Nonpoint Source Program

Annual Report

2018

http://www.dep.wv.gov/nonpoint

west virginia department of environmental protection

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

Nonpoint Source Program Annual Report

Submitted February 27, 2019

Responded to USEPA comments, revised and re-submitted March 27, 2019

STATEMENT OF POLICY REGARDING THE EQUAL OPPORTUNITY TO USE AND PARTICIPATE IN PROGRAMS

It is the policy of the West Virginia Department of Environmental Protection (WVDEP) to provide its facilities, services and programs to all persons without regard to sex, race, color, age, religion, national origin or handicap. Proper licenses/registration and compliance with official rules and regulations are the only sources of restrictions for facility use or program participation. WVDEP is an equal opportunity employer.

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: The *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*.

Table of contents

Photo credits and other contributors

Cover: 2018 Watershed Celebration Day, Jennifer Pauer; Acid mine drainage treatment sites in the Deckers Creek and Cheat watersheds, Tim Craddock; Group photo EPA-tour 2018, Beth Warnick; Kitchen Creek fish survey, Tim Craddock.

Within the document: Chesapeake Bay updates, Sebastian Donner/Alana Hartman; BMP-LR map, Chad Thompson; Valley Point 12, Martin Christ and Sarah Clayton; Morris Creek upper mainstem, Tomi Bergstrom and Mike King; Sewell Creek, Dennis Burns; Watershed plan highlights, Martin Christ, Sarah Clayton, Levi Rose and Jennifer Liddle; Final thoughts, Teresa Koon and Tim Craddock; Staff activities, Alana Hartman, Martin Christ, Tomi Bergstrom, Jennifer Liddle, Glenn Nelson, Sebastian Donner and Jason Crowder. Other figures/tables created by Tim Craddock unless otherwise noted. Acronyms are defined throughout the report.

Executive summary

In 2018 West Virginia's NPS Program provided technical and financial support to more than 100 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. Project categories

Type	Q	% complete	
§319 Nonpoint grants	17	7	0.41
§319 Watershed grants	42	10	0.24
§319 Additional grants	42	37	0.88
Other grants	7	3	0.43
Totals	**108**	**57**	**0.53**

All 2014 projects were completed on-time, and several were under budget. For fiscal year 2015, 54% of 24 projects are complete; 2016, 35% of 23 projects are complete; 2017, 10% of the 21 projects are complete; and 2018, zero of the 11 projects are complete. *Appendix 4* provides additional information.

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 2018 BMP implementation occurred in *44 different HUC12 watersheds* with 50 percent of the implementation occurring in priority watersheds. The remaining are a result of WV Conservation Agency (WVCA) statewide *agriculture enhancement programs* (AgE). *Table 2* shows BMP implementation in 2018. Additional details are provided in *Appendix 1*.

Table 2. 2018 BMP implementation

BMPs	Q	U
AMD treatment systems	3	
AMD components	23,839	sqft
Channel stabilization	3,864	ft
Erosion control	1,259.5	ac
Fencing	3,220	ft
Nutrient management	2,713.8	ac
Riparian buffer	10	ac
Septic systems	33	
Water systems	13	
Water system components	4,308	ft
Outreach/education	14,648	

Acid mine drainage (AMD) treatment systems are listed as complete systems and components. The components include vertical flow treatment, limestone channels, limestone beds, upflow well and catchment basins. Septic systems include new installation, repairs and pumping. Fencing includes pasture and streamside. Nutrient management often includes a wide variety of practices specific to the situation. These can include heavy use protection, liming, irrigation etc. Water systems include a variety of alternate water options and their components such as piping and trenches. 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 septics, whereas the AMD pollutants (acidity and heavy metals etc.) are associated with abandoned mining. 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 Management Plan (MP) goals prior to the five-year revision schedule. Note: Updates on the MP were provided in the 2017 annual report. The next update will be provided following approved MP revisions, which will be submitted to USEPA spring 2019.

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).

Table 3. Progress towards reducing CB pollutants

Pollutant	Category	Baseline	Progress 2018	Targets 2025	WVWIP-3 (DRAFT)
Nitrogen	Agriculture	3.22	3.13	NS	NS
	Urban Runoff	1.21	1.21		
	Wastewater+CSO	0.70	0.50		
	Septic	0.33	0.33		
	Natural+Deposition	2.60	2.56		
	All Sources	**8.06**	**7.72**	**8.22**	**7.50**
Phosphorus	Agriculture	0.13	0.12	NS	NS
	Urban Runoff	0.06	0.06		
	Wastewater+CSO	0.14	0.04		
	Septic	0.00	0.00		
	Natural+Deposition	0.21	0.20		
	All Sources	**0.56**	**0.43**	**0.43**	**0.38**

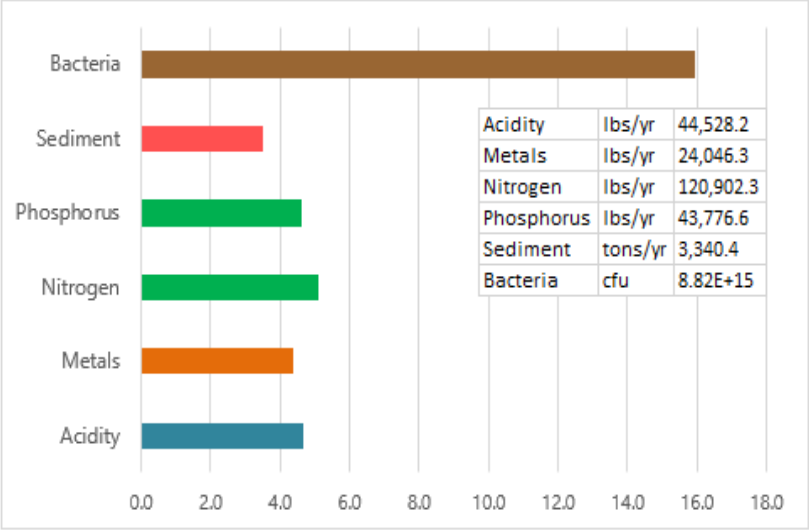
Units: millions lbs/year NS: Not specified

USEPA's *midpoint assessment* of the Chesapeake Bay TMDL report recognized West Virginia as being on-track through 2017.

Throughout 2018, WV's Tributary Team partners developed much of the Phase 3 WIP. They gathered input from local governments, watershed groups, and many other stakeholders to identify strategies that will contribute to local goals while also reducing nitrogen and phosphorus loads in waterways. Table 3 shows historic, recent and 2025 target loads of nutrient pollutants.

Uncertainties like climate change and expected decisions about the Conowingo Dam led WV's Tributary Team to aim for smaller loads than those prescribed by the CB Program Partnership. WV's WIP 3 will prescribe many nonpoint source actions including stream restoration, livestock exclusion with riparian buffers, and stormwater management practices.

Figure 1. Pollutant reductions in 2018

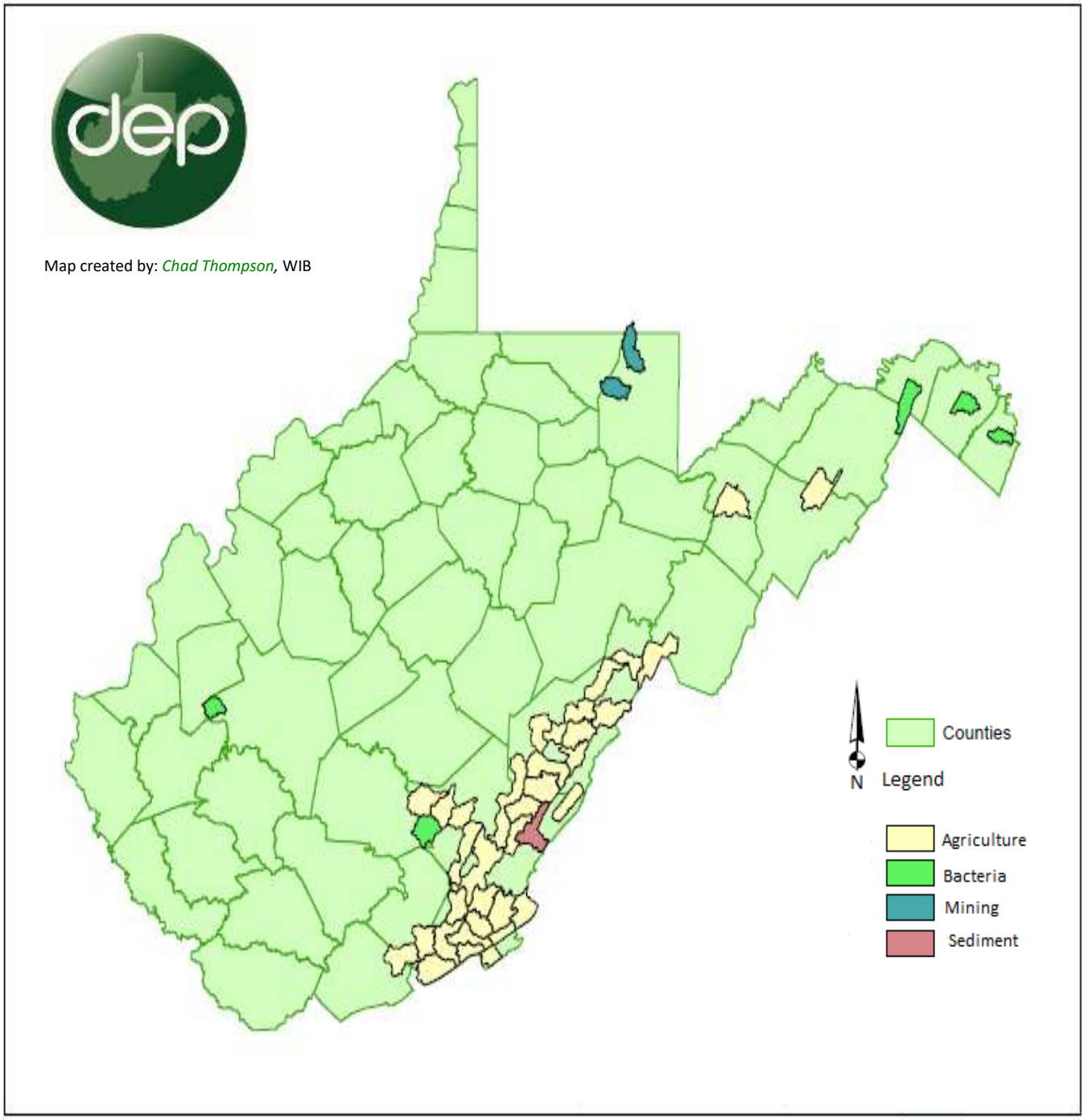


These reductions are a result of projects in 44 watersheds, 23 in priority areas and an additional 21 are a result of WVCA's agriculture enhancement program.

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

Figure 1 provides a snapshot of §319 and AgE pollutant reductions from projects completed in 2018. The bar graph compares the amount of reduction from each major category. A log scale was used to normalize the data for this comparison.

Figure 2. BMPs and load reductions in priority and non-priority basins



Alphabetized list of HUC12 implementation: Browns Creek-Coal River, Brush Run-Greenbrier River, Burnside Branch, Clover Creek-Greenbrier River, Elks Run, Headwaters Deckers Creek, Headwaters Lunice Creek, Laurel Fork-North Fork South Branch, Laurel Run-Greenbrier River, Lick Creek-Bluestone Lake, Little Clear Creek, Locust Creek-Greenbrier River, Lower Anthony Creek, Lower Big Sandy Creek, Lower Indian Creek, Lower Second Creek, Meadow Creek-Meadow River, Meadow Run-North River, Middle Indian Creek, Middle Second Creek, Mill Creek-Meadow River, Mill Creek-Opequon Creek, Milligan Creek-Greenbrier River, Muddy Creek, Outlet East Fork Greenbrier River, Outlet Knapp Creek, Outlet Spring Creek, Rich Creek, Rock Camp Creek, Sewell Creek, Slabcamp Run-Greenbrier River, South Fork Potts Creek, Stamping Creek-Greenbrier River, Stitlington Creek, Stoney Creek, Sweet Springs Creek-Cove Creek, Thorny Creek-Greenbrier River, Tuscarora Creek, Upper Anthony Creek, Upper Indian Creek, Upper Second Creek, Upper Sleepy Creek, Upper Williams River, Wolf Creek

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

Partnerships

Partners are the KEY to past, current and future success of West Virginia's Nonpoint Source (NPS) Program. Without their dedication the majority of project implementation is not possible. Below is a summary from state agencies and just a few of our 2018 partners.

WV Department of Environmental Protection as the lead agency, WVDEP-WIB, §319 Program manages and coordinates the statewide activities. They are guided by adherence to the stated goals, objectives and schedules included in the program's *MP*. The administration and coordination involve a concentrated effort on the part of the lead agency and partner agencies, as well as volunteers, colleges and universities and a variety of others. See *Appendix 3* for more on WIB staff activities.

WVCA remains the primary entity responsible for the implementation of the West Virginia agriculture and construction components of the §319 Program, and for coordinating and implementing watershed projects. In 2018 WVCA implemented BMPs through their statewide programs and in priority watersheds. WVCA completed additional phases of Sleepy Creek and Sewell Creek. Other active projects include: Elks Run, Back Creek, Indian Creek and Second Creek. WVCA also completed AGOs in Anthony Creek (a future watershed protection plan) and Howards Creek. See *Appendix 3* for more on WVCA's staff activities.

WV University (WVU) *National Minelands Reclamation Center* (NMLRC) is a major partner for implementing AMD projects in the Monongahela, West Fork and Tygart basins. NMRC project managers coordinate with local watershed groups to secure *Office of Surface Mine* (OSM) funding, which provides match and additional construction funding in 2018. NMLRC made progress in Herods and Swamp Run, Cane Fork and Roaring Creek. They also completed revisions to Lamberts Run WBP, which is currently being reviewed by WVDEP.

Friends of the Cheat (FOC) is one of the most advanced watershed groups in West Virginia. Their progress for reducing AMD impacts in the Lower Cheat has been well document with multiple success and 2018 is no different. FOC completed projects in Greens and Sovern Run and have on-going projects in Muddy Creek where significant improvements have occurred through partnerships with WVDEP's Office of Special Reclamation (OSR) More on this story later. FOC is also working on three new watershed based plans (WBPs).

Friends of Deckers Creek (FODC) focuses on AMD projects in the Deckers Creek watershed. Their efforts have made a major contribution to the quality of Deckers Creek, and the once dead stream has come to life again. Fishing, kayaking, hiking and other recreational pursuits have returned to the watershed. In 2018 FODC completed two projects in the headwaters. They have three active projects, Sandy Run, Hartman Run and Dillan Creek. The Natural Resource Conservation Service (NRCS) and WVDEP's Abandoned Minelands (AML) Program plan to invest significant funding to restore Richard Mine, a major AMD pollution source in the lower watershed. This effort was brought to bear by FODC's activities and voice in the basin.

WVDEP's *Watershed Pilot Program* received additional funding support and awarded grants to four watershed groups in 2018. These include *Coal River Group* (CRG), *Morris Creek Watershed Association* (MCWA), *Piney Creek Watershed Association* (PCWA), and *Save the Tygart Watershed Association* (STTWA). These groups have six active §319 projects and are planning future proposals. WPP staffing support has provided a significant boost for §319, enabling local project management that may not have been possible before. The WPP was the brainchild of and is managed by the NPS Coordinator with assistance from three regional Basin Coordinators (BCs).

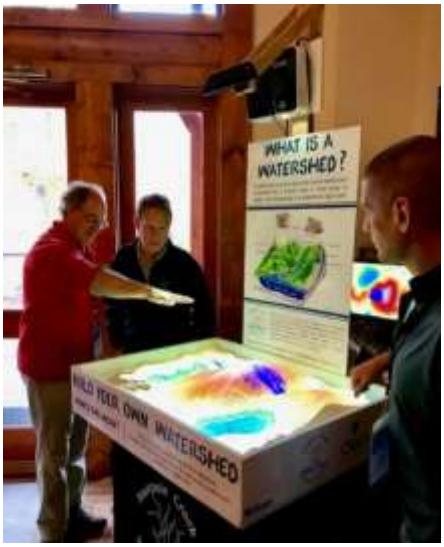
WV Rivers Coalition (WVRC) takes an active/lead role in the protection of source water in West Virginia. WVRC received and completed multiple §319-AGOs focusing on *shale gas monitoring* and source water protection. They also applied for and received §319 funding for the first ever effort to integrate source water protection and watershed planning and was funded for a second phase in 2017. The focus is integrating these plans in two priority watersheds; Elk Run and Cacapon/Lost River. Both projects are on-going.

There are many more state and federal agency partners, Non-governmental organizations (NGOs), local citizen groups and landowners that are dedicated to the mission of the NPS Program, and work to promote a better understanding of their local issues. ***It's all about volunteering***…

See *Appendix 3* for WIB and WVCA highlights.

Watershed Celebration Day

WIB's NBC demonstrates Fourpole Watershed Association's watershed sandbox.



2018 was the 20th Anniversary of Watershed Celebration Day (WCD). The logistics of the event came together because of the team led by the WIB's Western Basin Coordinator. The team consisted of representatives from WVDEP's *Environmental Advocate Office*, WVRC, OSM, WIB's Northern Basin Coordinator, Southern Basin Coordinator, NPS Coordinator, and several watershed groups. Because of the team's hard work, funds were raised through grants and multiple sponsors. The result was an excellent venue, free meals, lodging and travel scholarships, speakers, and watershed - outdoor related door prizes that were distributed during day-two's ceremonies.

Day-one of WCD consisted of workshops, project site visits and several outdoor events such as zip-lining, hiking, and even whitewater rafting opportunities. Day-two was all about West Virginia's watershed groups who were honored for their accomplishments. The day included presentations, networking and an award ceremony. The groups received a total of $7,000 in monetary awards for their efforts, with FOC winning the Watershed of the Year award and $5,000 prize. To learn more visit: *https://dep.wv.gov/news/Pages/Citizen-Groups-Honored-at-Annual-Watershed-Celebration-Day.aspx*

Thoughts from the Assistant Director

WIB staff visit a Kitchen Creek farm as part of a 2018 staff meeting. WIB partnered with WVCA to conduct a fish survey in a tributary to Kitchen Creek.

Partnership – Synonyms include cooperation, collaboration, coalition, alliance. That is what West Virginia's Nonpoint Source Program is built around and that is what makes the effort successful. Over the past year, collaboration with and between watershed associations, local, state and federal government, other nonprofit partners and private businesses and landowners has resulted in the completion of watershed projects across the state. From the eastern panhandle to the state capital, the Greenbrier Valley and the southern coalfields, WVDEP-WIB has relied on partnerships to protect and restore our waters. We thank you for your efforts and look forward to new and expanding alliances including working closely with WVDEP-AML to realize greater gains in water quality improvement. - *Teresa Koon*, Assistant Director

Watershed project highlights

In 2018, nine watershed and 16 AGO projects were completed. Read the final reports from completed AGOs *here* and *here*. This next section will highlight several completed projects that include AMD remediation efforts and bacteria reductions. *Appendix 5* provides a list of projects from 2014-2018. Summaries of additional projects are available from USEPA's GRTS *public access portal*.

Valley Point 12

Friends of Deckers Creek
Contact(s): *Sarah Clayton* and *Martin Christ*

Watershed information

HUC8	05020003 - Monongahela River
HUC12	050200030201 - Headwaters Deckers Creek
Stream code	WVM-8-F

Introduction

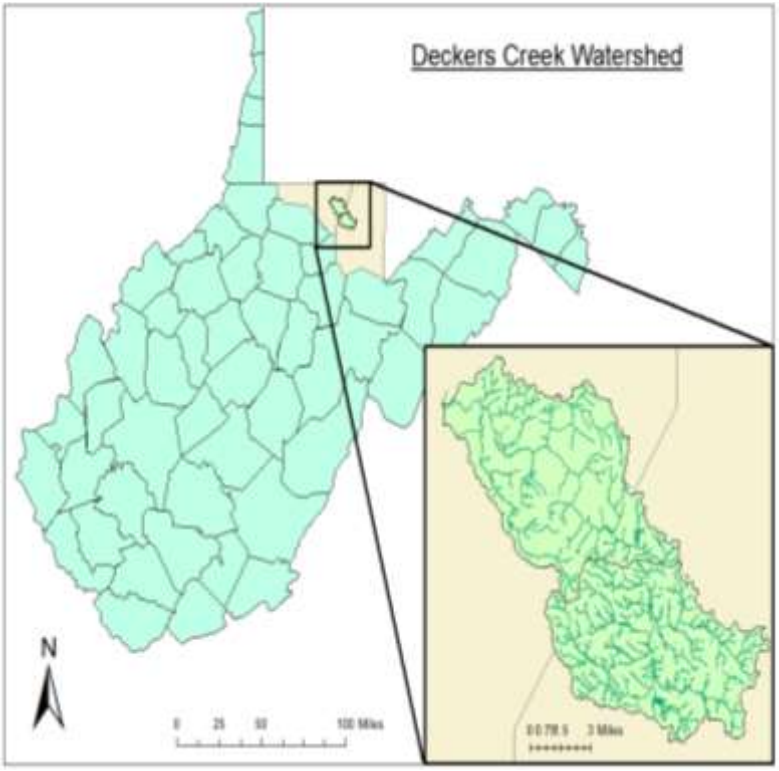


Figure 3. Map of the Deckers Creek watershed located in northern WV.

The Deckers Creek Watershed drains approximately 64 square miles throughout Preston and Monongalia Counties in northern West Virginia (*Figure 3*). Kanes Creek, a tributary to Deckers Creek is polluted by acid mine drainage (AMD). AMD, coming mostly from abandoned mines, impairs human health and aquatic life by causing pH, iron, and aluminum levels to violate state standards in the main stream and many tributaries. Kanes Creek is the tributary farthest upstream that adds a significant load of AMD to the creek. A substantial decrease in the pollution from Kanes Creek will greatly improve the water quality in parts of Deckers as well as Kanes Creek. The uppermost part of Kanes Creek has two branches; this project was to treat the water from Valley Point #12, the site that contributes the largest load to the uppermost part of the creek. Valley Point #12 is located on the Northern Branch of Kanes Creek.

Kanes Creek and Deckers Creek are both on West Virginia's 303(d) list and are impaired by AMD pollutants. Both fail to meet water quality criteria for pH, iron, and dissolved aluminum. Long-term data on the Kanes Creek subwatershed and Deckers Creek have been collected by FODC and through remediation efforts of FODC, along with other state and federal agencies Kanes, and consequently Deckers Creek, have seen vast improvements.

Project highlights

FODC originally constructed the Valley Point #12 project in 2008 to treat AMD entering Kanes Creek. Unfortunately, due to mine seepage that could not be collected, as well as overall wear-and-tear on the project itself, the site needed upgrades. The Valley Point #12 Revitalization project demonstrates how this old project site was upgraded and became functional once again.

The treatment site consists of water entering an iron oxidation terrace, then being piped for several hundred feet to a series of treatment ponds including a flushing limestone bed, two settling ponds, an open limestone channel, and finally an aerobic wetland. The issue addressed in the repurpose is the decline in effectiveness of the iron oxidation

terrace. The limestone fines put there in the original construction have since washed out leaving the structure ineffective and the pipes scaled and clogged with debris. In the repurpose FODC replaced limestone on the terrace with larger limestone. After consulting with professionals at the WVDEP's AML it was decided that adding more limestone would only increase scaling in the pipes and decrease the longevity of the system. To prevent that from happening it was suggested that FODC utilize the re purposed limestone to collect AMD seeping from the hill surrounding the location of the terrace. This will treat the otherwise neglected run off on the hill and channels where it runs and bypasses the treatment system. FODC believes this fix will be a better treatment solution than the one originally proposed.

Results

Analysis from samples taken show that water flowing into the system from the uptake wells is entering at a 2.93 pH, when exiting the system, the pH is up to a 7.82. When the water exits the treatment system and combines with other runoff from another outlet in the hillside, the combined pH is 7.16 when it finally runs under the road into the tributary leading to Deckers. The total load of iron exiting Valley Point 12 treatment system is 476.2 lbs per year. The total load of aluminum exiting the system is 94.2 lbs per year.

Input	pH	Acidity (mg/L)	Al (mg/L)	Fe (mg/L)
Entering system	2.93	263.56	24.34	29.60
Exiting system	7.16	< 8.16	0.55	2.75

Partners and funding

This project was supported by the USEPA and WVDEP's Watershed Improvement Branch ($163,100) and Office of Surface Mining (OSM) WCAP Program ($90,000). FODC contributed $19,628 as an in-kind match.

Select site photos

Before

During

After

Morris Creek upper mainstem remediation

Morris Creek Watershed Association
Contact(s): *Mike King* and *Tomi Bergstrom*

Watershed information

HUC8	05050006 - Lower Kanawha River
HUC12	050500060306 - Hughes Creek-Kanawha River
Stream code	WVK-70

Introduction

Morris Creek is a tributary of the Upper Kanawha River. It drains a 5,000-acre forested watershed of mountainous terrain that borders Fayette and Kanawha Counties in West Virginia. The watershed was continuously mined from the mid-19th century until the late 20th century resulting in numerous water quality issues including AMD, sedimentation and stream bank erosion. After the formation of MCWA in 2002, WVDEP-AML and OSM partnered with the MCWA to address AMD issues. Surveys identified four primary project sites for treating AMD: Possum Hollow, Blacksnake Hollow, lower and upper mainstem. In 2006, passive treatment systems were installed at each of the four sites at a total cost of $1.7 million dollars.

Several of these treatment sites have failed or no longer function as intended, so following the revised *2013-WBP*, MCWA is repairing and developing new projects.

Project highlights

Limestone lining and cell re-construction

The goal of this project is to reduce loads of acidity by 9,679 lbs/year, aluminum by 643 lbs/year and iron by 2,641 lbs/year and install BMPs at the upper mainstem site to improve water quality downstream. The project did not remove enough loads to meets standards; however, MCWA will address additional loads with future project proposals. This system is the largest of the four projects.

Originally constructed in 2006, the system re-routed Morris Creek stream channel, utilizing the old channel to construct treatment cells. Each cell was separated by check dams lined with a 12-inch layer of limestone as well as baffle curtains installed in cells of the treatment system. The re-construction also included removing sludge and re-configuring the AMD seep so that it entered at the top of the system. A *Nelson Tank* added additional alkalinity.

One of the major highlights is the continuous educational outreach opportunities it has provided. Numerous volunteers and students ranging from 3rd grade to undergraduate and beyond visit the site to collect water chemistry and conduct research. Three Biology majors of West Virginia Institute of Technology (WVIT) collected data at five sites for their Ecology class. Students receive field experience in water sampling and analyzing data. Students were encouraged to think outside the box and share their ideas on treating impaired streams.

In late summer 2018, WVDEP's leadership program chose Morris Creek watershed as a stop on their project tour. WVDEP's WIB/WAB staff and MCWA representatives presented project information and multiple demonstrations. Future WVDEP leaders were made aware of the benefits of partnerships and the commitment to improving our environment and communities.

Results

Water quality (WQ) data was collected by WVDEP's AML/WIB employees six-times/year and WVIT's biology club partnered with WV *Save Our Streams* (SOS) to provide benthic collection support. Early benthic analysis suggests a positive response from the streams biology, but more information is needed. Visual surveys suggest a dramatic fishery response, as trout are found in the upper reaches and downstream of the treatment systems. WQ results are in the table below.

Table 4. MCWA upper mainstem WQ results

Pollutants	Unit	Proposed LR	Achieved LR	% Difference
Acidity	lbs/year	9,676	23,968	+ 84.9
Aluminum	lbs/year	643	473	- 30.5
Iron	lbs/year	2,641	8,455	+ 104.8

% Difference: (+) is a greater than anticipated load reduction (LR)
(-) is less than anticipated

Partners and funding

The treatment site was completed in 2018. The employees of WVDEP were a key component in preparation, implementation and monitoring of this site. WVIT has provided monitoring support as well and worked with other volunteers within the watershed.

A countless number of volunteers have been incredibly helpful with the success of this project. Their contributions included water sampling, fixing loosed pipes to getting covered in orange AMD. Their efforts are greatly appreciated… The amount of time/effort cannot be adequately depicted by a simple financial table.

Re-constructed treatments cells with baffles

Table 5. Upper mainstem project expenditures

Funding sources	Award	Expenditures	Balance
§319	$49,265	$49,265	$0
OSM-WCAP	$6,470	$6,470	$0
Match (includes volunteer time and other state contributions)	$44,200	$44,200	$0
Totals	**$99,935**	**$99,935**	**$0**

Sewell Creek of Meadow River

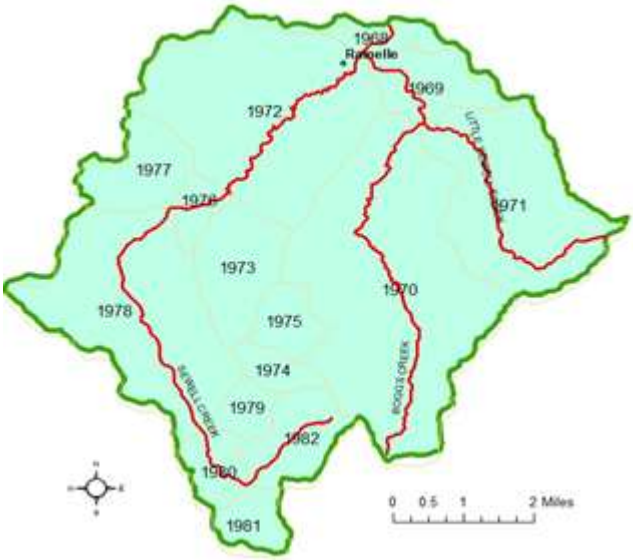
WV Conservation Agency
Contact(s): *Dennis Burns* and *Pamela Russell*

Watershed information

HUC8	05050005 - Gauley River
HUC12	050500050604 - Sewell Creek
Stream code	WVKG-19-Q, Q1, Q-1A

Introduction

Figure 4. Sewell Creek watershed



Sewell Creek, Little Sewell (WVKG-19-Q-1) and Boggs Creeks (WVKG-19-Q-1A) are identified in the TMDL as being contaminated with fecal coliform from failing septic systems. All but three of its subwatersheds are identified in the TMDL as needing on-site wastewater load reductions. These streams are included in the 2012 Upper Meadow River WBP.

Beginning in the spring of 2016, funding was made available for homeowners in this watershed to receive assistance fixing failing septic systems. To promote the program, mailers were sent to every resident, and two public meetings were held. Initially, the program began well and was expected to be a quick success, but progress was abruptly halted in late June 2016 as the area was hit with a one thousand year rain event that caused catastrophic flooding. It was more than a year after this event before anyone would participate in the program as they had bigger issues to address.

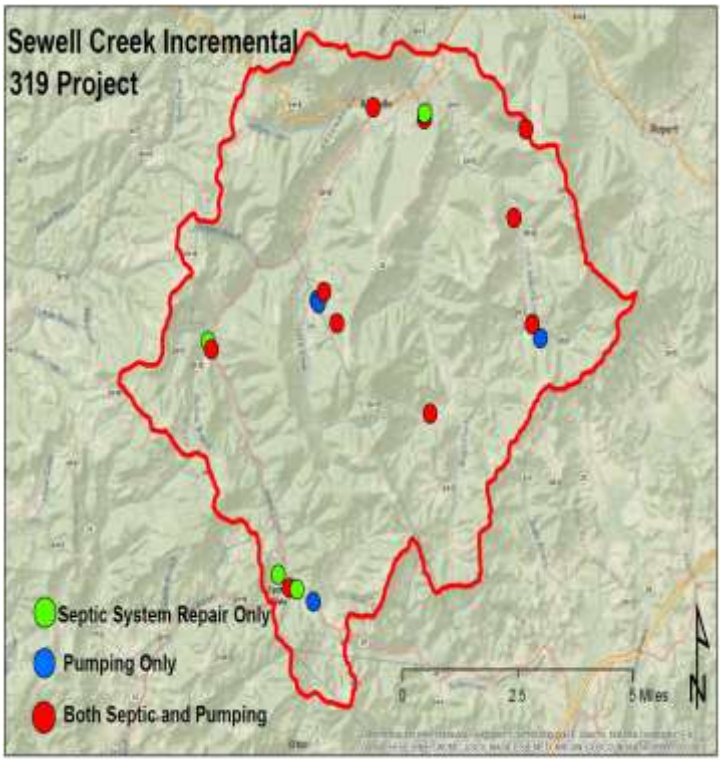
Project highlights

The most important highlight of this project has been the overall partnership between various forms of government and private individuals to accomplish the goal of the project. Officials with the City of Rainelle which is located near the mouth of the stream, went to great effort to promote the program and provide necessary applications to interested landowners. Additionally, the contractors in the area who repair, install, and pump septic systems also promoted the program and kept applications on hand to provide to potential customers. Since this watershed crossed conservation district lines, the Greenbrier Valley Conservation District and the Southern Conservation District worked together to approve applications and reimburse landowners for the cost share as quickly as possible.

Results

Due to construction in the area, the 2016 flood, high water levels, and other stream conditions that deemed it unsafe in addition to poor sampling conditions, water quality monitoring for Sewell Creek did not occur until the last month of the project. To compensate for loss of time and still allow for the data to be useful, samples were taken twice a week during the month of June 2018.

Figure 5. Sewell Creek implementation



This sampling allowed for a monthly average geometric mean to be calculated as 673 cfu/100 ml; Note: the standard is 400 cfu/100 ml. The pre-project average was 955 cfu/100 ml. These results combined with overall stream flow data were used to calculate the new baseline bacteria load for the stream at 1.02E+14.

This project resulted in pumping of 14 seasonal failing systems, and repairing of 13 completely failing systems, which has allowed for a modeled load reduction of 2.74E+15 based on the TMDL model. Monitoring has determined a load reduction of 8.84E+15, with a monthly geometric mean of grab samples being 672 counts/100 ml. This accounts for 98% of the required load reduction of 8.94E+15. While these figures are still slightly higher than state water quality requirements, it does provide significant evidence to support the fact that BMPs installed under this program have made a significant positive impact on the water quality of the Sewell Creek watershed.

Partners and funding

Funding for this project was provided by Clean Water Act §319 for $53,100. Homeowners and state sources funded the remaining balance. Homeowners provided 50% of the funding for seasonally failing systems, and 25% of the funding for completely failing systems. Cost share amounts were capped at $500 for septic system pumping and $5,000 for septic system repairs. Additional in-kind support was provided in the form of technical support by WVCA and the Local Health Departments.

Table 6. Sewell Creek project budget.

Final budget Tasks	Total expenses	§319 expenses	Match	
			Landowner	Local
Completely failing septics	$65,373	$52,345	$13,028	
Seasonally failing septics	$1,549	$702	$848	
Outreach/education	$364			$364
Monitoring	$834	$52		$834
Technical assistance provided by WVCA, GVCD, SCD, and local Health Depts.	$20,379			$20,379
Totals	**$88,499**	**$53,099**	**$13,876**	**$21,577**

Project partners

1) WV Conservation Agency
1) Greenbrier Valley Conservation District
2) Southern Conservation District
3) WVDEP, Watershed Improvement Branch
5) City of Rainelle
6) Fayette County Health Dept
7) Greenbrier County Health Dept.
8) Local landowners

Watershed based plan highlights

2018 was one of the most active years for new plan work and revisions in recent memory. Several WBPs and one watershed protection plan (WPP) were submitted to WVDEP and are currently under review or have been reviewed and recently submitted to USEPA. Several others are close to being completed (*Table 6*).

NRCS is also promoting funding and watershed plan development through the Watershed Flood Prevention Act. Multiple public scoping meetings were held focusing on the Elkhorn Creek, the Upper Guyandotte basin and the Cherry River. The last meeting occurred on *December 18th* in Richwood, WV. WVDEP-WIB will likely be a stakeholder and contributor for most of these efforts. The time frame for development and completion is unknown at this time as public feedback and additional agency input/data is still being sought.

Trout Unlimited is tasked with plan development in the Cherry River and a local sponsor is still being secured. Local sponsors and developers have not been selected/secured in the other target basins. To learn more about this effort visit: *https://www.nrcs.usda.gov/wps/portal/nrcs/main/wv/programs/planning/wsp/*.

Table 7. 2018 WBP development.

Watershed plan	HUC12	HUC12_name	HUC8_name	Type	Pollutant	Sponsor	BC_Region	Status
Anderson Run	020700010602	Anderson Run	South Branch	Restoration	Bacteria/sediment	WVCA	Potomac	WVR
Beaver Creek	050200040202	Middle Blackwater River	Cheat	Restoration	Metals/pH	FOB	Northern	EPAR
Big Sandy Creek	050200040604	Beaver Creek - Little Sandy Creek	Cheat	Restoration		FOC	Northern	WVR
	050200040604	Middle Big Sandy Creek	Cheat	Restoration	Metals/pH	FOC	Northern	
	050200040605	Lower Big Sandy Creek	Cheat	Restoration		FOC	Northern	
Pringle Run	050200040702	Pringle Run - Cheat River	Cheat	Restoration	Metals/pH	FOC	Northern	UD
Muddy Creek	050200040703	Muddy Creek	Cheat	Restoration	Metals/pH	FOC	Northern	UD
North Fork Greens Run	050200040705	Greens Run - Cheat River	Cheat	Restoration	Metals/pH	FOC	Northern	UD
West Virginia Fork	050200050102	West Virginia Fork	Dunkard	Restoration	Metals/Bacteria	DCWA	Northern	S
Anthony Creek	050500030502	North Fork Anthony Creek	Greenbrier	Protection		WVCA	Southern	EPAR
	050500030503	Upper Anthony Creek	Greenbrier	Restoration	Bacteria	WVCA	Southern	
	050500030504	Middle Anthony Creek	Greenbrier			WVCA	Southern	
	050500030505	Lower Anthony Creek	Greenbrier			WVCA	Southern	

https://dep.wv.gov/WWE/Programs/nonptsource/WBP/Pages/WBP.aspx
WBP website

Status symbols
WVR - WVDEP review
EPR - EPA review
UD - under development
S - stalled

Sponsors
DDWA: Dunkard Creek Watershed Assoc.
FOB: Friends of Blackwater
FOC: Friends of the Cheat
WVCA: WV Conservation Agency

The Deckers Creek and Wolf Creek watershed plans are highlighted in this report. Previously highlighted WBPs include: Lambert Run, Back Creek WPP, Milligan Creek and Knapp Creek (*2017*); Sleepy Creek and the Upper Buckhannon River were highlighted in 2016, and multiple bacteria WBPs of the Potomac Direct Drains were the focus in 2015.

Deckers Creek watershed plan

Watershed information

HUC8: 05020003 - Monongahela River
HUC12: 050200030201 - Headwaters Deckers Creek, 050200030202 - Outlet Deckers Creek
Sponsor: Friends of Deckers Creek

Watershed description

Deckers Creek drains 64 square miles of Monongalia and Preston Counties, West Virginia. It discharges to the Monongahela River in Morgantown, the seat of West Virginia University (WVU). In 1951 research at WVU had already found pH values near 4 in Deckers Creek because of acid mine drainage (AMD) created from mining the high-sulfur coal seams in the area. Despite the pollution, the steep rapids of Deckers Creek, rock outcrops suitable for climbing, and an opportunity to build a rail-trail attracted outdoor enthusiasts to Deckers Creek and made the residents of the area realize that the watershed could be both an economic engine and a thing of pride and beauty. FODC, a non-profit association, wrote a watershed-based plan to restore its water quality.

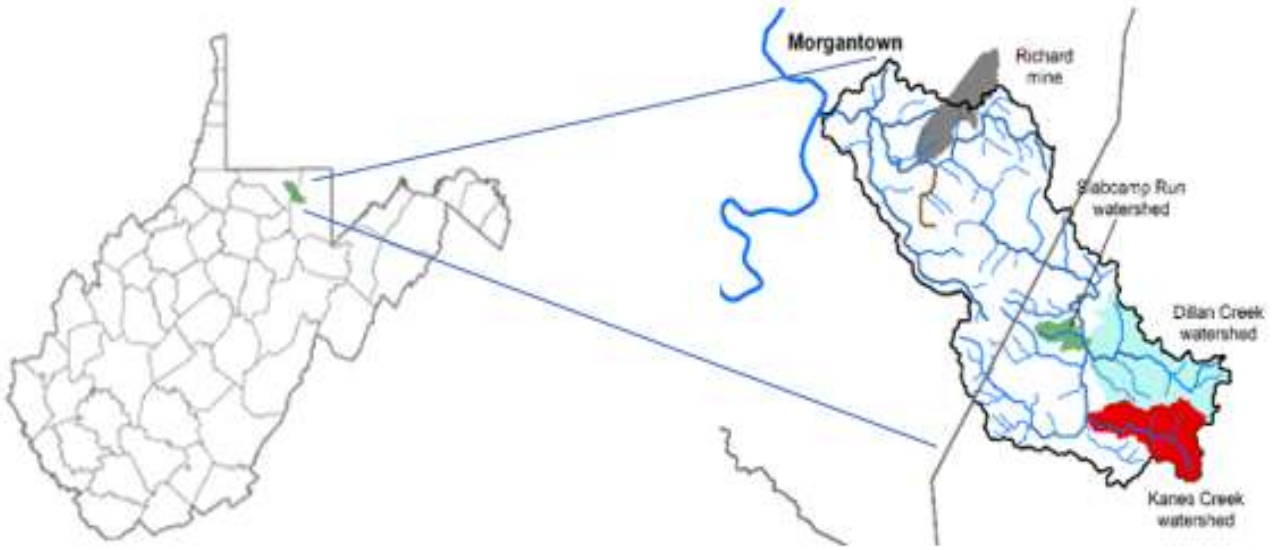


Figure 6. Deckers Creek watershed based plan map

Goals

The plan has two major branches. FODC will use funding from WIB and matching sources to treat smaller abandoned mine land sources of AMD that lie mostly in the headwaters portion of the watershed. Meanwhile, FODC and government agencies, such as USDA-NRCS and WVDEP, will seek funding for, plan, and construct an active-treatment project to address the Richard mine, which discharges to Deckers Creek six miles from its mouth, and just upstream from the most populous part of the watershed.

Partnerships

Several agencies have played a role in the remediation of Deckers Creek. WVDEP reclaimed coal refuse remaining from pre-1977 mining and sealed mine portals, controlling the accumulation of water within mine voids as well as where it flowed outside the mine. The Natural Resources Conservation Service also reclaimed abandoned mine lands and installed water treatment projects to neutralize AMD. FODC has installed seven projects and continues with additional ones. Arch Coal and other NPDES permittees have controlled their discharges to maintain even better water quality.

Project highlights

In 2011, after FODC reported persistent good water quality in the mainstem, volunteers with Trout Unlimited stocked it with brown trout (*Salmo trutta*). Since then, fish surveys have shown cohorts of fish surviving in the creek year-round and growing larger.

At the mouth of Kanes Creek, average pH values have steadily increased and metal concentrations have steadily decreased over the duration of the plan. Recent projects at Kanes Creek South Site 1 and Valley Point 12 have improved treatment to the larges unnamed tributary, which enters at river mile 3.2.

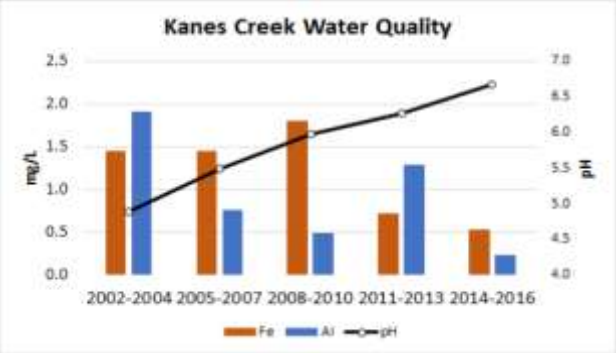
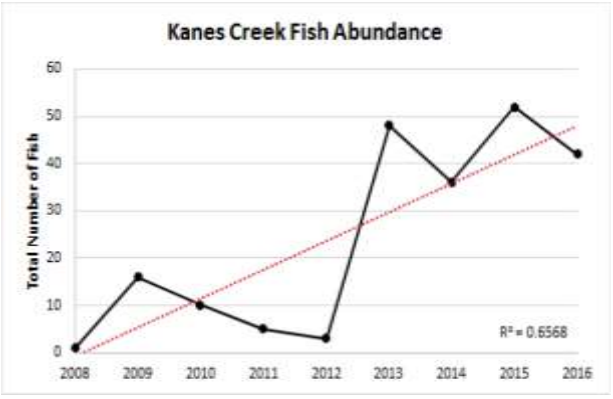


Figure 7. Kanes Creek water quality 2002 - 2016

Kanes Creek South Site 1 (left): This project is a partnership with WVDEP, which supplies lime to a silo. A dosing apparatus adds that lime to AMD from a sealed mine portal. Solar panels power an aerator to rid the AMD of CO_2, which would otherwise consume the lime, and power a mixer to make sure that the lime is used efficiently.

Valley Point 12: In this project, the acidity is decreased by rapidly passing it through a very small volume of limestone. After that, the stream is split and passes through two beds with a mixture of limestone sand and organic material.

Figure 8. Kanes Creek fish abundance 2008 - 2016



Annual surveys at the mouth of Kanes Creek have shown that the number of fish using it is steadily increasing. Upcoming projects in the watershed will begin to tackle Dillan's Creek, and Slabcamp Run, other AMD impaired tributaries to Deckers Creek.

In addition to the work of the non-profit watershed group, the Abandoned Mine Lands group in WVDEP, in partnership with USDA-NRCS, are moving forward with a multi-year plan to treat the drainage from the Richard mine, which pollutes the last six miles of Deckers Creek.

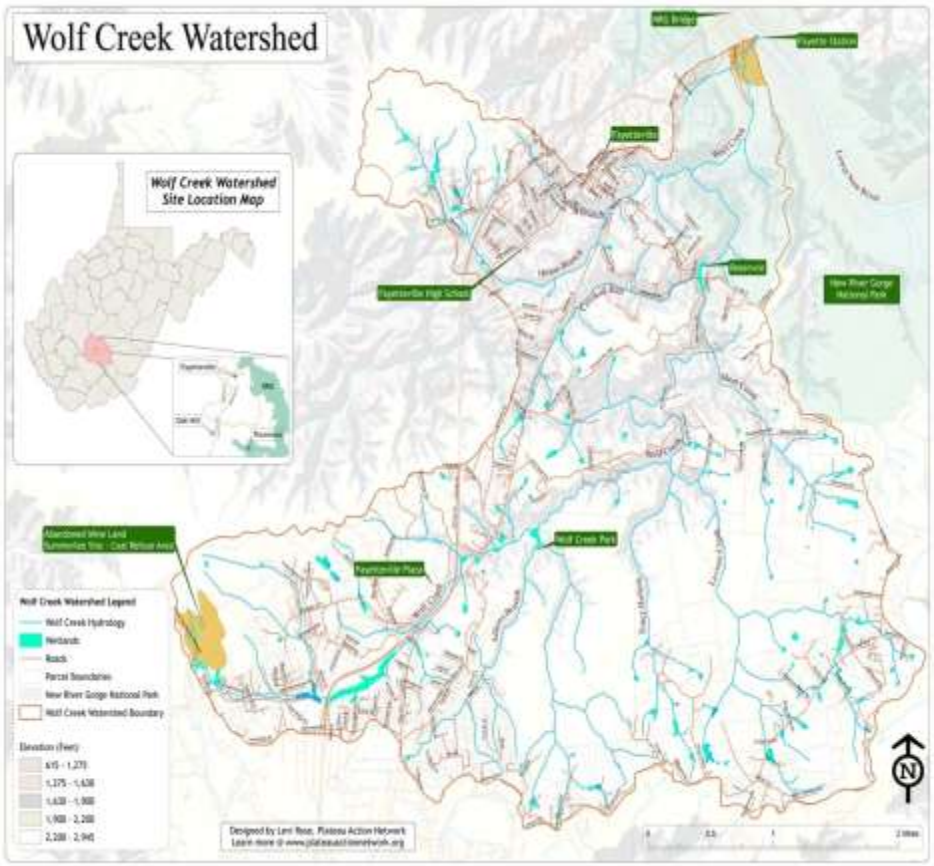
Thus far a total load reductions are 142,338 lbs/yr (metals) and 338,326 lbs/yr (acidity). Total WBP cost including §319, match and other contributions is $2,941,348. See the table in *Appendix 4* for additional details.

Wolf Creek watershed plan

Watershed information

HUC8: 05050004 – Lower New River
HUC12: 050500040304 - Wolf Creek-New River
Sponsor: Plateau Action Network

Watershed description



The Wolf Creek watershed is in Fayette County, West Virginia and is a sub watershed of the lower New River watershed. The headwaters of Wolf Creek start at Summerlee, an Abandoned Mine Land site, that flow downstream through parts of Fayetteville and Oak Hill. Wolf Creek and its tributaries are impaired by high levels of iron, aluminum and fecal coliform bacteria as well as low pH. The pH impairment identified in the TMDL is caused by the organic enrichment and sedimentation and can be solved by reducing iron loads and fecal coliform. The WBP focuses on abandoned minelands, streambank erosion, pasture/cropland, and onsite sewer systems. In 2014 the WBP was revised, and §319 funds were used to install Phase 2 and design Phase 3A.

Figure 9. Wolf Creek watershed based plan map

Goals

Plateau Action Network (PAN), WVDEP-WIB, AML and OSR plan to work together to collect more monitoring data to have a better design for phase 3A . Phase 3A outcomes will determine whether finishing system Phase 3B will be active or passive. The initial thoughts are to increase the terrace iron formations (TIFs) to reduce as much iron as possible before the next phase. AML will take on this project and strive to achieve water quality standards after Phase 3B is installed. This will allow a majority of the allocated 319 funds for this project to be used to do other projects in the state.

Partnerships

PAN and WVDEP have been working together to implement the next phases of this project. WVDEP AML program has agreed to take over the project which also includes the operation and maintenance needs for the Summerlee project. A project meeting was held with WVDEP Special Reclamation, WVDEP-AML, WIB and PAN to discuss the current passive design. The project is slated for construction in 2021 while monitoring will continue to help determine the next year and coordinate efforts for the last phases of this project.

Project highlights

Summerlee Refuse Pile, located in the headwaters of Wolf Creek, is the most significant source of iron loading in the watershed. Beginning in 2007, PAN has worked to remediate and reduce the heavy metals draining into Wolf Creek. Because the mine water contains very high metals and high acidity, this project has been tackled in phases. Phase 1 was designed to capture AMD during low flows and divert through limestone channels to reduce acidity before reaching a settling pond. Phases 1.1 and 1.2 involved construction of terraced iron formations and utilize existing space to take advantage of the low-pH ferrous iron oxidation process. These efforts were funded in partner with §319 funds, OOSM-WCAP grants, the Wolf Creek Trust and PAN.

The most recent phase, Phase 2, was constructed in November 2016 which included more channel for TIFs and the construction of automatic flushing limestone beds.

Figure 10. Summerlee Phase 2 post-construction

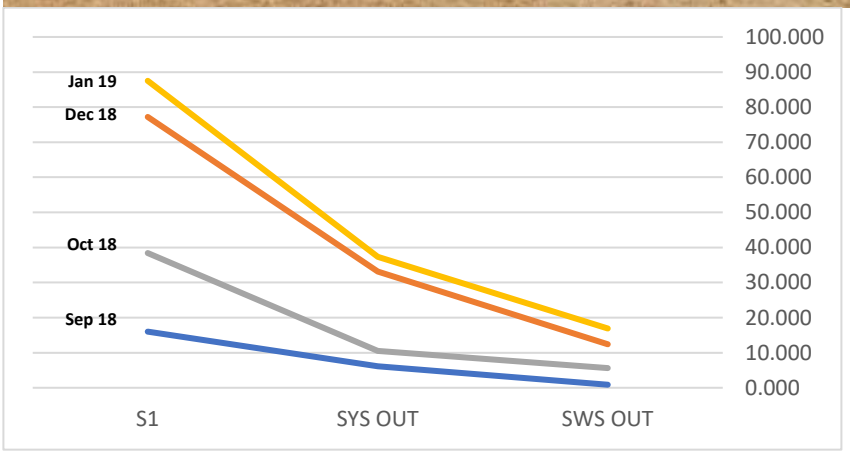


Figure 11. Pre- Phase 3 monitoring showing dissolved Fe into system (S1) and out of the system (SYS-SWS)

Terrace iron formations

Starting in September 2018, WVDEP-WIB began monitoring to determine the outcome of Phase 2 and determine the next steps. TIFs have become well established in the limestone channel however, the Automatic Flushing Limestone Beds have become armored and need maintenance. The past few months of sampling has shown that the heavy metals are reduced but still high leaving the Summerlee site.

Thus far total load reductions are 106,085 lbs/yr (metals) and 323,920 lbs/yr (acidity). Total WBP cost including §319, match and other contributions is $629,752. See the table in *Appendix 4* for additional details.

From Polluted to Playground: It's Taken 25 Years to Clean Up the Cheat River

By BRITTANY PATTERSON • JUN 11, 2018

Paul Ziemkiewicz, director of West Virginia University's Water Research Institute, on a bridge overlooking Big Sandy Creek.

On a recent sunny Wednesday, Paul Ziemkiewicz, director of West Virginia University's Water Research Institute, was standing on a bridge looking out at Big Sandy Creek. It was a balmy afternoon, perfect for kayaking, and the creek running the Cheat River was clear. But 25 years ago, this water was a shocking orange color -- from acid mine drainage. "Look at this," Ziemkiewicz said, gesturing to the raging water below. "This is a fishery now, but it was completely dead back then." This year the last heavily-polluted stretch of the watershed is set to be cleaned up. "In my lifetime a river that was dead has now come back," said Amanda Pitzer, executive director of Friends of the Cheat (FOC), a local conservation group that was formed by a motley crew of river guides and enthusiasts in 1994 to deal with acid mine pollution. The group also hosts the annual Cheat River Festival to celebrate the river and raise money to restore it.

The Cheat was known to be polluted for decades, but the pollution grabbed national attention after two blowouts at the active T&T coal mine in 1994 and 1995 poured millions of gallons of acidic water into the main stem of the Cheat. Fish were killed 16 miles downstream in Cheat Lake. More than two decades later, Friends of the Cheat, residents and businesses and state and federal regulators have a reason to celebrate: Once fully operational, an active water treatment plant run by WVDEP near the T&T mine will clean polluted water currently running through Muddy Creek. Once the 3.4-mile stretch of Muddy Creek is clean, fish will be able to travel the entire length of the Cheat River -- one of the longest free-flowing rivers in the eastern United States -- unimpeded by pollution. "It was such an accomplishment to bring the Cheat back, but to bring Muddy Creek back -- I mean we're kicking butt and taking names," Pitzer said.

A New Approach

This success is largely the result of a decision among regulators, scientists and a local conservation group to treat the pollution problem as an entire watershed. Across the Cheat River's 1,422-mile watershed, more than 340 abandoned coal mines feed pollution into the Cheat and its tributaries, like the Big Sandy. Acid mine drainage, or AMD, is one of the largest contributors of pollution to thousands of miles of rivers and streams from Alabama to Pennsylvania. The bright orange, and sometimes milky white, pollution contains iron, aluminum and manganese. It forms when pyrite, a mineral buried deep underground with coal, is exposed to air and water.

State regulators have limited federal dollars to ensure water coming from these mines meets federal Clean Water Act standards. An estimated 300,000 abandoned mines dot Appalachia, complicating the problem. Water that comes from mines built before 1977, when the Surface Mining Control and Reclamation Act went into effect, must be treated by the state. The law mandated that mines built after 1977 must be bonded, or have insurance, in case they go out of business or the operator chooses to stop maintaining the site. If that happens, WVDEP takes the money from those bonds and must reclaim the land and treat the water from these so-called "bond-forfeiture" sites. Ziemkiewicz, of WVU, said originally in the Cheat River watershed -- as is the case in many places dealing with AMD across Appalachia -- regulators tried to address the problem by treating each individual mine contributing pollution to the river, but it's not always effective. "You can throw almost infinite amounts of money trying to treat point sources like that in a watershed like this that has both abandoned mines and also bond forfeiture sites and not make any impact at all on the quality of the stream because the abandoned mines dominate the whole picture," he said.

A key piece to making this new approach work was some innovative thinking on the part of state regulators. The state DEP created an alternative clean water permit, which allowed the agency to address stream wide water quality, rather than treat individual pollution sources. "The watershed scale strategy that DEP is using here actually restores the creek and for a lot less money," Ziemkiewicz said. Scientists also needed to show federal regulators they could get results treating AMD pollution on a watershed level.

A Testbed in the Watershed

Standing in a grassy clearing overlooking this forested valley, it's just possible to see the entry to a now-abandoned coal mine here in the headwaters of Sovern Run, a tributary of Big Sandy Creek, which runs into the Cheat. Ziemkiewicz and his team built what's called a "passive treatment" system. At Sovern site No. 62, AMD pollution flows through a series of limestone-lined ponds and channels. The alkaline limestone turns low pH, acid water coming out of the mine into much cleaner water through naturally-occurring chemical reactions. Passive systems don't require power or the addition of chemicals and are often lower maintenance. "We were able to knock off something like 80 percent of the acid load, most of the iron," Ziemkiewicz said, of the passive treatment system. "The idea was to put a lot of these all over the watershed."

Part of the passive treatment system at Sovern site No. 62.

During the first Cheat Fest in 1995, FOC and Ziemkiewicz and his team took federal officials from the Interior Department and Office of Surface Mining (OSM) to the treatment system at Sovern site No. 62. The strategy being employed in the Cheat River watershed could be valuable to other communities struggling with AMD pollution. To help widen the scope, OSM created a federal plan inside its acid mine drainage program that allowed states to dole out federal Abandoned Mine Land dollars to local government agencies and watershed organizations, like FOC, to clean up streams impaired by AMD. FOC took it and ran with it. They installed more than a dozen passive treatments. Today, they maintain those and a series of active treatments, or engineered systems. Active treatments include in-stream dosers, which deposit a steady stream of alkaline lime to help neutralize the water. Active treatments also include things such as water treatment plants.

Toddi Steelman, one of the founding members of FOC, studies watershed restoration She said the collaboration between Friends of the Cheat and regulators at both state and federal levels has been a 25-year experiment. "Having the university close by and invested was a huge stroke of luck," she said. "Having several sources of financial support in the 90s has really been essential." She also underscored the importance of having a local conservation group that is deeply invested in seeing the restoration of a river come to fruition. "You need a local champion that is going to see it through because it's really a labor of love," she said. "It's really about love of land, love of the river, love of community and I would say that's really what has characterized the group over time."

This type of grassroots model can be a template for others, according to Scott Hardy, with the Ohio Sea Grant program at Ohio State University. He studies collaborative watershed management and said the federal government moved toward providing resources for more grassroots, collaborative watershed restoration in the 1990s, with plenty of success stories. Hardy said although collaboration can take longer than traditional top down restoration efforts, having local groups that are passionate about their watershed helps.

The Last Piece

It takes a lot of heart, but it also takes a lot of money to clean a watershed. Since 2000, the Environmental Protection Agency has contributed more than $5 million to the Cheat watershed. The state DEP has spent more than $13 million constructing and maintaining treatment systems across the area. Now, one of the last treatments is almost in place. Once fully operational, a water treatment plant near the T&T mine will take care of the last major polluted stretch of the watershed.

T&T treatment facility near Albright, WV.

You can see the T&T Treatment plant just off Route 26 near Albright. In some ways, it can best be described as a dishwasher for dirty mine water. The plant will process AMD polluted water from three abandoned mine sites. Water pumped in from the polluted Fickey Run, will also be piped to the plant, said Larry Riggleman, the regional engineer for northern region of DEP's Office of Special Reclamation.

Riggleman helped design the plant. It can treat between 800 to 4,200 gallons of polluted water each minute. A lime slurry is added to the two 80-foot tanks, or clarifiers, as they're called. When the lime is added the iron and aluminum drop to the bottom. The metal sludge is pushed to the middle, drains out, and is pumped back into the T&T mine nearby. "And then from here it's a straight discharge to the river," Riggleman said. If another mine blowout were to happen like the events in 1994 and 1995, the plant can handle up to 7,600 gallons per minute, which will flow through the two tanks and come out the other side clean. The site cost about $8.5 million to construct and $30,000 a month to run, funded in part by the bond forfeited by the T&T mine. DEP also received support from oil and gas company, Southwest Energy. The company has a policy to offset its water use by contributing in other water restoration efforts.

"Within West Virginia we were looking for meaningful projects that were out there that we could be a contributor towards and the Cheat River is a beautiful river and one that stood out to us as a place that we could make a positive impact," said Rowlan Greaves, manager of strategic solutions for Southwestern Energy. Riggleman has been working in this watershed for years and he said once the plant is fully operational, Muddy Creek, which has been the single largest contributor of acid mine drainage for years, will be clean. He said it's hard to quantify what that will mean. "I mean, to be able to bring a stream back to life -- which I can't tell you when the last time it had life -- but from an environmental standpoint on the Cheat it's huge," he said. "I think from a recreational standpoint with people wanting to fish, kayak, things of that nature, I think that's huge. I think it's very important that this gets done and I think it'll be very successful."

Paul Hart, president of local rafting company, Cheat River Outfitters, agrees that the work done over the last two decades has made a difference in the water quality of the river. Today, he said, guides will often catch fish in the clear, clean water. "A lot of people have seen it and decided 'you know we can do better,'" he said. "And they've put their heads together and made it happen, which is a dream turned into a reality. The Cheat is just too much of a gem to be lost to something like acid mine drainage, it really is." Hart added the river was already losing appeal as a rafting destination before the big mine blowouts in the 90s, and it has yet to recover. Pitzer, said they recognize overcoming a polluted reputation takes time. "Just like anything it takes time to change people's perception of what a river is," she said. "If you came here in the 80's and you paddled the river and you remember it being orange and awful and then someone tells you 'oh my gosh, I went, and I caught walleye down in Jenkinsburg,' they might be like 'oh, get out of here' you know. So, I think it just takes time." The groups plan to continue working to restore the river in the hopes that one day the Cheat has a different reputation: One of a clean, beautiful river.

This article was published in WV Public Broadcasting's – *Telling the Story*

NONPOINT SOURCE SUCCESS STORY

West Virginia

Tuscarora Creek Relocation and Restoration Improves Biodiversity

Waterbody Improved

Tuscarora Creek was added to West Virginia's Clean Water Act (CWA) section 303(d) list of impaired waters in 2002 for not meeting the state's biological water quality standard. Sediment and organic enrichment were identified as the key stressors to aquatic life in the 2008 total maximum daily load. Project partners re-routed the creek around an obsolete dam to adjust the creek's profile and pattern to transport sediment more effectively through a 950-foot reach. Abundance and diversity of benthic macroinvertebrates have improved in the first year, indicating water quality progress. Thanks to the generous cooperation of the landowners, the site has served as a demonstration to the community through articles, videos and tours to inspire more streamside vegetation and general awareness about pollution in the Tuscarora Creek watershed.

Problem

Tuscarora Creek is a tributary of Opequon Creek in Berkeley County, West Virginia (Figure 1). Tuscarora Creek was added to West Virginia's list of impaired waters in 2002 for not meeting the state's biological water quality standard due to organic enrichment and sediment. A dam was built in the 1920s to provide irrigation water for a nearby orchard (now gone). A local group of fishermen, the Creekside Anglers, identified the removal of the dam as an important next step for improving habitat for trout, because the slack water behind the dam was causing an increase in water temperature. The dam was also a barrier to aquatic organism passage and captured sediment being naturally transported by the stream. West Virginia Department of Environmental Protection (DEP) staff sampled above and below the dam in April 2013 for benthic macroinvertebrates and found that the community had a combined score of "poor."

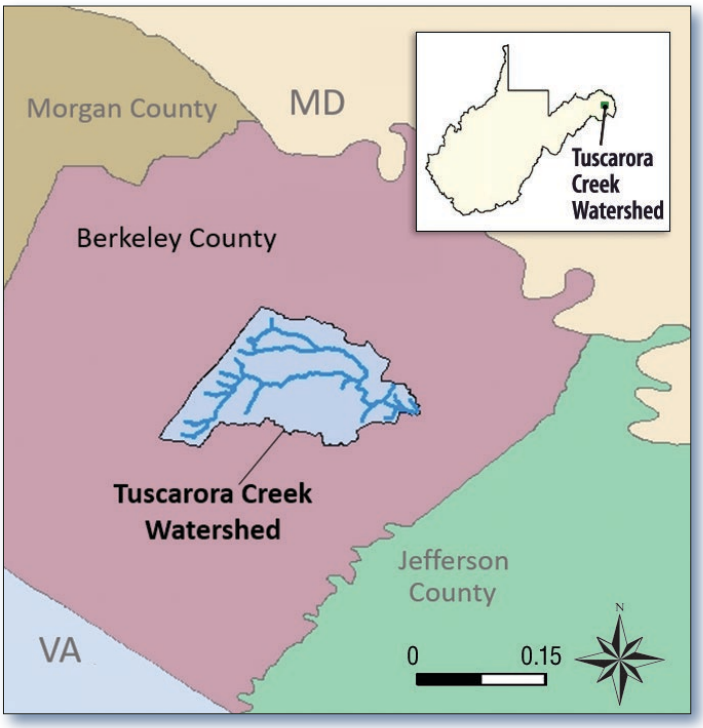


Figure 1. Tuscarora Creek is in the West Virginia panhandle.

Story Highlights

Using CWA section 319 funds, the Canaan Valley Institute (CVI) designed a stream restoration project that adjusted the stream's path to avoid the dam while also approaching the road culvert at a better angle (Figures 2 and 3). The new design added shallow riffles, deep pools, and vegetative bank stabilization to improve the benthic habitat for organisms as well. The project restored 448 feet of natural channel and established 1.5 acres of trees and shrubs. CVI obtained a grant from National Fish and Wildlife Foundation to implement the dam removal portion of the project. In 2016 a portion of the spillway was removed, the remaining portion of the dam was abandoned and buried in place, and the stream was rerouted to flow around the abandoned dam site.

Figure 2. The new stream channel diverts water around a small concrete dam, now buried.

Figure 3. The stream channel was configured to allow water to flow more directly into the culvert.

Figure 4. Upper portion of the restored reach.

Figure 5. Lower portion of the restored reach.

Results

Native plants in the new riparian buffer along the restored areas flourished quickly after project completion, stabilizing the area (Figures 4 and 5). In September 2017 (one year after the project was completed), DEP collected benthic macroinvertebrates with dip nets from several riffles along the project reach and found that the IBI score has significantly improved. The IBI score recorded on April 23, 2013 (before project implementation) was 31.5 ("poor" integrity). The IBI score recorded on September 12, 2017 (after project implementation), was 57.4 ("marginal" integrity)—a 58 percent increase.

An elevated nitrate-nitrogen level and the abundance of certain pollutant-tolerant macroinvertebrates indicate there are still water quality challenges influencing this reach. The Tuscarora Creek Project Team continues to implement the watershed-based plan to reduce nonpoint sources of pollution such as leaking septic systems, livestock access to surface water, and residential fertilizer over-use. Streambank stabilization work at upstream sites may also decrease excess sediment delivered to the creek.

Partners and Funding

This work was implemented with funding from the National Fish and Wildlife Foundation (through a Chesapeake Stewardship grant) and the West Virginia DEP CWA Section 319 Program. CVI designed and managed the project with help from the Roach Family, Eastern Panhandle Conservation District, West Virginia DEP, West Virginia Division of Forestry, U.S. Environmental Protection Agency, Appalachian Stream Restoration and the Opequon Creek Project Team.

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

EPA 841-F-19-001K
March 2019

For additional information contact:

Tim Craddock
West Virginia Department of Environmental Protection
304-926-0499 • Timothy.D.Craddock@wv.gov
Kristin Mielcarek
Canaan Valley Institute
304-940-3443 • kristin.mielcarek@canaanvi.org

Appendix 1. BMP Implementation

BMP	Q	U	Date	HUC12	HUC Name
Septic	1.0		Sep-18	050500090608	Browns Creek-Coal River
Nutrient management	14.3	ac	Sep-18	050500030107	Brush Run-Greenbrier River
Erosion control	35.5	ac	Sep-18	050500030107	Brush Run-Greenbrier River
Nutrient management	227.3	ac	Sep-18	050500020701	Burnside Branch
Erosion control	90.5	ac	Sep-18	050500020701	Burnside Branch
Erosion control	145.0	ac	Sep-18	050500030402	Clover Creek-Greenbrier River
Septic	1.0		Sep-18	020700041107	Elks Run
AMD system	1.0		Sep-18	050200030201	Headwaters Deckers Creek
AMD system	1.0		Sep-18	050200030201	Headwaters Deckers Creek
Upflow limestone well	1.0		Sep-18	050200030201	Headwaters Deckers Creek
Catch basin	500.0	sqft	Sep-18	050200030201	Headwaters Deckers Creek
Limestone bed	4,950.0	sqft	Sep-18	050200030201	Headwaters Deckers Creek
Tank/trough	500.0	sqft	Sep-18	050200030201	Headwaters Deckers Creek
Vertical flow treatment	5,372.0	sqft	Sep-18	050200030201	Headwaters Deckers Creek
Nutrient management	130.2	ac	Sep-18	020700010201	Headwaters Lunice Creek
Nutrient management	81.2	ac	Sep-18	020700010101	Laurel Fork-North Fork South Branch
Nutrient management	5.8	ac	Sep-18	050500030901	Laurel Run-Greenbrier River
Erosion control	31.5	ac	Sep-18	050500021002	Lick Creek-Bluestone Lake
Nutrient management	88.8	ac	Sep-18	050500050601	Little Clear Creek
Nutrient management	100.0	ac	Sep-18	050500030407	Locust Creek-Greenbrier River
Channel stabilization	1,900.0	ft	Sep-18	050500030505	Lower Anthony Creek
AMD system	1.0		Sep-18	050200040605	Lower Big Sandy Creek
Limestone bed	7,995.0	sqft	Sep-18	050200040605	Lower Big Sandy Creek
Limestone bed	4,272.0	sqft	Sep-18	050200040605	Lower Big Sandy Creek
Limestone channel	250.0	ft	Sep-18	050200040605	Lower Big Sandy Creek
Nutrient management	104.6	ac	Sep-18	050500020705	Lower Indian Creek
Nutrient management	95.4	ac	Sep-18	050500030703	Lower Second Creek
Erosion control	42.0	ac	Sep-18	050500030703	Lower Second Creek
Nutrient management	4.8	ac	Sep-18	050500050606	Meadow Creek-Meadow River
Nutrient management	32.8	ac	Sep-18	020700030601	Meadow Run-North River
Nutrient management	99.4	ac	Sep-18	050500020704	Middle Indian Creek
Erosion control	34.5	ac	Sep-18	050500020704	Middle Indian Creek
Nutrient management	195.0	ac	Sep-18	050500030702	Middle Second Creek
Erosion control	35.5	ac	Sep-18	050500030702	Middle Second Creek
Nutrient management	42.3	ac	Sep-18	050500050605	Mill Creek-Meadow River
Buffer	3.0	ac	Sep-18	020700040905	Mill Creek-Opequon Creek
Fencing	2,400.0	ft	Sep-18	020700040905	Mill Creek-Opequon Creek
Septic	1.0		Sep-18	020700040905	Mill Creek-Opequon Creek
Nutrient management	118.0	ac	Sep-18	050500030903	Milligan Creek-Greenbrier River
Nutrient management	235.2	ac	Sep-18	050500030408	Muddy Creek
Erosion control	102.0	ac	Sep-18	050500030804	Muddy Creek
Nutrient management	41.4	ac	Sep-18	050500030104	Outlet East Fork Greenbrier River
Nutrient management	21.8	ac	Sep-18	050500030203	Outlet Knapp Creek
Nutrient management	208.0	ac	Sep-18	050500030302	Outlet Spring Creek
Erosion control	11.5	ac	Sep-18	050500030302	Outlet Spring Creek
Nutrient management	179.4	ac	Sep-18	050500020601	Rich Creek
Erosion control	38.5	ac	Sep-18	050500020601	Rich Creek
Erosion control	7.0	ac	Sep-18	050500020702	Rock Camp Creek
Septic	2.0		Mar-18	050500050604	Sewell Creek
Septic	5.0		May-18	050500050604	Sewell Creek

Septic-pump	10.0		May-18	050500050604	Sewell Creek
Nutrient management	103.2	ac	Sep-18	050500030408	Slabcamp Run-Greenbrier River
Erosion control	41.5	ac	Sep-18	050500030408	Slabcamp Run-Greenbrier River
Erosion control	57.0	ac	Sep-18	020802010401	South Fork Potts Creek
Nutrient management	6.0	ac	Sep-18	050500030406	Stamping Creek-Greenbrier River
Erosion control	327.0	ac	Sep-18	050500030406	Stamping Creek-Greenbrier River
Erosion control	9.5	ac	Sep-18	050500030401	Stitlington Creek
Erosion control	180.0	ac	Sep-18	050500030403	Stoney Creek
Nutrient management	28.2	ac	Sep-18	020802010301	Sweet Springs Creek-Cove Creek
Erosion control	32.5	ac	Sep-18	020802010301	Sweet Springs Creek-Cove Creek
Nutrient management	24.0	ac	Sep-18	050500030404	Thorny Creek-Greenbrier River
Erosion control	3.0	ac	Sep-18	050500030404	Thorny Creek-Greenbrier River
Buffer	3.0	ac	Sep-18	020700040907	Tuscarora Creek
Livestock crossing	2.0		Sep-18	020700040907	Tuscarora Creek
Septic	10.0		Sep-18	020700040907	Tuscarora Creek
Nutrient management	90.4	ac	Sep-18	050500030503	Upper Anthony Creek
Channel stabilization	1,964.0	ft	Sep-18	050500030503	Upper Anthony Creek
Erosion control	19.5	ac	Sep-18	050500020703	Upper Indian Creek
Alternate water	9.0		Mar-18	050500030701	Upper Second Creek
Irrigation pipe	4,308.0	ft	Mar-18	050500030701	Upper Second Creek
Pump plant	2.0		Mar-18	050500030701	Upper Second Creek
Well	2.0		Mar-18	050500030701	Upper Second Creek
Fencing	820.0	ft	Sep-18	050500030701	Upper Second Creek
Heavy use area	4,275.0	sqft	Mar-18	050500030701	Upper Second Creek
Nutrient management	232.4	ac	Sep-18	050500030701	Upper Second Creek
Buffer	4.0	ac	Sep-18	020700040201	Upper Sleepy Creek
Infiltration basin	3.0	ac	Sep-18	020700040201	Upper Sleepy Creek
Septic	4.0		Mar-18	020700040201	Upper Sleepy Creek
Nutrient management	62.4	ac	Sep-18	050500050101	Upper Williams River
Nutrient management	147.3	ac	Sep-18	050500030904	Wolf Creek
Erosion control	16.0	ac	Sep-18	050500030904	Wolf Creek
Outreach/education	11,431			Statewide	WV Conservation Agency
Outreach/education	5,117			Statewide	DEP-Project WET
Outreach/education	3,400			Statewide	DEP-Save Our Streams
Outreach/education	700+			CB-region	DEP-Stormwater

Priority areas	
Statewide/other	

Appendix 2. Pollutant load reductions

Pollutant	Q	U	Date	HUC12	HUC name
Coliform	1.48E+13	cfu	Sep-18	050500090608	Browns Creek-Coal River
Coliform	1.58E+12	cfu	Sep-18	050500030107	Brush Run-Greenbrier River
Phosphorus	866.4	lbs/yr	Sep-18	050500030107	Brush Run-Greenbrier River
Sediment	106.5	tons/yr	Sep-18	050500030107	Brush Run-Greenbrier River
Coliform	1.89E+12	cfu	Sep-18	050500020701	Burnside Branch
Nitrogen	4,617.3	lbs/yr	Sep-18	050500020701	Burnside Branch
Phosphorus	1,048.8	lbs/yr	Sep-18	050500020701	Burnside Branch
Phosphorus	820.8	lbs/yr	Sep-18	050500020701	Burnside Branch
Sediment	271.5	tons/yr	Sep-18	050500020701	Burnside Branch
Coliform	2.52E+12	cfu	Sep-18	050500030402	Clover Creek-Greenbrier River
Phosphorus	1,094.4	lbs/yr	Sep-18	050500030402	Clover Creek-Greenbrier River

Sediment	435.0	tons/yr	Sep-18	050500030402	Clover Creek-Greenbrier River
Coliform	1.64E+12	cfu	Sep-18	020700041107	Elks Run
Acidity	14,121.0	lbs/yr	Sep-18	050200030201	Headwaters Deckers Creek
Acidity	28,314.2	lbs/yr	Dec-18	050200030201	Headwaters Deckers Creek
Metals-Al	4,695.0	lbs/yr	Sep-18	050200030201	Headwaters Deckers Creek
Metals-Al	673.9	lbs/yr	Dec-18	050200030201	Headwaters Deckers Creek
Metals-Fe	9,580.0	lbs/yr	Sep-18	050200030201	Headwaters Deckers Creek
Metals-Fe	2,563.1	lbs/yr	Dec-18	050200030201	Headwaters Deckers Creek
Nitrogen	13,020.0	lbs/yr	Sep-18	020700010201	Headwaters Lunice Creek
Nitrogen	6,496.0	lbs/yr	Sep-18	020700010101	Laurel Fork-North Fork South Branch
Phosphorus	6,090.0	lbs/yr	Sep-18	020700010101	Laurel Fork-North Fork South Branch
Nitrogen	200.8	lbs/yr	Sep-18	050500030901	Laurel Run-Greenbrier River
Phosphorus	45.6	lbs/yr	Sep-18	050500030901	Laurel Run-Greenbrier River
Coliform	6.30E+11	cfu	Sep-18	050500021002	Lick Creek-Bluestone Lake
Phosphorus	273.6	lbs/yr	Sep-18	050500021002	Lick Creek-Bluestone Lake
Sediment	94.5	tons/yr	Sep-18	050500021002	Lick Creek-Bluestone Lake
Nitrogen	2,409.0	lbs/yr	Sep-18	050500050601	Little Clear Creek
Phosphorus	547.2	lbs/yr	Sep-18	050500050601	Little Clear Creek
Nitrogen	6,022.5	lbs/yr	Sep-18	050500030407	Locust Creek-Greenbrier River
Phosphorus	1,368.0	lbs/yr	Sep-18	050500030407	Locust Creek-Greenbrier River
Sediment	15.0	tons/yr	Sep-18	050500030505	Lower Anthony Creek
Acidity	2,093.0	lbs/yr	Nov-18	050200040605	Lower Big Sandy Creek
Metals-Al	52.4	lbs/yr	Nov-18	050200040605	Lower Big Sandy Creek
Metals-Fe	138.9	lbs/yr	Nov-18	050200040605	Lower Big Sandy Creek
Metals-Mg	6,343.0	lbs/yr	Nov-18	050200040605	Lower Big Sandy Creek
Nitrogen	6,424.0	lbs/yr	Sep-18	050500020705	Lower Indian Creek
Phosphorus	1,459.2	lbs/yr	Sep-18	050500020705	Lower Indian Creek
Coliform	1.47E+12	cfu	Sep-18	050500030703	Lower Second Creek
Nitrogen	4,417.5	lbs/yr	Sep-18	050500030703	Lower Second Creek
Phosphorus	1,003.2	lbs/yr	Sep-18	050500030703	Lower Second Creek
Phosphorus	638.4	lbs/yr	Sep-18	050500030703	Lower Second Creek
Sediment	126.0	tons/yr	Sep-18	050500030703	Lower Second Creek
Phosphorus	91.2	lbs/yr	Sep-18	050500050606	Meadow Creek-Meadow River
Nitrogen	3,300.0	lbs/yr	Sep-18	020700030601	Meadow Run-North River
Phosphorus	1,135.0	lbs/yr	Sep-18	020700030601	Meadow Run-North River
Coliform	3.78E+12	cfu	Sep-18	050500020704	Middle Indian Creek
Nitrogen	3,613.5	lbs/yr	Sep-18	050500020704	Middle Indian Creek
Nitrogen	3,613.3	lbs/yr	Sep-18	050500030903	Middle Indian Creek
Phosphorus	820.8	lbs/yr	Sep-18	050500020704	Middle Indian Creek
Phosphorus	1,641.6	lbs/yr	Sep-18	050500020704	Middle Indian Creek
Phosphorus	1,368.0	lbs/yr	Sep-18	050500030903	Middle Indian Creek
Phosphorus	820.8	lbs/yr	Sep-18	050500030903	Middle Indian Creek
Phosphorus	547.2	lbs/yr	Sep-18	050500030903	Middle Indian Creek
Sediment	103.5	tons/yr	Sep-18	050500020704	Middle Indian Creek
Sediment	21.0	tons/yr	Sep-18	050500030903	Middle Indian Creek
Coliform	1.58E+12	cfu	Sep-18	050500030702	Middle Second Creek
Nitrogen	7,427.8	lbs/yr	Sep-18	050500030702	Middle Second Creek
Phosphorus	1,687.2	lbs/yr	Sep-18	050500030702	Middle Second Creek
Phosphorus	684.0	lbs/yr	Sep-18	050500030702	Middle Second Creek
Sediment	106.5	tons/yr	Sep-18	050500030702	Middle Second Creek
Nitrogen	1,606.0	lbs/yr	Sep-18	050500050605	Mill Creek-Meadow River
Coliform	1.64E+12	cfu	Sep-18	020700040905	Mill Creek-Opequon Creek
Coliform	1.26E+12	cfu	Sep-18	050500030903	Milligan Creek-Greenbrier River

Coliform	2.21E+12	cfu	Sep-18	050500030804	Muddy Creek
Nitrogen	5,621.0	lbs/yr	Sep-18	050500030804	Muddy Creek
Phosphorus	1,276.8	lbs/yr	Sep-18	050500030804	Muddy Creek
Phosphorus	957.6	lbs/yr	Sep-18	050500030804	Muddy Creek
Sediment	306	tons/yr	Sep-18	050500030804	Muddy Creek
Nitrogen	803.0	lbs/yr	Sep-18	050500030104	Outlet East Fork Greenbrier River
Phosphorus	182.4	lbs/yr	Sep-18	050500030104	Outlet East Fork Greenbrier River
Nitrogen	401.5	lbs/yr	Sep-18	050500030203	Outlet Knapp Creek
Nitrogen	401.5	lbs/yr	Sep-18	050500050605	Outlet Knapp Creek
Phosphorus	91.2	lbs/yr	Sep-18	050500030203	Outlet Knapp Creek
Phosphorus	364.8	lbs/yr	Sep-18	050500050605	Outlet Knapp Creek
Coliform	4.20E+11	cfu	Sep-18	050500030302	Outlet Spring Creek
Nitrogen	11,242.0	lbs/yr	Sep-18	050500030302	Outlet Spring Creek
Phosphorus	2,553.6	lbs/yr	Sep-18	050500030302	Outlet Spring Creek
Phosphorus	182.4	lbs/yr	Sep-18	050500030302	Outlet Spring Creek
Sediment	34.5	tons/yr	Sep-18	050500030302	Outlet Spring Creek
Coliform	8.40E+11	cfu	Sep-18	050500020601	Rich Creek
Nitrogen	3,613.5	lbs/yr	Sep-18	050500020601	Rich Creek
Phosphorus	820.8	lbs/yr	Sep-18	050500020601	Rich Creek
Phosphorus	364.8	lbs/yr	Sep-18	050500020601	Rich Creek
Sediment	115.5	tons/yr	Sep-18	050500020601	Rich Creek
Coliform	5.25E+11	cfu	Sep-18	050500020702	Rock Camp Creek
Phosphorus	228.0	lbs/yr	Sep-18	050500020702	Rock Camp Creek
Sediment	21	tons/yr	Sep-18	050500020702	Rock Camp Creek
Coliform	8.66E+15	cfu	May-18	050500050604	Sewell Creek
Coliform	3.28E+12	cfu	Mar-18	050500050604	Sewell Creek
Coliform	2.94E+12	cfu	Sep-18	050500030401	Stitlington Creek
Phosphorus	1,276.8	lbs/yr	Sep-18	050500030401	Stitlington Creek
Sediment	28.5	tons/yr	Sep-18	050500030401	Stitlington Creek
Coliform	1.68E+12	cfu	Sep-18	050500030408	Slabcamp Run-Greenbrier River
Nitrogen	4,416.5	lbs/yr	Sep-18	050500030408	Slabcamp Run-Greenbrier River
Phosphorus	1,003.2	lbs/yr	Sep-18	050500030408	Slabcamp Run-Greenbrier River
Phosphorus	729.6	lbs/yr	Sep-18	050500030408	Slabcamp Run-Greenbrier River
Sediment	133.5	tons/yr	Sep-18	050500030408	Slabcamp Run-Greenbrier River
Coliform	4.20E+12	cfu	Sep-18	020802010401	South Fork Potts Creek
Phosphorus	182.4	lbs/yr	Sep-18	020802010401	South Fork Potts Creek
Sediment	171.0	tons/yr	Sep-18	020802010401	South Fork Potts Creek
Coliform	2.32E+12	cfu	Sep-18	050500030406	Stamping Creek-Greenbrier River
Nitrogen	401.5	lbs/yr	Sep-18	050500030406	Stamping Creek-Greenbrier River
Phosphorus	1,003.2	lbs/yr	Sep-18	050500030406	Stamping Creek-Greenbrier River
Phosphorus	91.2	lbs/yr	Sep-18	050500030406	Stamping Creek-Greenbrier River
Sediment	777.0	tons/yr	Sep-18	050500030406	Stamping Creek-Greenbrier River
Coliform	1.58E+12	cfu	Sep-18	050500030403	Stony Creek
Phosphorus	684.0	lbs/yr	Sep-18	050500030403	Stony Creek
Sediment	180.0	tons/yr	Sep-18	050500030403	Stony Creek
Coliform	4.20E+11	cfu	Sep-18	020802010301	Sweet Springs Creek-Cove Creek
Nitrogen	2,007.5	lbs/yr	Sep-18	020802010301	Sweet Springs Creek-Cove Creek
Phosphorus	456.0	lbs/yr	Sep-18	020802010301	Sweet Springs Creek-Cove Creek
Phosphorus	182.4	lbs/yr	Sep-18	020802010301	Sweet Springs Creek-Cove Creek
Sediment	97.5	tons/yr	Sep-18	020802010301	Sweet Springs Creek-Cove Creek
Coliform	2.10E+12	cfu	Sep-18	050500030404	Thorny Creek-Greenbrier River
Nitrogen	401.5	lbs/yr	Sep-18	050500030404	Thorny Creek-Greenbrier River
Phosphorus	91.2	lbs/yr	Sep-18	050500030404	Thorny Creek-Greenbrier River

Sediment	9.0	tons/yr	Sep-18	050500030404	Thorny Creek-Greenbrier River
Coliform	3.14E+13	cfu	Nov-18	020700040907	Tuscarora Creek
Nitrogen	1,204.5	lbs/yr	Sep-18	050500030503	Upper Anthony Creek
Phosphorus	273.6	lbs/yr	Sep-18	050500030503	Upper Anthony Creek
Sediment	10.0	tons/yr	Sep-18	050500030503	Upper Anthony Creek
Coliform	6.30E+11	cfu	Sep-18	050500020703	Upper Indian Creek
Phosphorus	273.6	lbs/yr	Sep-18	050500020703	Upper Indian Creek
Sediment	58.5	tons/yr	Sep-18	050500020703	Upper Indian Creek
Coliform	4.37E+12	cfu	Mar-18	050500030701	Upper Second Creek
Nitrogen	8,350.0	lbs/yr	Mar-18	050500030701	Upper Second Creek
Nitrogen	8,833.0	lbs/yr	Sep-18	050500030701	Upper Second Creek
Nitrogen	1,405.3	lbs/yr	Sep-18	050500030701	Upper Second Creek
Phosphorus	1,896.0	lbs/yr	Mar-18	050500030701	Upper Second Creek
Phosphorus	2,006.4	lbs/yr	Sep-18	050500030701	Upper Second Creek
Phosphorus	319.2	lbs/yr	Sep-18	050500030701	Upper Second Creek
Sediment	70.9	tons/yr	Mar-18	050500030701	Upper Second Creek
Coliform	8.3E+12	cfu	Mar-18	020700040201	Upper Sleepy Creek
Coliform	6.39E+13	cfu	Nov-18	020700040201	Upper Sleepy Creek
Nitrogen	2,609.8	lbs/yr	Sep-18	050500050101	Upper Williams River
Phosphorus	592.8	lbs/yr	Sep-18	050500050101	Upper Williams River
Coliform	6.30E+11	cfu	Sep-18	050500030904	Wolf Creek
Nitrogen	6,022.5	lbs/yr	Sep-18	050500030904	Wolf Creek
Phosphorus	1,367.6	lbs/yr	Sep-18	050500030904	Wolf Creek
Phosphorus	273.6	lbs/yr	Sep-18	050500030904	Wolf Creek

Priority areas	
Statewide/other	

Appendix 3. WIB/WVCA staff highlights

Potomac Basin – *Alana Hartman, Sebastian Donner* ***and*** *Chad Thompson*

PBC checked the condition of permeable pavers at the Shanghai public access site on Back Creek after intense flood events. All was well as of June 2018.

WVDEP's *Potomac Basin Coordinator* (PBC) supervised two summer interns who made great progress assessing the streambanks of Back Creek's tributaries and identifying future project opportunities such as riparian buffer plantings and streambank restoration. The PBC continued to co-facilitate Tuscarora Creek project meetings and participate in *Safe Water Harpers Ferry* (Elks Run watershed) and Safe Water Baker (Lost River watershed) efforts. She served as a project liaison for a tree planting day at Augusta Elementary School and shared NPS reduction activities at Hampshire County 4-H camp. The PBC facilitated meetings of the CB Tributary Team and coordinated the annual submittal of BMP data to the CB Program. She hosted two training sessions for the Tributary Team on the Chesapeake Assessment Scenario Tool (*CAST*), which enters comprehensive wastewater and BMP scenarios into the CB Model to refine a state nutrient reduction strategy. The PBC also co-presented a session on marketing of river trails at River Rally.

WVDEP's *Stormwater Specialists* (SWS) worked with local government, developers, engineers, Home Owner Associations, and interested parties on implementing BMPs to treat stormwater runoff with the goal is to improve the water quality by reducing pollutants and quantity from developed lands. While assisting statewide, their primary service area is the Potomac watershed. Being funded through the CB program, SWS tries to leverage local investments with CB grant funding for implementation efforts in the Potomac

watershed. The SWS and PBC meet often to coordinate efforts and plan/organize future activities. In addition to technical assistance the SWS positions are responsible for stormwater outreach in the CB region of West Virginia. Examples include presentations and demonstrations for multiple schools and at events such as the annual Discovery Day at Seneca Rocks with more than 200 in attendance. SWS also partnered with WVRC to teach 500+ Mineral County students source water and stormwater concepts. A portable stream table was developed and built and is a popular hands-on tool for stormwater and overall watershed concepts. Two MS4 workshops were conducted. The workshops discussed West Virginia's MS4 permit requirements, appropriate stormwater BMPs for the region, and the goals of the *CB TMDL*.

Northern Basin – *Martin Christ*

WVDEP's *Northern Basin Coordinator* (NBC) participated in all phases of project development and watershed planning. He reviewed and improved three watershed based plans. He assisted with water monitoring by participating, finding new more monitoring sites, or designing monitoring plans. He reviewed and improved project proposals, assisted with engineer procurement, reviewed engineering designs for projects, and visited projects during construction to coordinate and evaluate work. He entered project progress information into GRTS and added water quality data to the WQXweb system. He participated in outreach through rain barrel presentations and helped watershed associations prepare contingency plans for mine drainage projects.

One notable pleasure for the NBC was sending a database of water quality data to staff of STTWA. While the NBC had been maintaining these data, the watershed staff now have that capacity.

Western Basin *– Tomi Bergstrom*

WVDEP's *Western Basin Coordinator* (WBC) had three watershed projects in full swing, the Browns Creek Septic Remediation Project with CRG, Restoration Project and Road/Stream Restoration Project with MCWA, and Cane Fork AMD Passive Treatment Project 1 with Cane Fork Watershed Association and West Virginia Water Research Institute. Additionally, there are two AGO grants, one focuses on water quality baseline monitoring and one with installing a lavender field as a sediment BMP. Each will be submitting final reports in 2019.

The WBC was involved in many outreach components including the following events: WVDEP's Earth Day, Black Diamond Girl Scouts summer camp and conference, Point Harmony Outdoor Day, Mill Creek Adventure Day, Discover Forks of Coal Day, Forest Fun Day, water festivals for MCWA, Nicholas County, Grandview, St. Albans, Marshall University and CRG. The WBC also worked with Osher Lifelong Learning Institute (OLLI) to present on the impacts of plastics. Partnering with the City of Charleston Stormwater Department, the WBC hosted five rain barrel workshops, sharing stormwater education with over 120 citizens of the Kanawha Valley. A two-day *stormwater exhibit* was hosted at Charleston's FestivALL event.

Southern Basin *– Jennifer Liddle*

Cane Fork project team plan their monitoring

Upon being re-hired in October 2018, WVDEP's *Southern Basin Coordinator* (SBC) focused on the areas watershed associations and other partners learning about their current projects. A major priority was to help PAN, plan and gather partners for next phases of the Summerlee project. The NBC, SBC and SOS coordinator came together to complete pre-construction monitoring at several Summerlee sites. Meetings with partners were held to discuss the design for the next phase, responsible parties and the future of Summerlee. The SBC conducted outreach activities in the region, attended trainings on sampling, Project WET, grant writing and Project Learning Tree. Planning for future water festivals with assistance from Project WET coordinator and National Park

Service have begun. The SBC worked with PCWA to identify next steps for sustaining the organization and developing future projects.

Morris Creek water festival

Project WET – *Tomi Bergstrom*

West Virginia's *Project WET* (Water Education for Teachers) had a productive year attending over 15 outreach events and reaching around 2,100 West Virginians across the state. The Coordinator hosted and assisted with 11 water festivals in Kanawha, Cabell, Nicholas, Ritchie, Fayette, and Raleigh counties that reached over 2,800 students. Project WET Educator Workshops were held in 14 counties, certifying 217 educators with the Project WET Curriculum Guide on water education.

Save Our Streams – *Glenn Nelson*

WV *Save Our Streams* (SOS) *Coordinator* completed 25% more than the minimum number of required monitoring workshops and other outreach through the course of the year. Workshops were provided to watershed groups, Trout Unlimited chapters, WVCA, WVRC, schools and more. Additionally, the Coordinator participated in 18 water festivals, where live benthic macroinvertebrates were presented. This approach engages the students understanding of stream integrity. By partnering with WVCA, multiple bio-surveys were completed on Deer and Anthony Creeks. The team documenting stream health and biology relating to the candy darter and brook trout. The data was also used for the Anthony Creek WPP. SOS remained an aquatic instructor for Envirothon as well as technical advisor and presenter for statewide events like Folkwater Fest and Seneca Discover Day. SOS deployed temperature monitors to distinguish cold water fisheries from that of warmer, non-trout waters for Trout on the Classroom releases. SOS organizing WIB's 2018 staff meeting agenda, tour and study. More than 3,400 participated in SOS workshops and outreach events.

WV Conservation Agency

WVCA provides a significant amount of services to agricultural (Ag) communities, watershed groups, academia and the public through agricultural enhancement (AgE) programs, outreach and §319 project management. 2018 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, and all participate to some degree; however, Greenbrier Conservation District was the most active in 2018. AgE programs helped 121 producers implement a variety of BMPs - the major focus to improve nutrient management. AgE specialist also provided technical assistance for another 284 producers. 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 2018 outreach was provided to 11,431 participants. This included presentations, school activities, special events/programs, camps, Envirothon, Ag field days, Soil Tunnel demonstrations and more. WVCA partners with WVDEP and other agencies and NGOs to support the *Stream Partners* Program and WCD. They also participated in planning and organizing workshops for West Virginia's annual Construction *EXPO* and the *Mid-Atlantic Erosion Control* Association's conference.
3. WVCA is dedicated to improving watersheds impacted by Ag-related NPS pollution. In 2018 WVCA specialist provided project management support for 13-§319 watershed projects. These activities include planning, developing and writing project proposals and WBPs, reporting, technical assistance, right-of-entry agreements, contracts/bids, tracking, monitoring etc.

To learn more contact *Pam Russell* and visit: *http://www.wvca.us/*

Plan Name	Deckers Creek		Plan date 2005/2015	Project Tracking							
Project Name	HUC12 BASINS	Stream	Best Management Practices	#	Pollutants	LRs	Units	319 funds	Other funds	Total	FY
Valley Point #12	Headwaters Deckers Creek	WVM-8	Land Reconstruction, AML	1	Metals (Aluminum)	9,400	lbs/yr	$150,301	$103,248	$253,549	2005
					Metals (Iron)	45,400	lbs/yr				
Valley Highwall #3/	Headwaters Deckers Creek	WVM-8-I	AMD-Limestone Open Channel	2	Metals (Aluminum)	1,600	lbs/yr	$237,694	$161,775	$399,469	2007
Kanes Creek South #1	Headwaters Deckers Creek		AMD-Constructed Wetland	2	Metals (Iron)	4,400	lbs/yr				
			AMD-Sulfate Reducing Bioreactor	1							
Kanes Creek South #3/	Headwaters Deckers Creek	WVM-8-I	AMD-Limestone Open Channel	2	Acidity	73,800	lbs/yr	$300,000	$210,000	$510,000	2008
Reed mine	Outlet Deckers Creek	WVM-8-I	AMD-Constructed Wetland	2	Metals (Aluminum)	17,000	lbs/yr				
			AMD-Steel Slag Treatment	2	Metals (Iron)	15,200	lbs/yr				
			AMD-Limestone Leach Bed/Pond	1							
Slabcamp mainstem	Headwaters Deckers Creek	WVM-8-F	AMD-Constructed Wetland	2	Acidity	82,000	lbs/yr	$211,800	$140,700	$352,500	2010
			AMD-Limestone Open Channel	1	Metals (Aluminum)	7,800	lbs/yr				
			AMD-Vertical Flow Treatment	4	Metals (Iron)	5,400	lbs/yr				
Sandy Run	Headwaters Deckers Creek		AMD-Constructed Wetland	1	Acidity	77,000	lbs/yr	$298,925	$209,340	$508,265	2011
			AMD-Limestone Open Channel	2	Metals (Aluminum)	8,400	lbs/yr				
					Metals (Iron)	2,000	lbs/yr				
Slambcamp tributary	Headwaters Deckers Creek	WVM-8-F-1	AMD-Limestone Leach Bed/Pond	2	Acidity	63,000	lbs/yr	$274,089	$185,726	$459,815	2012
			AMD-Limestone Open Channel	2	Metals (Aluminum)	3,800	lbs/yr				
					Metals (Iron)	5,000	lbs/yr				
Kanes Creek south upgrade	Headwaters Deckers Creek	WVM-8-I	Catch Basin-Leaching	1	Acidity	28,314	lbs/yr	$112,750	$74,200	$186,950	2014
			Tank/ Trough	1	Metals (Iron)	2,563	lbs/yr				
Valley Pt-12 upgrade	Headwaters Deckers Creek	WVM-8-I	AMD-Limestone Leach Bed/Pond	2	Acidity	14,212	lbs/yr				
			AMD-Vertical Flow Treatment	1	Metals (Aluminum)	4,695	lbs/yr	$163,000	$107,800	$270,800	2014
					Metals (Iron)	9,680	lbs/yr				
					Total Metals	142,338	lbs/yr		**Total $**	$2,941,348	
					Acidity	338,326	lbs/yr				

Table 8. Deckers Creek watershed plan tracker

Plan Name	Wolf Creek		Plan date 2009/2013	Project tracking							
Project Name	HUC code	Stream code	Best Management Practices	#	Pollutants	LRs	Units	319 funds	Other funds	Total	FY
Summerlee Phase I	050500040304	WVKN-10-M	Land Reconstruction, AML		Acidity	109,447	lbs/yr	$54,456	$36,304	$90,760	2010
			AMD-Passive Treatment	Multiple	Metals (Aluminum)	7,731	lbs/yr				
			AMD-Constructed Wetland	1	Metals (Iron)	27,239	lbs/yr				
			AMD-Limestone Open Channel	1	Metals (Manganese)	3,751	lbs/yr				
Fayette Square	050500040304	WVKN-10	Urban Infiltration Basin	4	Oil and Grease	67	%	$83,553	$56,066	$139,619	2012
			Urban Grassed Swale	4	Chemical Oxygen	1					
			Urban Infiltration Trench	4	Suspended solids	406	lbs/yr				
					Nutrients	9	lbs/yr				
Summerlee Phase 1.2	050500040304	WVKN-10-M	AMD-Constructed Wetland	1	Acidity	91,409	lbs/yr	$29,733	$66,120	$95,853	2013
			AMD-Limestone Open Channel	1	Metals (Aluminum)	3,323	lbs/yr				
					Metals (Iron)	17,010	lbs/yr				
					Metals (Manganese)	1,549	lbs/yr				
Summerlee Phase 2	50500040304	WVKN-10-M	AMD-Limestone Open Channel	2	Acidity	123,064	lbs/yr	$163,412	$140,108	$303,520	2015
			AMD-Vertical Flow Treatment	2	Metals (Aluminum)	7,500	lbs/yr				
					Metals (Iron)	34,990	lbs/yr				
					Metals (Manganese)	2,992	lbs/yr				
					Total Metals	106,085	lbs/yr				
					Total Acidity	323,920	lbs/yr		**Total $**	$629,752	
					Other pollutants	415	lbs/yr				

Table 9. Wolf Creek watershed plan tracker

Appendix 5. Project status

2014	NPS#	End-date	319-funds	Spent	Basin
Nonpoint funds	$752,973				
DEP			$483,811	$324,775	SW
WVCA	1479	30-Sep-14	$200,000	$199,957	SW
Watershed Plan Tracking EPA in-kind			$10,000	$10,000	
WVRC monitoring AGO	1499	30-Apr-15	$20,000	$20,000	SW
Lattas Stormwater	1516	31-Dec-15	$34,600	$34,600	W
App WS stream monitoring - Mt. Inst.	1544	30-Sep-17	$20,000	$20,000	SW
FOB restoration planning	1546	30-Sep-17	$10,000	$10,000	N
WVRC WQ monitoring	1547	30-Sep-17	$20,000	$20,000	SW
Source Water Protection Planning - Fayette County	1551	30-Sep-17	$10,000	$10,000	S
Lamberts Run WBP	1568	30-Sep-18	$56,043	$56,041	N
WCD lunch 2017 - WVCA	1580	30-Sep-18	$1,748	$1,748	
TMI Experienced Learning	1595	30-Sep-17	$20,000	$20,000	SW
WVCA Back Creek Porous Pavers	1601	30-Sep-17	$20,000	$20,000	P
FOC DIY Data Loggers	1655	30-Sep-18	$5,750	$3,889	N
Watershed project funds	$997,149				
Sovern England AMD - FOC	1500	30-Sep-17	$252,368	$216,831	N
Greens Run Railroad Refuse	1527	31-Dec-16	$105,000	$98,485	N
Kanes Creek South Upgrade	1502	30-Sep-17	$122,750	$120,874	N
Revitalization of Valley Point 12	1503	30-Sep-16	$163,100	$163,088	N
Sleepy Creek - Phase 3	1504	30-Sep-17	$74,600	$74,600	P
Milligan Creek / Davis Springs 2	1505	30-Sep-16	$150,000	$150,000	S
Finley Run - FOB	1569	30-Sep-17	$5,402	$5,402	
Meadow River Sewell Creek Septics - WVCA	1570	30-Sep-17	$53,100	$32,898	S
Coketon Mine FOB	1615	30-Sep-17	$69,988	$69,988	N

2015					
Nonpoint funds	$619,631				
DEP			$278,986	$279,364	SW
WVCA	1523	30-Sep-16	$116,000	$95,192	SW
Watershed Plan Tracking EPA in-kind					
FOC Big Sandy WS planning	1531	30-Jun-18	$84,000	$75,557	N
Opequon Ck Tree Maintenance Intern	1528	30-Sep-17	$3,000	$3,000	P
FODC Clean Creek Program	1545	30-Sep-17	$12,000	$12,000	N
WVRC Source Water Protection Planning	1548	30-Sep-17	$15,000	$15,000	SW
Hursher's Run Monitoring - Hughes River	1549	30-Sep-17	$1,282	$1,282	W
AMD and WW research - WVU	1550	30-Sep-17	$18,000	$17,994	N
Friends of Hughes Source Water Monitoring	1607	30-Sep-17	$20,000	$20,000	W
Piney Creek WSA Pet Waste Campaign	1600	30-Jun-18	$4,000	$4,000	S
WVCA Anthony Creek stream stabilization	1602	30-Sep-17	$20,000	$20,000	S
WV DOF WVU LSCA	1616	30-Sep-18	$10,310	$10,000	N
FOC Cheat River Bacteria Monitoring	1636	30-Sep-18	$11,125	$10,150	N
FOH Baseline monitoring balance of Hursher's Run	1651	30-Apr-19	$4,622		W
Experience Learning	1678	31-Jul-19	$20,000		SW
Watershed project funds	$1,017,378				
Tuscarora Creek Phase 2 - CVI	1540	30-Jun-19	$56,523	$38,749	P
Mill Creek Opequon Phase 2 - CVI	1541	30-Jun-19	$161,801	$77,158	P
Morris Creek Upper Mainstem	1529	31-Dec-17	$49,265	$48,664	W
Pase Active Treatment - FOC	1530	31-Dec-18	$101,387	$87,587	N
Valley Highwall Upgrade - FODC	1532	30-Jun-19	$170,500	$22,260	N
Summerlee - Phase 2	1534	1-Dec-16	$163,412	$163,412	S

YMCA land restoration - Piney Creek	1535	30-Jun-18	$20,145	$19,141	S
Elks Run Watershed Phase 2 - WVCA	1536	30-Jun-19	$68,200	$17,211	P
Herods Run, Buckhannon - WVU	1533	30-Jun-19	$226,145	$144,403	N

2016

Nonpoint funds	$647,510				
DEP			$420,448	$293,170	SW
WVCA	1580	30-Sep-18	$131,062	$33,379	SW
Watershed Plan Tracking EPA in-kind			$10,000	$10,000	
NF Greens Run WBP - FY 15 carryover	1581	30-Sep-19	$25,516	$15,475	N
Muddy Creek WBP - FY 15 carryover	1582	30-Sep-19	$60,484	$26,390	N
Friends of Blackwater monitoring	1596	30-Jun-18	$12,986	$12,406	N
FODC clean creek program	1597	30-Jun-18	$12,000	$2,262	N
FOC state of the watershed	1598	30-Jun-18	$15,000	$14,275	N
Goodnews Mtneer Garage rain gardens	1599	1-Dec-17	$3,000	$2,906	W
WVRC volunteer monitoring	1603	30-Sep-17	$18,000	$18,000	SW
WVRC Source Water Community Engagement	1604	30-Sep-17	$17,000	$17,000	SW
FODC Kanes Creek Study	1639	30-Sep-19	$13,350		N
WVRC Capacity Building for WSAs	1634	30-Sep-19	$4,450	$1,346	SW
WVRC WV TU WVCA monitoring program	1635	30-Sep-18	$8,900	$8,900	SW
WVCA Howards Creek Improvements	1637	30-Sep-18	$13,350	$11,388	S
CVI ALIVE education	1638	30-Sep-19	$4,461	$1,404	N
City of Charleston Rain Barrel Kits	1648	31-Jul-18	$4,075	$3,950	W
Rain Barrels			$1,885		
WVCA Sleepy Creek septic mini grant	1677	30-Sep-21	$21,000		P
Watershed project funds	$1,099,895				
Browns Creek - Coal River	1583		$8,381	$8,381	W
Beaver Creek AMD - FOC	1584	30-Sep-19	$175,100	$67,399	N
Sandy Run Renovation - FODC	1585	30-Jun-20	$223,500	$7,224	N
Beckley Little League - PCWA	1586	30-Sep-18	$54,291	$37,001	S
Second Creek WSA - WVCA	1587	30-Sep-18	$127,600	$127,600	S
Back Creek - WVCA	1588	30-Sep-18	$209,450		P
Swamp Run #2 - WRI	1589	30-Jun-20	$183,954	$46,039	N
Browns Creek - Coal River thru WVCA	1619	31-Dec-19	$94,000	$43,330	W

2017

Nonpoint funds	$743,531				
DEP			$407,667	$324,282	SW
WVCA	1605	30-Sep-19	$191,500		SW
Watershed Plan Tracking EPA in-kind			$10,000	$10,000	
WV Rivers Coalition	1610	30-Sep-19	$100,000	$20,729	SW
WV Fork WBP - Dunkard Creek	1653		$24,000		
Beaver Creek WBP - FOB	1647	30-Sep-19	$10,364	$1,610	N
WVRC Building capacity for WSAs	1668	31-Dec-19	$5,000		SW
WVRC water quality monitoring	1669	30-Sep-20	$10,000		SW
FOB Targeted Analysis of Beaver Creek	1670	30-Sep-20	$9,000		N
GWF Lamberts Run Study	1671	31-Dec-19	$9,000		N
WVU Fisheries in treated AMD trib	1672	31-Dec-20	$12,000		N
Piney Creek monitoring and education	1673	30-Sep-20	$4,000	$4,000	S
Morris Creek Lavender Patch	1674	30-Sep-20	$5,000		W
FODC evaluating coliform	1675	30-Sep-20	$12,000		N
FOC state of the watershed 2018	1676	30-Sep-20	$9,000		N
Watershed project funds	$1,115,279				
Summerlee AMD Phase 3A - PAN	1611	31-Dec-19	$169,392		S
New River Drive Soil Erosion - Piney Ck	1612	30-Sep-18	$32,500		S

Morris Creek Rd and Stream Restoration	1613	30-Sep-20	$72,000	$67,000	W
Muddy Creek Dream Mountain Improvements - FOC	1633	30-Sep-20	$176,800	$1,397	N
Hartman Run AMD - FODC	1641	30-Sep-20	$185,000		N
WALD treatment - Phase 1 - FOB	1632	30-Sep-19	$149,594	$16,388	N
Cane Fork Treatment - Phase 1 - WVU	1642	30-Sep-20	$155,882	$16,076	W
Spring Creek - Phase 1 - WVCA	1643	30-Apr-21	$180,000		S

2018

Nonpoint funds	$513,417				
DEP			$332,662	$289,611	SW
WVCA	1646	30-Sep-19	$95,750		SW
Watershed Plan Tracking EPA in-kind			$10,000	$10,000	
Watershed project funds	$1,347,125				
WALD Passive Treatment 2 - FOB	1680	31-Dec-20	$134,000		N
Beaver Creek McElroy Seep - FOC	1681	30-Sep-21	$130,000		N
Dillan Creek Remediation 1 - FODC	1682	30-Sep-20	$207,000		N
Summerlee AMD Treatment 3B - PAN	1683	30-Sep-20	$186,894		S
Barlow Portal 1 - WVU	1684	30-Sep-21	$212,716		N
Woodrow Wilson HS Stream Restoration - Piney	1685	30-Sep-19	$60,000		S
Upper Indian Creek - WVCA	1650	30-Sep-21	$100,000		S
Second Creek Tall Hickory Farms - WVCA	1686	30-Sep-21	$100,000		S
Back Creek Protection - WVCA	1687	30-Sep-20	$216,515		P

Legend

BC regions	N	Northern
	P	Potomac
	W	Western
	S	Southern
Statewide	SW	**2018 completed projects**

Appendix 6. West Virginia's 2019 §319 grant proposal

Table 10. 2019 §319 grant proposal

Org	Nonpoint Funds	§319	Match	Total	
WVDEP	WVDEP NPS Program	$404,932	$279,535	$684,467	
WVCA	WVCA NPS Program	$65,000	$43,333	$108,333	
WVRC	Integrating SWP and WBP (Phase 2)	$80,000	$53,506	$133,506	
EPA	USEPA watershed tracking	$10,000	$6,667	$16,667	
	Total Nonpoint	**$559,932**	**$383,041**	**$942,973**	32%
	Watershed Project Funds				
FOC	Sovern Tom Clark Passive Treatment	$152,000	$105,000	$257,000	
FODC	Marilla Park Restoration	$118,121	$83,230	$201,351	
FODC	Slabcamp Run Remediation Phase 1	$207,778	$150,827	$358,605	
WVU	Roaring Creek - North Portal	$262,195	$174,976	$437,171	
PCWA	Creasant Elementary Retrofit	$90,000	$59,000	$149,000	
WVCA	Burnside Branch - Indian Creek	$121,770	$81,147	$202,917	
WVCA	Mill Creek - Meadow River	$111,200	$77,200	$188,400	
WVCA	Second Creek Karst III	$127,000	$84,667	$211,667	
	Total Watershed	**$1,190,064**	**$816,047**	**$2,006,111**	68%
	Total Grant	**$1,749,996**	**$1,199,088**	**$2,949,084**	

West Virginia's 2019 §319 workplans consist primarily of continuous work in priority watersheds.

Watershed project funds focus on reducing the impacts of metals and acidity in the lower Cheat, Roaring Creek and Deckers Creek basins, sediment in Deckers Creek, sediment and bacteria in the Piney Creek basin, and agricultural projects targeting bacteria in the Indian Creek, Meadow River and Second Creek basins. Our Nonpoint funds will support a second phase of the WBP/SWP integration and statewide program administration.

Sub-grantees in 2019 will include WVCA, WVRC, FOC, FODC, PCWA, STTWA and WVU-NMLRC.

West Virginia Department of Environmental Protection
Division of Water and Waste Management
Watershed Improvement Branch
Nonpoint Source Program

Nonpoint Source Program Annual Report
March 2019

Coordinator: Timothy.D.Craddock@wv.gov