apr-19	§319-AGO
Mill Creek	Septic (Pumpout)	10	IU	Jun-19	§319
Tuscarora Creek	Septic (Pumpout)	30	IU	Jun-19	§319
Upper Sleepy Creek	Septic (Pumpout)	2	IU	Apr-19	§319-AGO
Upper Indian Creek	Water Well	1	IU	Mar-19	§319
Upper Indian Creek	Water Well	1	IU	Sep-19	NWQI
Upper Indian Creek	Water Well	1	IU	Sep-19	§319
Upper Indian Creek	Water Well	2	IU	Mar-19	§319
Upper Indian Creek	Water Well	1	IU	Sep-19	§319
Statewide (WVCA-WVDEP)	Outreach/Education	> 10,000	IU	ALL-2019	§319

Appendix 2. Pollutant load reductions

HUC name	Pollutant	LR	Unit	Date	Program
Outlet Piney Creek	Metals (Iron)	11.5	LBS/YR	Aug-19	§319
Upper Indian Creek	Nitrogen	301,125	LBS/YR	Sep-19	§319
Upper Indian Creek	Nitrogen	100,375	LBS/YR	Sep-19	§319
Upper Indian Creek	Nitrogen	3,332	LBS/YR	Sep-19	NWQI
Upper Indian Creek	Nitrogen	7,227	LBS/YR	Sep-19	§319
Upper Indian Creek	Nitrogen	1,807	LBS/YR	Sep-19	AgE
Big Run-Dry Fork	Nitrogen	3,067	LBS/YR	Apr-19	AgE
Chenoweth Creek	Nitrogen	3,130	LBS/YR	Oct-19	AgE
East Dry Run-South Branch	Nitrogen	16,059	LBS/YR	Apr-19	AgE
Files Creek	Nitrogen	2,017	LBS/YR	Oct-19	AgE
French Creek	Nitrogen	1,039	LBS/YR	Apr-19	AgE
Headwaters Elk Creek	Nitrogen	3,322	LBS/YR	Oct-19	AgE
Laurel Creek	Nitrogen	26,334	LBS/YR	Oct-19	AgE
Left Fork-Sandy Creek	Nitrogen	3,465	LBS/YR	Oct-19	AgE
Mill Creek-Tygart Valley River	Nitrogen	3,034	LBS/YR	Oct-19	AgE
Red Creek	Nitrogen	1,832	LBS/YR	Oct-19	AgE
Shavers Run-Tygart Valley River	Nitrogen	3,083	LBS/YR	Oct-19	AgE
South Mill Creek	Nitrogen	28,387	LBS/YR	Apr-19	AgE
Sugar Creek	Nitrogen	6,079	LBS/YR	Apr-19	AgE
Teter Creek	Nitrogen	5,180	LBS/YR	Apr-19	AgE
Wickwire Run-Tygart Valley River	Nitrogen	3,346	LBS/YR	Oct-19	AgE
Tuscarora Creek	Pathogens (Coliform)	3.76E+13	CFU	Oct-19	§319
Browns Creek-Coal River	Pathogens (Coliform)	2.30E+13	CFU	Sep-19	§319
Upper Indian Creek	Pathogens (Coliform)	1.58E+14	CFU	Sep-19	§319
Upper Indian Creek	Pathogens (Coliform)	5.25E+13	CFU	Sep-19	§319
Upper Indian Creek	Pathogens (Coliform)	1.68E+12	CFU	Sep-19	NWQI
Upper Indian Creek	Pathogens (Coliform)	3.78E+12	CFU	Sep-19	§319
Upper Indian Creek	Pathogens (Coliform)	9.45E+11	CFU	Sep-19	§319
Upper Sleepy Creek	Pathogens (Coliform)	6.23E+12	CFU	Apr-19	§319-AGO
Upper Indian Creek	Phosphorus	68,400	LBS/YR	Sep-19	§319
Upper Indian Creek	Phosphorus	22,800	LBS/YR	Sep-19	§319
Upper Indian Creek	Phosphorus	757	LBS/YR	Sep-19	§319
Upper Indian Creek	Phosphorus	1,642	LBS/YR	Sep-19	NWQI
Upper Indian Creek	Phosphorus	410	LBS/YR	Sep-19	§319
Beaver Creek-Tygart Valley River	Phosphorus	3,536	LBS/YR	Apr-19	§319
Big Run-Dry Fork	Phosphorus	2,243	LBS/YR	Apr-19	AgE
Chenoweth Creek	Phosphorus	2,289	LBS/YR	Oct-19	AgE
East Dry Run-South Branch	Phosphorus	23,028	LBS/YR	Apr-19	AgE
Files Creek	Phosphorus	1,475	LBS/YR	Oct-19	AgE
French Creek	Phosphorus	760	LBS/YR	Apr-19	AgE
Headwaters Elk Creek	Phosphorus	2,430	LBS/YR	Oct-19	AgE
Laurel Creek	Phosphorus	19,262	LBS/YR	Oct-19	AgE
Left Fork-Sandy Creek	Phosphorus	2,534	LBS/YR	Oct-19	AgE
Mill Creek-Tygart Valley River	Phosphorus	2,226	LBS/YR	Oct-19	AgE
Red Creek	Phosphorus	1,340	LBS/YR	Oct-19	AgE
Shavers Run-Tygart Valley River	Phosphorus	2,255	LBS/YR	Oct-19	AgE
South Mill Creek	Phosphorus	17,742	LBS/YR	Apr-19	AgE
Sugar Creek	Phosphorus	4,447	LBS/YR	Apr-19	AgE
Teter Creek	Phosphorus	3,789	LBS/YR	Apr-19	AgE

HUC name	Pollutant	LR	Unit	Date	Program
Wickwire Run-Tygart Valley River	Phosphorus	2,447	LBS/YR	Oct-19	AgE
Outlet Piney Creek	Sediment-Siltation	0.25	TONS/YR	Aug-19	§319
Elk Branch-Back Creek	Sediment-Siltation	0.92	TONS/YR	Nov-19	§319
Upper Indian Creek	Sediment-Siltation	1.6	TONS/YR	Nov-19	§319

Appendix 3. §319 project status

2015	NPS#	Requested	Spent	Status
NPS Program				
DEP		$279,364	$279,364	Complete
WVCA	1523	$116,000	$108,797	Complete
Watershed Plan Tracking EPA in-kind				
FOC Big Sandy WS planning	1531	$84,000	$83,314	Complete
FODC Clean Creek Program	1545	$12,000	$12,000	Complete
WVRC Source Water Protection Planning	1548	$15,000	$15,000	Complete
Hursher's Run Monitoring - Hughes River	1549	$1,282	$1,282	Complete
AMD and WW research - WVU	1550	$18,000	$17,994	Complete
Friends of Hughes Source Water Monitoring	1607	$20,000	$20,000	Complete
Piney Creek WSA Pet Waste Campaign	1600	$4,000	$4,000	Complete
WVCA Anthony Creek stream stabilization	1602	$20,000	$20,000	Complete
WV DOF WVU LSCA	1616	$10,310		Complete
FOC Cheat River Bacteria Monitoring	1636	$12,175	$12,174	Complete
FOH Hursher's Run monitoring	1651	$4,622	$4,622	Complete
Experience Learning	1678	$20,000	$20,000	Complete

Watershed Project	NPS#	Requested	Spent	Status
Tuscarora Creek Phase 2 - CVI	1540	$56,523	$46,229	Complete
Mill Creek Opequon Phase 2 - CVI	1541	$161,801	$110,545	Complete
Morris Creek Upper Mainstem	1529	$49,265	$48,664	Complete
Pase Active Treatment - FOC	1530	$101,387	$101,959	Complete
Valley Highwall Upgrade - FODC	1532	$170,500	$198,950	Complete
Summerlee - Phase 2	1534	$163,412	$163,412	Complete
YMCA land restoration - Piney Creek	1535	$20,145	$20,140	Complete
Elks Run Watershed Phase 2 - WVCA	1536	$68,200	$64,050	Complete
Herods Run, Buckhannon - WVU	1533	$226,145	$225,306	Complete

2016	NPS#	Requested	Spent	Status
NPS Program				
DEP		$295,082	$295,062	Complete
WVCA	1580	$131,062	$33,379	On-going
Watershed Plan Tracking EPA in-kind		$10,000	$10,000	
NF Greens Run WBP - FY 15 carryover	1581	$25,516	$24,635	Complete
Muddy Creek WBP - FY 15 carryover	1582	$60,484	$56,393	On-going
Friends of Blackwater monitoring	1596	$12,986	$12,406	Complete
FODC clean creek program	1597	$12,000	$9,086	On-going
FOC state of the watershed	1598	$15,000	$14,275	Complete
Goodnews Mtneer Garage rain gardens	1599	$3,000	$2,906	Complete
WVRC volunteer monitoring	1603	$18,000	$18,000	Complete
WVRC Source Water Community Engagement	1604	$17,000	$17,000	Complete
FODC Kanes Creek Study	1639	$13,350	$3,522	On-going
WVRC Capacity Building for WSAs	1634	$4,450	$4,450	Complete
WVRC WV TU WVCA monitoring program	1635	$8,900	$8,900	Complete
WVCA Howards Creek Improvements	1637	$13,350	$11,388	Complete
CVI ALIVE education	1638	$4,461	$4,461	Complete
City of Charleston Rain Barrel Kits	1648	$4,075	$3,950	Complete
WVCA Sleepy Creek septic mini grant	1677	$21,000	$14,093	On-going

Watershed Projects	NPS#	Requested	Spent	Status
Browns Creek - Coal River	1583	$8,381	$8,381	On-going
Beaver Creek AMD - FOC	1584	$175,100	$93,631	On-going
Sandy Run Renovation - FODC	1585	$223,500	$26,940	On-going
Beckley Little League - PCWA	1586	$54,291	$54,291	Complete
Second Creek Karst	1587	$127,600	$127,600	Complete
Back Creek - WVCA	1588	$209,450	$209,450	Complete
Swamp Run #2 - WRI	1589	$183,954	$78,220	On-going
Browns Creek - Coal River thru WVCA	1619	$94,000	$72,623	On-going

2017	NPS#	Requested	Spent	Status
NPS Program				
DEP		$324,282	$327,467	Complete
WVCA	1605	$191,500	$31,736	On-going
Watershed Plan Tracking EPA in-kind		$10,000	$10,000	
WV Rivers Coalition	1610	$100,000	$53,820	On-going
Beaver Creek WBP - FOB	1647	$10,364	$10,078	Complete
WVRC Building capacity for WSAs	1668	$5,000	$760	On-going
WVRC water quality monitoring	1669	$10,000	$10,000	Complete
FOB Targeted Analysis of Beaver Creek	1670	$9,000	$3,099	On-going
WVU Fisheries in treated AMD trib	1672	$12,000	$7,005	On-going
Piney Creek monitoring and education	1673	$4,000	$4,000	Complete
Morris Creek Lavender Patch	1674	$5,000	$4,026	On-going
FODC evaluating coliform	1675	$12,000	$677	On-going
FOC state of the watershed 2018	1676	$9,000	$6,548	On-going
Watershed Projects	**NPS#**	**Requested**	**Spent**	**Status**
Summerlee AMD Phase 3A - PAN	1611	$23,200		On-going
New River Drive Soil Erosion - Piney Ck	1612	$32,500		On-going
Morris Creek Rd and Stream Restoration	1613	$72,000	$68,186	On-going
Muddy Creek Dream Mountain Improvements - FOC	1633	$206,800	$28,337	On-going
Beaver Creek AMD Addition	1584	$115,628		On-going
Hartman Run AMD - FODC	1641	$185,000	$10,612	On-going
WALD treatment - Phase 1 - FOB	1632	$149,594	$88,261	On-going
Cane Fork Treatment - Phase 1 - WVU	1642	$149,993	$33,702	On-going
Spring Creek - Phase 1 - WVCA	1643	$180,000		On-going

2018	NPS#	Requested	Spent	Status
NPS Program				
DEP		$332,662	$288,949	On-going
WVCA	1646	$95,750		On-going
Watershed Plan Tracking EPA in-kind		$10,000	$10,000	
FODC O&M AMD treatment	1714	$12,000		On-going
WVRC Capacity Building for WSAs	1715	$5,000		On-going
EL AWSM Program	1716	$15,000		On-going
FOB Sand Run investigation	1717	$7,500		On-going
PCWA Data Loggers	1718	$8,034	$6,372	On-going
WVRC water quality monitoring	1719	$10,000		On-going
FOC Capacity expansion	1720	$12,000		On-going
FODC Using GIS to improve service	1721	$10,000		On-going
Watershed Projects	**NPS#**	**Requested**	**Spent**	**Status**
WALD Passive Treatment 2 - FOB	1680	$134,000		On-going
Beaver Creek McElroy Seep - FOC	1681	$130,000	$12,025	On-going
Dillan Creek Remediation 1 - FODC	1682	$207,000	$3,996	On-going
Browns Creek Phase 2		$186,000		On-going
Barlow Portal 1 - WVU	1684	$212,716	$6,207	On-going
Woodrow Wilson HS Stream Restoration - Piney	1685	$60,000		On-going
Upper Indian Creek - WVCA	1650	$100,000	$99,502	On-going
Second Creek Tall Hickory Farms - WVCA	1686	$100,000		On-going
Back Creek Protection - WVCA	1687	$216,515		On-going

2019	NPS#	Requested	Spent	Status
NPS Program				
DEP		$404,932	$336,394	On-going
WVCA	1709	$65,000		On-going
Watershed Plan Tracking EPA in-kind		$10,000		On-going
WVRC Integrating SW and WBP P2	1723	$80,000		On-going
Watershed Projects				
Sovern Tom Clark AMD FOC	1701	$152,000		On-going
Marilla Park Restoration FODC	1702	$118,121		On-going
Slabcamp Run AMD P 1 FODC	1703	$207,778		On-going
Roaring Creek N. Portal WVU	1704	$262,195		On-going
Crescent Elementary SW Piney Ck	1705	$90,000		On-going
Burnside Branch Indian Ck WVCA	1706	$121,770		On-going
Mill Creek Meadow River WVCA	1707	$111,200		On-going
Second Creek Karst P3 WVCA	1708	$127,000		On-going

Appendix 4. Second Creek WBP implementation

Best management practices identified in the WBP	BMP goals of the WBP	U	BMP goals achieved in the WBP	Percent achieved
Waste storage facilities	6	IU	5	83.3%
Stream crossing	22	IU	19	86.4%
Spring development	32	IU	7	21.9%
Pond	16	IU	7	43.8%
Water troughs	48	IU	71	147.9%
Pumping plant	24	IU	12	50.0%
Pipeline	14,400	FT	29,420	204.3%
Wetland restoration	1	AC	0	0.0%
Wetland development	1	AC	1	100.0%
Nutrient management	1,550	AC	1,696	109.4%
Nutrient management plan	31	IU	25	80.6%
Grazing plan	31	IU	25	80.6%
Forested buffer	56	AC	104	183.6%
Herbaceous buffer	113	AC	123	109.0%
Buffer rental	169	AC	13	7.7%
Critical area planting	101	AC	5	5.0%
Fence	194,719	FT	118,246	60.7%
Septic system rehab	356	IU	0	0.0%
Overall average BMP implementation				**76.3%**
Streams with LR goals	Goal		Total LR achieved	Percent achieved
Kitchen Creek	2.22E+13		1.92E+13	86.5%
Back Creek	1.88E+13		2.70E+12	14.4%
Second Creek	1.93E+14		1.82E+14	94.3%

U (units), IU (individual units), AC (acres), FT (feet)

Appendix 5. Tuscarora Creek and Elks Run WBP reductions

Tuscarora Creek septic goal		Failing systems	Fecal load (cfu)
TMDL baseline (Fecal)	6.27E+12	713	4.47E+15
Phase 1	Replaced	6	3.76E+13
Phase 2	Replaced	3	1.88E+13
		Total load reduced	5.64E+13
		Percent of total Load	1.26%

Tuscarora Creek sediment goal			Sediment load (tons/yr)
WBP sediment goal (tons/yr)		724	
All practices implemented	Natural stream restoration	950 FT	19.0
		Total sediment reduction	19.0
		Percent of total Load	2.63%

Elks Run septic goals		Failing systems	Fecal load (cfu)
TMDL baseline (Fecal)	6.27E+12	239	1.50E+15
Phase 1	Replaced	0	0.00E+00
Phase 2	Replaced	4	2.51E+13
		Total load reduced	2.51E+13
		Percent of total Load	1.67%

Elks Run sediment goal			Sediment load (tons/yr)
WBP sediment goal (tons/yr)		3,222	
All practices implemented	Buffer	2.8 AC	2.9
	Tree planting	4.1 AC	4.3
	Cover crops	100 AC	32.6
	Stabilization	57 FT	1.5
		Total sediment reduction	41.3
		Percent of total Load	1.28%

West Virginia's 2020 §319 workplans consist of continuous work in priority watersheds. Nonpoint funds support planning, grant management, staff and other administration task. AGOs are also offered through these funds. Watershed project funds focus on project implementation. This includes AMD remediation, sediment and bacteria reduction in urban areas, and bacteria and nutrient reduction through septic repairs and agricultural BMPs in agriculturally impacted watersheds. Sub-grantees in 2020 include Save the Tygart Watershed Association (STTWA), Friends of Blackwater (FOB), Friends of the Cheat (FOC), Friends of Deckers Creek (FODC), WVU's National Mineland Reclamation Center (NMLRC), Guardians of the West Fork (GWF) Piney Creek Watershed Association (PCWA), Sleepy Creek Watershed Association (SCWA) and the WV Conservation Agency (WVCA).

See *appendix six* for more details.

Appendix 6. West Virginia's 2020 §319 grant proposal

2020 WIB §319 Grant

Organization	Nonpoint Funds	§319	Match	Total	
WVDEP	WVDEP NPS Program	$468,612	$314,408	$783,020	
WVCA	WVCA NPS Program	$68,000	$45,334	$113,334	
STTWA	Beaver Creek WBP development	$10,000	$6,160	$16,160	
	Total Nonpoint	**$546,612**	**$365,902**	**$912,514**	30.3%
	Watershed Project Funds				
FOB	Beaver Creek seep 100-02	$182,211	$121,000	$303,211	
FOC	Sovern Tom Clark passive treatment	$212,000	$141,500	$353,500	
FODC	Dillan Creek phase II	$191,500	$127,500	$319,000	
NMLRC/GWF	Lambert Site 7 passive treatment	$65,252	$42,638	$107,890	
WVCA/SCWA	Sleepy Creek	$92,130	$64,500	$156,630	
PCWA	Little League/Convention Center II	$97,132	$64,750	$161,882	
WVCA	Anthony Creek	$150,000	$100,000	$250,000	
WVCA	Pipestem Creek	$117,663	$78,444	$196,107	
WVCA	Cherry Fork	$151,500	$101,002	$252,502	
	Total Watershed	**$1,259,388**	**$841,334**	**$2,100,722**	69.7%
	Total Grant request	**$1,806,000**	**$1,207,236**	**$3,013,236**	