West Virginia's Nonpoint Source Programs Annual Report 2016

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West Virginia Department of Environmental Protection

Nonpoint Source Program Annual Report
February 2017

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

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

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 the *§319 Coordinator*.

Table of contents

Photography credits

Cover page: Swamp Run treatment, Jason Fillhart (NMLRC); tree planting Tuscarora Creek, Kristin Mielcarek (CVI); flow monitoring Morris Creek, Tomi Bergstrom (WIB); AMD treatment ponds Deckers Creek, Nicholas Revetta (FODC); Camp Virgil Tate outdoor classroom, Glenn Nelson (WIB) In the document: Elk Run kick/Sleepy Creek buffer, Suzy Campbell (WVCA); oxidation terrace, Nicholas Revetta (FODC); NF Greens Run aerial, Adam Webster (FOC); WIB staff, Wendy Radcliff; streambank, Suzy Campbell (WVCA); rain barrel workshop, Jake Glance (WVDEP-PIO); public meeting, Seth Burdette (WIB); swale, Sebastian Donner (WIB); Decker Creek mural, FODC volunteer; rain barrel workshop, Suzy Campbell (WVCA); Sovern 62, FOC volunteers. Note: Acronyms are defined throughout the report.

Executive summary

In 2016 West Virginia's NPS Program provided technical and financial support to 101 programs and projects ranging from general administration to outreach, planning, monitoring and 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	Projects	Completed 2016	
§319-Program	10	3	0.30
§319-Project	43	12	0.28
§319-AGO	35	19	0.54
§319-Planning	8	3	0.38
Other (SRF etc.)	5	2	0.40
Totals	**101**	**39**	0.39

All 2012 projects not completed previously were completed, and several in came under budget. For fiscal year 2013, 65% of the 17 projects are complete; 2014 33% of the 24 projects are complete; 2015 19% of the 21 projects are complete; and none of the 18 projects in fiscal year 2016 are complete.

Appendix 4 provides additional information, and includes funding.

Best management practices (BMPs)

BMP implementation and NPS pollutant reduction is the major goal 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 2016 BMP implementation was completed in *38 different HUC12 watersheds*, 53 percent of the implementation occurred in priority watersheds. The remaining are a result of WV Conservation Agency (WVCA) statewide *agriculture enhancement programs*. *Table 2* shows the total BMP implementation in 2016 and additional details are provided in *Appendix 1*.

Table 2. 2016 BMP implementation

BMP	Totals	Unit
AMD ponds-wetlands	276,032	Sqft
Limestone leachbed	62,893	Sqft
Fencing	40,364	Ft
Heavy use protection	11,694	Sqft
Stream restoration	7,506	Ft
Nutrient management	6,270	Ac
Limestone channel	2,876	Ft
Grazing systems	2,542	Sqft
Water systems	1,920	Ft/IU
Watering pond	600	Sqft
Septics	89	IU
AMD systems	7	IU
Erosion control	4	Sqft

Note: Acid mine drainage (AMD) ponds-wetlands includes settling and collection ponds and constructed aerobic wetlands. Fencing includes division and streamside fencing. The stream restoration category includes natural stream channel design and streambank enhancement/protection BMPs. The septic category includes all repair, replacement and pumping. AMD systems are the total number of treatment systems installed; important components of those systems are included in the table. Watering systems include individual units and feet because in certain cases spring fed trenches were used, whereas in other cases an individual unit may be needed. Erosion control projects are associated with construction projects of less than one acre and other agriculture situations where erosion control is necessary, such as heavy use protection areas.

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 (i.e. acidity, 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 focus, with the help of partner agencies we have already exceeded our Management Plan goals. Our revised

plan was approved in 2016. Nutrient and sediment reductions are important for restoration of the Chesapeake Bay (CB) watershed, and West Virginia continues to meet of the goals and objectives of the most recent CB *Watershed Implementation Plan* (WIP). *Table 3* provides a summary of the CB progress.

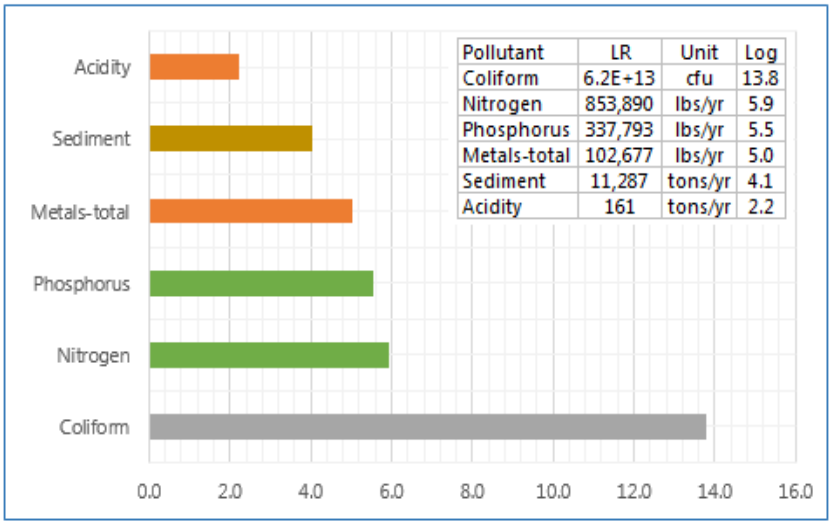
Table 3. Progress towards reducing CB pollutants

Pollutant	Category	Baseline 2009	Progress 2016	Targets 2017	Targets 2025
Nitrogen	Agriculture	1,330	1,190	1,215	1,136
	Urban runoff	400	433	390	387
	Wastewater + CSO	131	132	124	119
	Septic	85	79	90	90
	Forest+	785	773	785	780
	All sources	**2,731**	**2,607**	**2,600**	**2,512**
Phosphorus	Agriculture	278	214	232	201
	Urban runoff	58	36	43	33
	Wastewater + CSO	55	21	34	19
	Forest+	59	58	62	59
	All sources	**450**	**329**	**370**	**312**
Sediment	Agriculture	134,000	102,322	107,000	88,950
	Urban runoff	52,500	28,094	36,500	26,113
	Wastewater + CSO	400	296	800	1,072
	Forest+	36,000	35,244	56,500	35,170
	All sources	**222,900**	**165,956**	**201,000**	**151,306**
Units:	tons/year				

Table 3 summarizes point and nonpoint loads delivered to the CB from West Virginia's portion of the watershed. The "All sources" progress as of June 2016, (green column, bold numbers) indicates that West Virginia is on track to meet its 2017 targets and 2025 cap loads (blue columns, bold numbers), which are part of the CB Total Maximum Daily Load.

Figure 1 shows the pollutant reductions from all projects completed in 2016. The bar graph compares the amount of reduction from each major category. A log scale was used to normalize the data for this comparison.

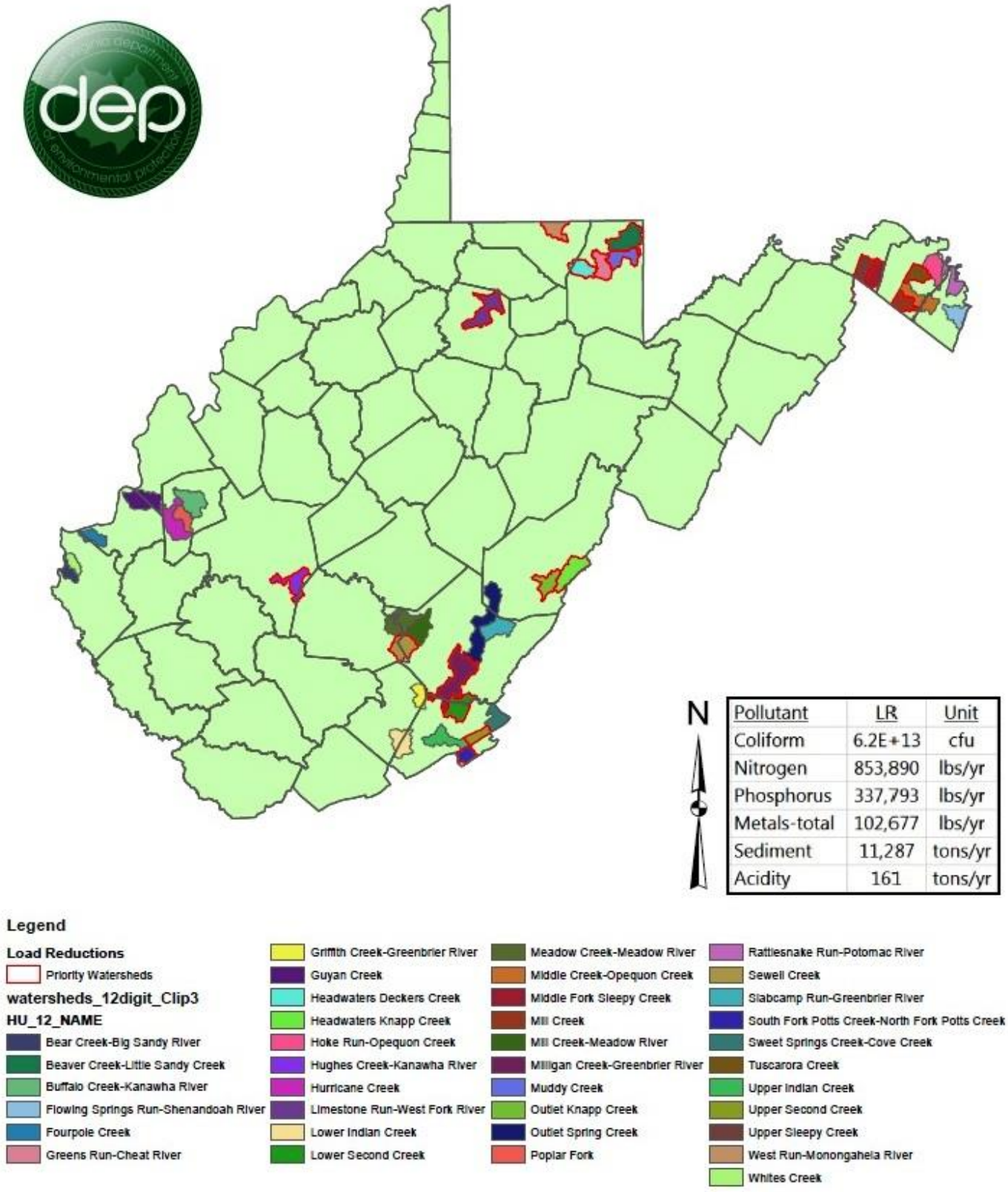
Figure 1. Pollutant reductions in 2016



These reductions are a result of 21 projects in 15 priority watersheds and an additional 18 projects from WVCA's agriculture enhancement programs in 23 other watersheds.

Figure 2 provides a map of the HUC12 watersheds where pollution reductions occurred in 2016. *Appendix 2* provides additional pollutant load reduction details. Note: *Appendix 6* provides a statewide water quality summary (Data source: *WVDEP's* Watershed Assessment Branch *(WAB)*)

Figure 2. Load reductions - priority and non-priority watersheds



Map created by: *Chad Thompson*, WIB

Organizations, partners and stakeholders

WV Department of Environmental Protection (WVDEP): 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 *Management Plan*. See *Appendix 5* for a summary of the pollutant reduction goals for 2014 - 2016. The administration and coordination involves a concentrated effort on the part of the lead agency and its partner agencies, as well as volunteer watershed groups, colleges and universities and a variety of other stakeholders. See *Appendix 3* for more on staff activities.

WV Conservation Agency (WVCA): 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 water quality improvement projects. In 2016 WVCA was responsible for implementing BMPs through their statewide programs and for specific projects in priority watersheds. WVCA's Conservation Specialist (CS) act as project managers for multiple Greenbrier, Potomac and the WV portion of the James River basin. In 2106 WVCA completed additional phases of Milligan Creek, Second Creek, Potts Creek and Sleepy Creek. See *Appendix 3* for more on WVCA's staff activities.

WV University's, *National Minelands Reclamation Center* (NMLRC): NMLRC is our major partner for implementing AMD projects in the Monongahela, West Fork and Tygart basins. NMRC project managers work with local watershed groups such as *Guardians of the West Fork* (GWF) and *Buckhannon River Watershed Association* (BRWA) to secure *Office of Surface Mine* (OSM) funding, which provides match and additional construction funding. In 2016 NMLRC completed projects in Swamp Run and West Run. They also completed the Lick Run WBP.

Friends of the Cheat (FOC): 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 one success after another. In 2016 they completed projects in North Fork of Greens Run and Upper Muddy Creek. Recently they have shifted focus and are currently working on several HUC12 size WBPs. Soon, WBPs will be completed for Muddy Creek, Greens Run and Big Sandy Creek. In July 2016, USEPA, WVDEP and FOC collaborated on a story on the *Re-birth of the Cheat River*, and a GIS story board for *Sovern Run*.

Friends of Deckers Creek (FODC): FODC also 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 2016 FODC completed two projects in the headwaters; Kanes Creek and the Ingrand Mine project.

Canaan Valley Institute (CVI): CVI is one of the most experienced stream restoration practitioners in the mid-Atlantic region. They are involved in restoration and protection projects throughout the highlands of WV, MD, VA and PA. In 2016 CVI didn't complete any projects in WV but they are making significant progress in Mill Creek and Tuscarora Creek focusing on *stream restoration* and septic upgrades.

Coal River Group (CRG): CRG is a recipient of our *Watershed Pilot Program* (WPP) funding. CRG is active in restoring and protecting the recreational value of the Coal River basin. They received their first 319 watershed project funding in 2016, and with assistance from NPS Program staff and other experienced project managers have begun the implementation of the Browns Creek septic program. Progress has been satisfactory, thus far.

Morris Creek Watershed Association (MCWA): WCWA has been involved in watershed work since 2006, when their first WBP was approved. Initial progress was dramatic but has slowed since. Since the revision of their WBP in 2014 they've nearly completed their first AMD restoration project in 2016, with only monitoring remaining. MCWA was another WPP recipient.

Piney Creek Watershed Association (PCWA): PCWA has one of the largest most extensive WBPs in the state. It involves both NPS and point source work with a focus on bacteria, sediment and metals. The plan is further complicated by MS4 requirements. PCWA received their first §319 watershed project funding in 2015; the projects focus is the restoration of barren lands that produce a large sediment load to Piney Creek. Note: PCWA is the third *WPP* recipient.

WV Rivers Coalition (WVRC): WVRC has taken 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. The focus is integrating these plans in two priority watersheds; Elk Run and Cacapon/Lost River. WVRC/WVDEP recently completed a *success story* in late 2016.

Local science teachers and their students monitor aquatic life in Elk Run.

Elk Run Watershed Association (ERWA): Elk Run is a small watershed in WV Eastern Panhandle. It is a focus watershed for the CB and West Virginia's §319 Program. ERWA is actively involved in project monitoring and source water protection. Note: WVCA is the local project manager for this effort; projects started in 2015/2016.

More partners: West Virginia's NPS Program works with a wide variety of stakeholders and group to implement projects and encourage the protection and restoration of waterbodies impaired by NPS pollution. Our AGOs critical to keeping these smaller organizations engaged and involved in watershed work. Other groups/businesses active in the program in 2016 include *Friends of Hughes River* (FOH), town of *Richwood*, *Fayette County*, *The Mountain Institute* (TMI), *Mountaineer Goodnews Garage*, *Plateau Action Network* (PAN), *Blue Heron Environmental Network*, *Friends of Blackwater* (FOB), *Save the Tygart Watershed Association* (STTWA), *Sleepy Creek Watershed Association* (SCWA) and more. Their projects focused on monitoring, source water protection, outreach and education, stormwater improvements, riparian buffer/tree planting and AMD remediation.

Watershed project highlights

In 2016, 12 watershed projects were completed. This section highlights several representative projects, which includes AMD remediation efforts and bacteria reductions. *Appendix 4* provides a list of all our projects from 2012-2016. Summaries of additional completed projects are provided by embedded links from EPAs Grant Records Tracking System (GRTS) *public access portal*.

Sleepy Creek Phase II

The goal of this project was to reduce fecal coliform counts in the watershed and meet the TMDL through the establishment of riparian buffers, urban tree plantings (reforestation) and stormwater management practices. Additionally, this project funded water quality monitoring to detect sources of fecal coliform impairment and public education events that included agricultural field days and stormwater management training.

Problem Description

Sleepy Creek is impaired relative to numeric water quality criteria for fecal coliform bacteria. The watershed (stream code WVP-9, TMDL SWS 9001–9063) is in Morgan County, West Virginia (87%) and Fredrick County, Virginia (13%). It flows 42 miles north into the Potomac River.

Project highlights and results

The total estimated reduction of all practices installed through this project to date is 4.48E+12 cfu. *Table 4* illustrates all the BMPs installed throughout the projects lifespan and the estimated reductions achieved through each practice.

Table 4. BMP implementation Sleepy Creek Phase II

Practice	Acres	Efficiency	Reduction
Bioretention	4.5	1	6.48E+11
Porous pavers	0.6	0.8	7.22E+10
Riparian buffers	3.6	0.8	3.32E+12
Urban planting	7.8	0.7	4.44E+11
Totals	16.5		4.48E+12

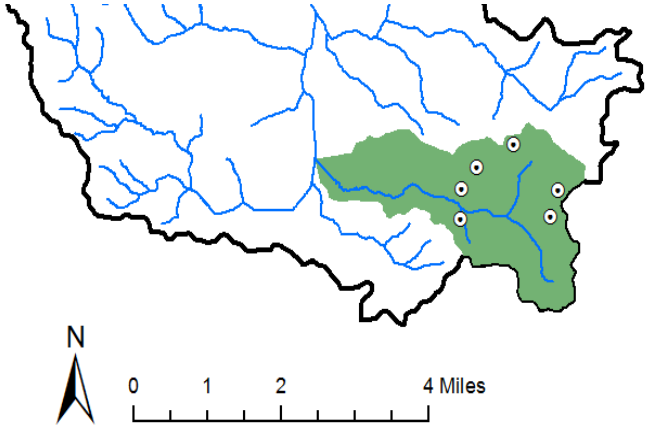
In addition to BMP implementation, several educational events were held including agricultural field days and a stormwater management training. *Cacapon Institute* (CI) conducted water quality monitoring and measured levels of fecal coliform bacteria. Their final report can be downloaded *here*.

Partner and funding

A wide variety of partners were involved in the implementation of this project, including *WVCA*, *Eastern Panhandle Conservation District* (EPCD), CI, *WV Division of Forestry* (WVDOF), USDA, *Natural Resource Conservation Service* (NRCS), Region 9 *Planning and Development Council*, *Sleepy* SCWA volunteers, landowners, local schools and others. The riparian buffer project shown provides an example of the effort. It consisted of 393 trees and several days of hard work from 36 volunteers as well as local, state and federal agency representatives. Other efforts in the watershed brought together diverse groups, but this riparian buffer planting provides the best example of the dedication to protecting and restoring the Sleepy Creek watershed.

The project was completed on-time and within budget using $70,200 in §319 funds, and $43,000 in state and local match for a total of $113,200.

Ingrand Mine AMD Remediation



The purpose of this project was to treat water draining from the abandoned Ingrand Mine before it enters an unnamed tributary to Kanes Creek. FODC received fiscal year 2013 funds to design and install a passive treatment system to capture and clean the AMD emanating from the Ingrand Mine. The completion of this project marks the sixth AMD remediation site installed by FODC within the Kanes Creek subwatershed (*Figure 3*).

Figure 3. Location of Kanes Creek projects

Problem description

The Deckers Creek Watershed, located in Preston and Monongalia counties in north-central West Virginia, is contaminated by acid mine drainage (AMD) emanating from various abandoned coal mines. Kanes Creek (WV-M-14-V), a major tributary to Deckers Creek (WV-M-14; HUC 0502000302) is in the south-eastern portion of the watershed and contributes a substantial load of AMD to the mainstem.

Project highlights and results

Low pH Iron oxidation terrace

The project was completed in August of 2016. It captures AMD discharging from four discrete seeps at the top a hill. The water is piped across private property and directed to most of the treatment components on the property. Note: FODC purchased the property in 2014. The mine water collected from the first discharge is sent to a low pH iron oxidation terrace designed to precipitate ferrous iron out of solution prior to entering the treatment cells that contain the alkalinity. This component improves the longevity of the project and reduces maintenance by allowing additional iron to settle out before entering the limestone pond.

The remaining discharges were routed into the same pipe that the low pH iron oxidation terrace drains into. The water is then brought to an auto flushing limestone pond which leads to a settling pond with a baffle curtain and a vertical flow wetland before traveling down an open limestone channel. The limestone channel further leads to a second settling pond with a baffle curtain and an aerobic wetland that is separated by a pervious limestone dam. The treated water discharges from this wetland and into the unnamed tributary to Kanes Creek.

Thus, far project performance is outstanding, significantly reducing the AMD pollutants entering the unnamed tributary to Kanes Creek. The first round of water quality data shows a 99.6% reduction, which is 21.8% better than the project's goals. Acidity reduction is 40,540 lbs/year and the total metals are being reduced by 7,210 lbs/year. FODC expects even better results once the wetland treatment systems mature.

Partners and funding

This project was supported by WVDEP's §319 Program, $284,585 and OSM's Watershed Cooperative Agreement Program (WCAP), $107,000. FODC contributed $68,415 as an in-kind match and further raised an additional $7,000 to purchase the land for the project. The final breakdown of the funding requested versus what was spent can be found below (*Table 5*).

Table 5. Project funding (request vs. final expenditures)

Categories	Requested Implementation	Non Implementation	Spent Implementation	Non Implementation
Personnel	$10,000	$13,600	$7,302	$19,649
Contractual	$218,385	$10,000	$228,737	$350
Travel	$500	$1,000	$577	$363
Supplies	$500	$3,000	$355	$44
Operating cost		$27,600		$27,035
Totals	**$229,385**	**$55,200**	**$236,971**	**$47,441**

North Fork Greens Run

The project is located on the North Fork in the Greens Run watershed (*Figure 4*) in Preston County, West Virginia. The Greens Run watershed is located north of Kingwood and is a tributary to the Cheat River. FOC currently has one other project (Dinkenburger) on the North Fork of Greens Run, and one project (Blood Lagoon) on the Middle Fork of Greens Run.

Figure 4. NF Greens Run project sites

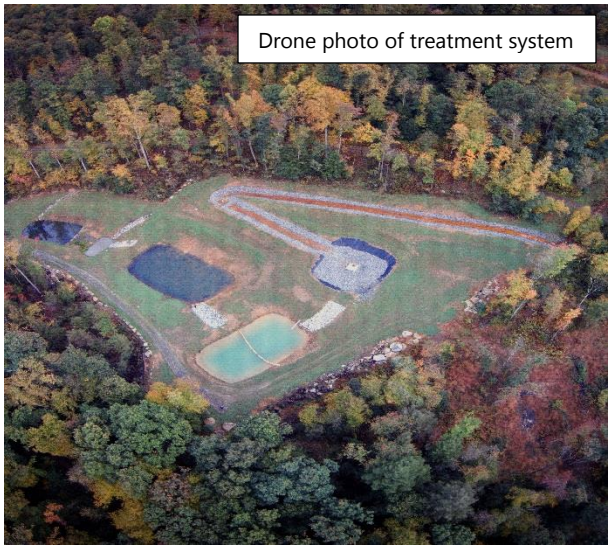
Problem description

The project treats non-point source runoff from the (Problem Area No. 1048) abandoned mine land site. AMD from 10 acres of refuse piles were reclaimed in 2003 by WVDEPs *Office of Abandoned Mine Lands and Reclamation* (OAMLR). Greens Run is listed on the state's 303(d) list for iron and aluminum impairments.

The goal of this project was to design and construct a passive treatment system that will discharge neutral pH water with less than 1 mg/L of aluminum, less than 5 mg/L of iron, and additional alkalinity into Greens Run.

Project highlights and results

BMPs constructed during this project include an oxidation precipitation channel, an automatic flushing vertical flow limestone pond, a settling pond, a Jennings-style vertical flow pond and a constructed wetland. The vertical flow pond utilizes an automatic bell siphon with high and low flow settings. The image is an aerial photo of the treatment system.


Drone photo of treatment system

Water quality from the wetseals at the top of the limestone channel is acidic (pH 3) with high concentrations of iron (200 mg/L) and aluminum (50 mg/L). After being treated, water discharging from the system is neutral (pH > 7) with low concentrations (<0.5 mg/l) of iron and aluminum. *Table 6* provides a summary of the treatment's effectiveness.

Table 6. System in and system out pollutant load reductions

System	Flow gpm	pH	Acidity load lbs/yr	Al load lbs/yr	Fe load lbs/yr
In	21	2.9	24.9	1,617	5,951
Out	39	7.3	-3.8	0	17
Load reduction			**28,723**	**1,617**	**5,934**
		Percent	115.1%	100%	99.7%

Partners and funding

Funding was provided through WVDEPs §319 program, $127.997, Stream Restoration Fund (SRF), $11,523 and WCAP, $100,000. The project engineer, BioMost, Inc. $3,700, landowner, $4,000 and FOC, $22,000 in matching resources. Total project costs were $369,220. Overall, FOC is very satisfied with the design and construction of the project. The engineer (BioMost, Inc.) and contractor (Solid Rock Excavating) worked well together, and the landowner continues to support the project and our organization.

Success stories

Protecting Source Water in West Virginia

US Environmental Protection Agency (EPA) funds helped West Virginia residents and utilities engage in source water protection efforts in the wake of the Elk River chemical spill of 2014. The spill contaminated the water supply of more than 300,000 people in the capitol city of Charleston and surrounding counties (nearly 1/6th of the state's population).

AT A GLANCE

- *Above: Counties impacted by the Elk River spill.*
- *Safe Water for WV project engaged citizens across the state after the spill.*

WVDEP used $15,000 from its EPA *§319 grant* to support a community education and engagement project to actively involve citizens in plans to protect their drinking water sources. The $15,000 was the largest contribution to the $50,000 project.

The "Safe Water for WV" project led by the West Virginia Rivers Coalition (WVRC) included a series of public forums, social media, educational tools, local partner network building and technical assistance to provide citizens with information on source water planning and their role in the process. A key activity was the development of a "*Citizen's Guide to Drinking Water Protection*."

The overall goal of the project was to help protect drinking water supplies throughout the state by ensuring that watershed groups and other community stakeholders assumed a constructive role in the source water planning process.

A law passed by the state after the spill (*SB-373*) required public water systems across the state to draft or update source water protection plans with the public's involvement. The plans are designed to help manage pollution from general sources that could endanger drinking water supplies.

Per *WVRC*, the Elk River chemical leak and ensuing water crisis was an awakening for many to the sources and vulnerability of their water supplies. It was the first time many people thought about where their drinking water comes from and the connection between watershed protection, public health and economic security.

Among the results of the Safe Water for WV project were five public forums attended by at least 345 community members, 72 local partners and 10 public water utilities. The Citizen's Guide was distributed at the forum and was discussed in a statewide webinar. WVDEP will use funds from its 2017 §319 grant award for a pilot project, which integrates Source Water Protection Plans and Watershed Based Plans in two watersheds. Contact *Timothy Craddock* for more information.

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WVDEP Watershed Improvement Branch, *NPS Program*

NONPOINT SOURCE SUCCESS STORY

West Virginia

Installing Limestone Dosers Improved Three Fork Creek

Waterbody Improved

Approximately 9,100 acres of untreated mine pools discharging acid, iron and aluminum into headwater tributaries left Three Fork Creek discolored and lifeless. As a result, the stream was added to West Virginia's 1996 Clean Water Act section 303(d) list of impaired waters list for not meeting the state's water quality standards for pH and metals. In-stream dosing of lime was implemented in the watershed, which reduced metals, increased pH and improved biological conditions. As a result, Three Fork Creek was removed from the state's impaired waters list for aluminum in 2014.

Problem

Most of the 103-square-mile Three Fork Creek watershed is in West Virginia's Preston and Taylor counties (Figure 1). The creek discharges into the Tygart Valley River, which in turn empties into the Monongahela River.

Extensive underground coal mining within the headwater tributaries (Birds, Raccoon and Squires creeks) of Three Fork Creek occurred before the enactment of the Surface Mining Control and Reclamation Act (SMCRA). This left behind approximately 9,100 acres of mine pools that continued to discharge acid mine drainage (AMD) into surface waters. In the Three Fork Creek watershed, the majority of pre-SMCRA mining was conducted in the headwaters section in the Upper Freeport coal seam.

Three Fork Creek (assessment unit WVMT-12-00) was placed on the state's list of impaired waters in 1996 for not meeting the water quality standards for metals and pH. The applicable water quality standards require that dissolved aluminum must be less than 0.75 milligrams per liter (mg/L) and pH must not be less than 6.0 nor greater than 9.0. A total maximum daily load was approved in 2001 to address the metals and pH impairments in the watershed. In 2004 the West Virginia Division of Natural Resources (WVDNR) determined that Three Fork Creek was the second highest contributor of AMD in the Monongahela River basin.

Project Highlights

The Three Fork Creek Watershed Restoration Project was initiated through a combined effort of the West Virginia Department of Environmental Protection's (WVDEP's) Office of Abandoned Mine Lands and Reclamation, West Virginia University (WVU), and the Save the Tygart Watershed Association. A new cost-effective approach to treating multiple discharges was necessary to achieve the desired watershed improvement. Ultimately, it was determined that in-stream, active treatment using lime dosers was the most viable option for treating the creek. Construction of the dosers was initiated in July 2010. Each system was completed and actively treating water by April 2011 (Figure 2).

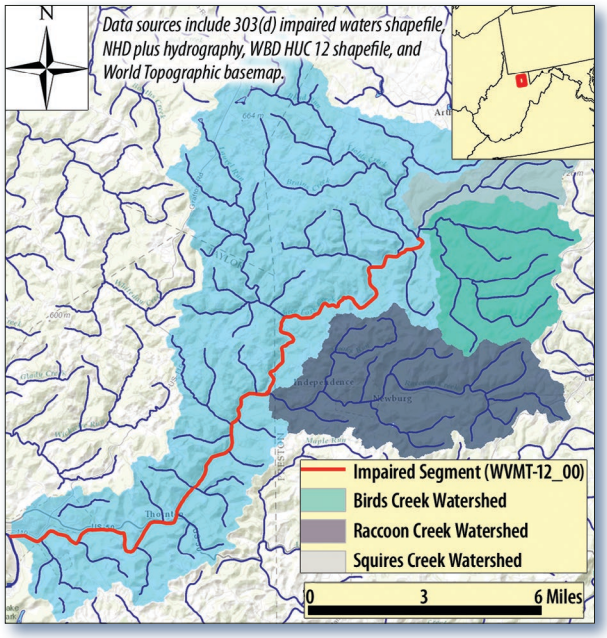

Figure 1. The Three Fork Creek watershed is in northern West Virginia.

Figure 2. This lime doser was installed as part of the Three Fork Creek restoration.

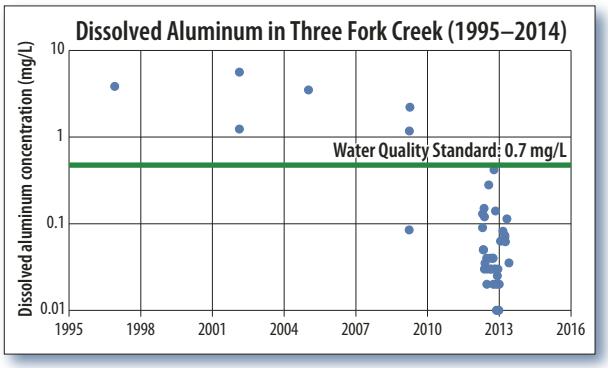

Figure 3. Dissolved aluminum levels in the Three Fork Creek watershed met state standards beginning in 2012.

Figure 4. Raccoon Creek before (inset photo) and after (main photo) lime dosing was implemented upstream.

In-stream treatment devices require constant maintenance and adjustments because of the dynamic conditions of the individual tributaries. WVDEP conducts sampling and adjustments of the doser systems twice per week. Volunteers from Save the Tygart sample the stream once per week.

Results

A post-construction water quality survey showed improvements in waters quality as seen in decreases in acidity and increases in pH and alkalinity (Table 1). With increases in pH, dissolved aluminum concentrations in Three Fork Creek also decreased (an almost 98 percent decrease in average concentrations in samples collected throughout the segment), meeting state standards (Figure 3). Because of these improvements, the 19-mile-long segment of Three Fork Creek (WVMT-12-00) was delisted for its dissolved aluminum impairment in 2014.

Table 1. Water quality (values are means) improved after lime doser installation

Stream	Dosing	pH	Acidity (mg/L)	Alkalinity (mg/L)
Birds Creek	before	3.9	85.1	0.8
Birds Creek	after	6.7	10.5	18.8
Squires Creek	before	3.4	101.6	0.8
Squires Creek	after	6.5	16.9	25.7
Raccoon Creek	before	4.1	96.2	1.7
Raccoon Creek	after	6.0	9.8	7.8
Three Fork Creek	before	5.1	21.9	2.3
Three Fork Creek	after	7.1	5.4	19.6

Restoration has led to improved biological conditions, as shown by increased populations of fish and benthic macroinvertebrates (including pollution-intolerant mayflies, stoneflies and caddisflies, collectively referred to as EPT—short for the order names Ephemeroptera, Plecoptera and Trichoptera). Pre-construction biosurveys in the watershed found a limited number of benthics (eight total taxa and three EPTs) and a single fish. Post-construction biosurveys in 2012 found positive benthic diversity (15 total taxa and eight EPTs) and a dramatic fish response. A total of 1,605 fish were collected, representing 21 species. Physical conditions have also improved (Figure 4). The local residents have noticed; many are taking advantage of the recreational opportunities now available in the watershed.

Partners and Funding

The restoration of Three Fork Creek was supported by the collaboration between WVDEP's Abandoned Mine Lands (AML) program and the Save the Tygart Watershed Association. WVDEP's AML Set-Aside account is used to fund the costs of operation and maintenance (O&M) and support monitoring. Capital construction cost for the dosers was $750,491. Since completion, O&M costs have totaled $274,440; the average cost per month is $18,296. The average cost per year for the past four years from October 2010 thru October 2014 for all nine dosers is $176,673. The total thus far is $1,060,036.

Save the Tygart volunteers perform monitoring at all doser sites. In FY 2014 they collected 1,144 samples (7,237 parameters) at an estimated cost of $41,503. The dosing effort continues and the typical cost seems to be decreasing slightly.

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

EPA 841-F-16-001C
January 2016

For additional information contact:

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304-926-0499 x1476 • Robert.Rice@wv.gov
Three Fork Creek Restoration Website

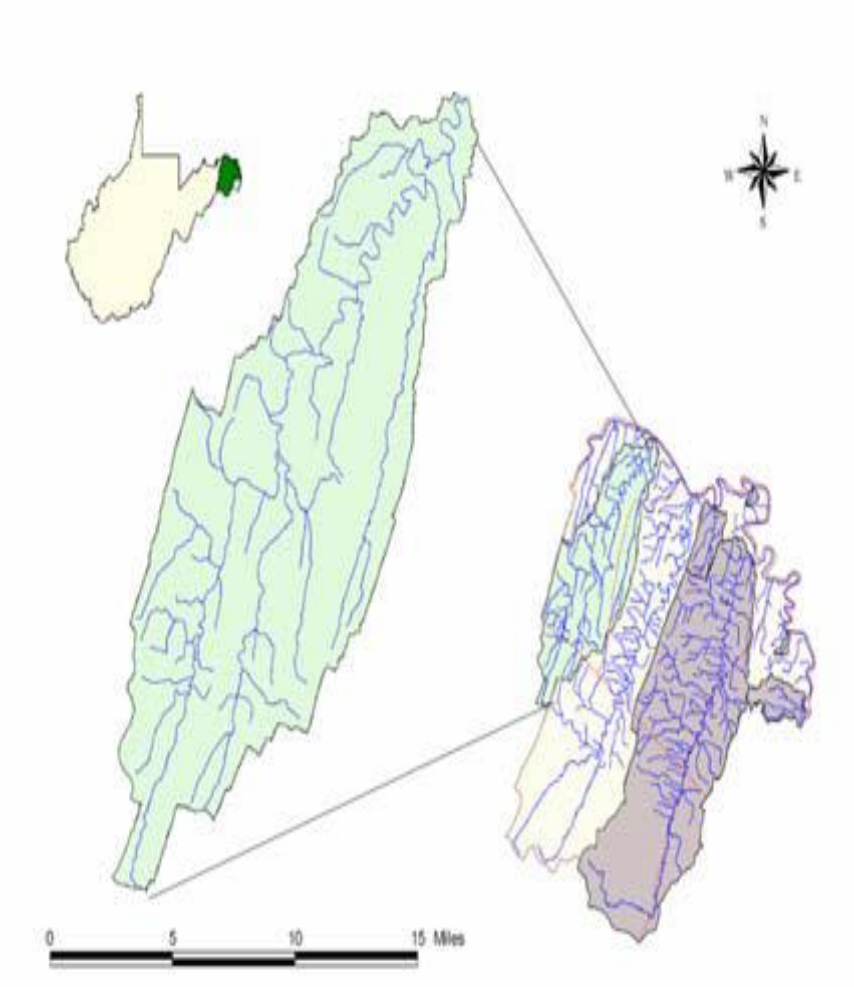
Watershed based plan highlights

Watershed planning includes development of new plans and revisions or upgrades to existing plans. In 2016 WVCA submitted a watershed based plan (WBP) for Beaver Creek, which was approved by EPA in late 2016. EPA also approved revisions to the North Fork of Blackwater River WBP, which was originally developed in 2005. In 2016 §319 watershed project work continued in 16 watersheds. These include:

- Knapp Creek, Sleepy Creek, Elk Run, Tuscarora Creek, Mill Creek – Opequon, James River, Milligan Creek, Second Creek, and Lower Coal River. (WPP) The focus of these WBPs is primarily bacteria reduction and sediment reduction.
- AMD remediation efforts continue in West Run, Upper Buckhannon River, Deckers Creek, Wolf Creek, Lower Cheat River, and Morris Creek. (WPP)
- The first project in the Piney Creek WBP focused on sediment and iron reduction. (WPP)

Visit the NPS Program's *WBP website* to learn more. Two WBPs, Sleepy Creek and Upper Buckhannon River, are highlighted.

Sleepy Creek



Sleepy Creek watershed

Sleepy Creek flows 42 miles north into the Potomac River. The watershed begins in Frederick County, Virginia, draining approximately 13,000 acres, and flows north into Morgan County, West Virginia where it covers 69,440 acres. Approximately half of the watershed area is forested, one-third is in agricultural use, and the remaining area is residential or small commercial operations. *The Sleepy Creek WBP* was developed by Tetra Tech, WVCA and local stakeholder groups. It was approved in 2008

The plan focuses on reducing fecal coliform levels through repairing failing septic systems and implementing a variety of agricultural and urban BMPs. The WBP *Total Maximum Daily Load* (TMDL) allocations are listed in *Table 7*.

Thus far, project support, implementation and results have been successful. As a result of CI's *2011 water quality monitoring report*, Indian Run was *delisted*.

Project highlights

The Project Team (consisting of WVCA, EPCD, SCWA, WVDOF, Morgan County Health Department, *CI*, *Region 9* and others) have pursued four separate grants to implement the WBP (*Table 8*). In total, $921,646 has been allocated through federal, state, and local partners to implement the WBP.

Table 7. Sleepy Creek TMDL allocations

	Baseline LA	LA	LA% Red
Indian Run (Delisted in 2012)			
WV Component	1.43E+14	2.28E+12	98.41%
Sleepy Creek Inclusive of Indian Run			
WV Component	5.51E+15	5.90E+13	98.93%
Sleepy Creek only	5.37E+15	5.67E+13	98.9%

Table 8. Sleepy Creek WBP progress

Phase	Funding	BMPs	Federal	Match	Total	Status
1	§319	Septic	$292,550	$195,036	$487,586	Complete
2	§319	Tree plantings/buffers/stormwater	$70,200	$53,000	$123,200	Complete
3	§319	Septic repair/replace/pumping	$74,600	$50,000	$124,600	Ongoing
4	CB Grant	Tree plantings/buffers/stormwater	$93,130	$93,130	$186,260	Ongoing
		Totals	**$530,480**	**$391,166**	**$921,646**	

One of the §319 projects were completed in 2011 and another in 2016. There is currently one active §319 project (scheduled for completion in 2017) and one active CB Implementation grant (scheduled for completion in 2020). The practices outlined in *Table 9* have been implemented using §319, *WVCA* state match and other leveraged funding sources.

Table 9. SC BMP implementation 2008-2016

2008-2016 Implementation		
BMPs	Quantity	Unit
Tree planting	7.8	acres
Riparian buffers	3.6	acres
Rain rardens	1796	square ft.
Porous pavers	7899	square ft.
Septic pumping	136	systems
Septic repair	46	systems

Results

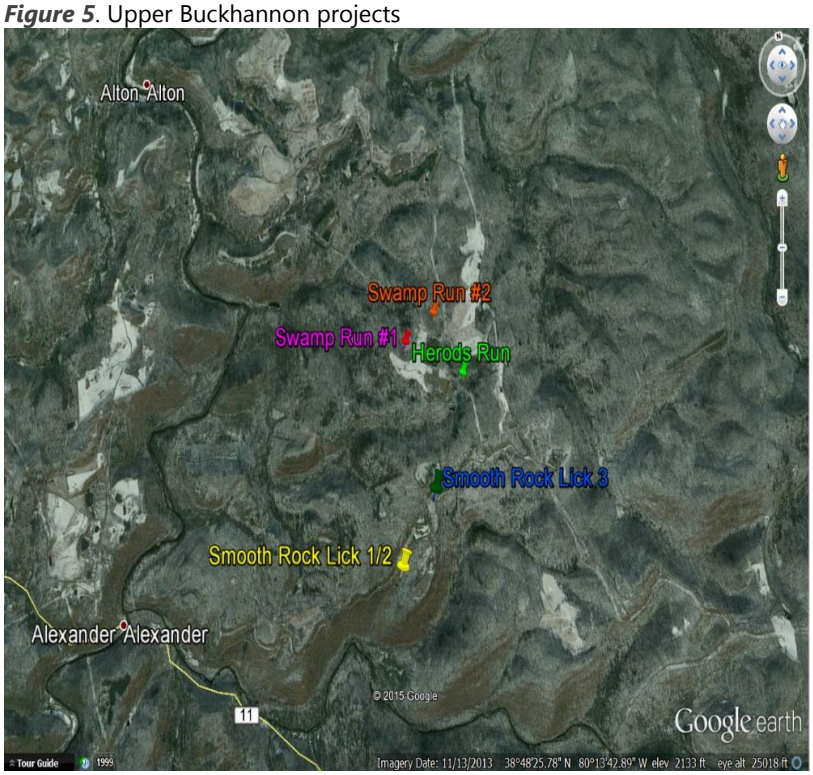
A *2015 water quality monitoring report* completed by *CI*, indicates that there are still exceedances of water quality standards for bacteria during rainy periods, however, sites that previously had frequent exceedances only had occasional exceedances in the 2015 study, suggesting some improvements.

Upper Buckhannon River

The Upper Buckhannon River watershed consists of approximately 127,623 acres located in north-central West Virginia. It is a sub-watershed of the Tygart Valley River Watershed and includes most of Upshur County and parts of Barbour, Lewis, Webster, Harrison and Randolph counties. The dominant water quality problems within the watershed are metals, acidity, sediment, and bacteria. The main sources of these contaminants are coal mining, acid precipitation, agriculture, logging, and wastewater. This WBP elucidates the sources of contamination and describes the steps that will need to be taken to achieve load reductions in metals, acidity, sediment, and bacteria due to NPS sources of these pollutants. The *Upper Buckhannon WBP* was approved in 2004.

Beginning in 2004-2005 a project team consisting of representatives from BRWA, NMLRC, WVDOF, WVDNR, WVDEP, WV Wesleyan College and others began planning passive treatment systems and working towards funding to install those systems. *Figure 5* indicates the location of current and future systems.

Figure 5. Upper Buckhannon projects



Project highlights

Smooth Rock Lick 1-2

The project area is in the headwaters of an unnamed tributary (UNT) and was selected based on its positive impacts on the receiving stream. The site had an existing impoundment and numerous seeps. Treatment consisted of collecting seeps and conveying the water to the impoundment via a limestone channel. The impoundment acted as a settling pond, and was retrofitted to better treat the acidic water. From here the water moved to a limestone leachbed and then discharged. To better control volume and allow for easier maintenance an agri-drain was installed.

Smooth Rock Lick 1-2 Phase II

In early 2013 following a routine maintenance visit, it was discovered that the limestone leachbed was compromised. Unexpected large flows caused the sides of the channel to erode, which added excess sediment to the leachbed. Phase II was completed to rectify the problem – the channel was angled to reduce erosive forces, and was grouted. The excess sediment was removed from the leachbed. The updates greatly improved system performance resulting in better water quality in the receiving tributary. The UNT was submitted as a success story candidate but did not meet minimum criteria. It is worth noting that the suspected cause of the high flows is not known; however, there is a large oil & gas pad upstream of this site.

Smooth Rock Lick 3

This site consisted of mine spoil and several smaller seeps. Treatment consisted of seep collection, an open limestone channel, and a finishing limestone leachbed. Treatment at #3 has increased alkalinity and substantially decreased AMD-metal concentrations.

Recent water quality data (*Table 10*) indicates these passive systems are operational and functioning as intended.

Table 10. WQ data for SRL sites

Site	pH su	Acidity mg/L	Alkalinity mg/L	Total Fe mg/L	Total Al mg/L	Total Mn mg/L
SRL 1/2	4.0, 4.5,	52, 74, 68	0, ~5, 0	8.85, 58.0,	1.74, 2.37, 1.24	0.616, 1.19,
SRL2 outfall	7.4	0	65	~0.03	~0.09	~0.115
SRL3 inflow	6.1	0	30	19.8	~0.09	1.26
SRL3 outflow	7.6	0	82	0.28	0	1.86

Swamp Run 1

This site consists of a large ferric iron deposit and multiple seeps creating a mushroom area. This mushroom area has damaged a large section of the valuable hardwood forest on-site. Treatment for this project consists of collecting seeps and conveying the water via a sandstone channel, which will allow Fe^{+2} to precipitate naturally into a collection area, then to a flushing limestone leachbed. The water from the leachbed is discharged to a settling pond, an aerobic wetland cell, and eventually to a tributary of Swamp Run. Project goals are to reduce current loads by at least 80 percent. Recent water quality data is shown in *Table 11*. Although progress is encouraging the system still needs time to mature (*Figure 6*).

Table 11. Swamp Run load reductions

Goals	Acid (lbs/yr)	Fe (lbs/yr)	Al (lbs/yr)
80% reduction	141,757	19,910	2,818
Current WQ	53,744	3,497	3,172
Performance	0.38	0.18	1.13

Note: Swamp Run phase II is currently on-going with an anticipated completion date of late 2018.

Herods Run

Herods Run is listed on WVDEPs 303(d) impaired streams list for pH; however, WQ sampling has also indicated AMD-metals present in high concentrations. The site is a previous OAMLR site and consists of seeps draining into a stormwater/settling pond, then back to a channel that joins the Buckhannon River 2.3 miles downstream. Sampling has indicated the site contributes approximately 29,235 lbs/yr of acidity, 5,079 lbs/yr of iron and 332 lbs/yr of aluminum. By installing a passive system here, NMLRC and BRWA estimate reducing loads from Herods Run by 80 percent. Treatment system components consist of open limestone channels and large limestone leachbeds.

Table 12 provides cost and timelines for all projects in the Upper Buckhannon watershed.

Table 12. Upper Buckhannon WBP projects

Project	Completed	Cost	Funding sources
SRL 1/2	2010	$219,007	§319-WCAP-Match
SRL 3	2010	$107,107	§319-WCAP-Match
SRL1/2 (II)	2013	$34,082	§319-Match
Swamp Run 1	2016	$660,000	§319-WCAP-SRF-Match
Herods Run	2017*	$335,000	§319-WCAP-Match
Swamp Run 2	2018*	$357,193	§319-WCAP-Match
* anticipated completion FY		**$1,712,389**	**Total**

Final thoughts


Watershed Improvement Branch staff

Watershed restoration is a long-term commitment. With the financial assistance of USEPA; volunteers, agencies, universities and other nonprofit and private partners in West Virginia have been working on watershed planning and implementing water quality improvement projects since the early 1990s. While there has been some turnover in staff and volunteers, we've continued to work with many of the same organizations who have dedicated their missions to helping the WVDEP and the citizens of West Virginia. At the same time, we have fostered new organizations who fear their watershed is threatened. The message of how we manage and reduce polluted runoff is one that must be told over and over to educate new stakeholders in our watersheds. WVDEP's *WIB* is dedicated to continuing this effort and thanks our many partners for their dedication. – *Teresa Koon*, Assistant Director

Appendix 1. BMP Implementation

Fiscal yr	Date	BMP	Number	Unit	Stream	Org	HUC12	HUC_Names
2014	Apr-16	Septic-pump	15	IU	Sleepy Creek	WVCA	020700040201	Upper Sleepy Creek
2016	Sep-16	Fencing	6,878	Ft	Middle Fk Sleepy Creek	WVCA	020700040202	Middle Fork Sleepy Creek
2014	Apr-16	Septic-pump	34	IU	Sleepy Creek	WVCA	020700040202	Middle Fork Sleepy Creek
2014	Apr-16	Septic-repair	1	IU	Sleepy Creek	WVCA	020700040202	Middle Fork Sleepy Creek
2014	Mar-16	Septic-replace	2	IU	Sleepy Creek	WVCA	020700040202	Middle Fork Sleepy Creek
2014	Apr-16	Septic-pump	18	IU	Sleepy Creek	WVCA	020700040205	Lower Sleepy Creek
2015	Apr-16	Septic-repair	1	IU	Mill Creek	CVI	020700040905	Mill Creek-Opequon
2016	Mar-16	Heavy use protection	5,108	Sqft	Middle Creek	WVCA	020700040906	Middle Creek-Opequon
2015	Apr-16	Septic-replace	1	IU	Tuscarora Creek	CVI	020700040907	Tuscarora Creek
2015	Sep-16	Stream restoration	1,600	Ft	Tuscarora Creek	CVI	020700040907	Tuscarora Creek
2015	Mar-16	Heavy use protection	1,914	Sqft	Hoke Run	WVCA	020700040909	Hoke Run-Opequon
2016	Mar-16	Heavy use protection	2,400	Sqft	Rattlesnake Run	WVCA	020700041106	Rattlesnake Run-Potomac
2015	Mar-16	Heavy use protection	2,272	Sqft	Flowing Spring Run	WVCA	020700070304	Flowing Springs Run-Shenandoah
2016	Mar-16	Nutrient management	16	Ac	Sweet Springs Creek	WVCA	020802010301	Sweet Spring Creek-Cove Creek
2013	Apr-16	Grazing system	21	Ac	South Fk Potts Creek	WVCA	020802010401	South Fk Potts Creek-NF Potts Creek
2016	Mar-16	Nutrient management	576	Ac	South Fk Potts Creek	WVCA	020802010401	South Fk Potts Creek-NF Potts Creek
2013	Apr-16	Streambank stabilization	900	Ft	South Fk Potts Creek	WVCA	020802010401	South Fk Potts Creek-NF Potts Creek
2013	Sep-16	Constructed wetland	7,500	Sqft	Swamp Run	WVU/BRWA	050200010304	Tenmile Creek-Buckhannon River
2013	Sep-16	Limestone channel	400	Ft	Swamp Run	WVU/BRWA	050200010304	Tenmile Creek-Buckhannon River
2013	Sep-16	Limestone leachbed	9,100	Sqft	Swamp Run	WVU/BRWA	050200010304	Tenmile Creek-Buckhannon River
2012	Sep-15	AMD treatment system	1	IU	Lambert Run	WVU/GWF	050200020602	Limestone Run-West Fork
2012	Oct-16	Constructed wetland	217,800	Sqft	Lambert Run	WVU/GWF	050200020602	Limestone Run-West Fork
2012	Apr-16	AMD treatment system	1	IU	Kanes Creek	FODC	050200030201	Headwaters Deckers Creek
2012	Apr-16	Constructed wetland	2,300	Sqft	Kanes Creek	FODC	050200030201	Headwaters Deckers Creek
2012	Apr-16	Limestone leachbed	1,430	Sqft	Kanes Creek	FODC	050200030201	Headwaters Deckers Creek
2012	Apr-16	Vertical flow treatment	9,000	Sqft	Kanes Creek	FODC	050200030201	Headwaters Deckers Creek
2013	Feb-16	AMD treatment system	1	IU	West Run	WVU	050200030309	West Run-Monongahela River
2013	Feb-16	Steel slag	1	IU	West Run	WVU	050200030309	West Run-Monongahela River
2013	Feb-16	Limestone channel	1,540	Ft	West Run	WVU	050200030309	West Run-Monongahela River
2013	Feb-16	Limestone leachbed	32,000	Sqft	West Run	WVU	050200030309	West Run-Monongahela River
2012	Sep-16	AMD treatment system	1	IU	Beaver Creek	WVDEP	050200040603	Beaver Creek-Little Sandy Creek
2012	Mar-16	AMD treatment system	1	IU	Muddy Creek	FOC	050200040703	Muddy Creek
2012	Mar-16	Limestone channel	500	Ft	Muddy Creek	FOC	050200040703	Muddy Creek
2014	Mar-16	AMD treatment system	1	IU	NF Greens Run	FOC	050200040705	Greens Run-Cheat River
2014	Mar-16	Constructed wetland	4,872	Sqft	NF Greens Run	FOC	050200040705	Greens Run-Cheat River
2014	Mar-16	Limestone channel	436	Ft	NF Greens Run	FOC	050200040705	Greens Run-Cheat River
2014	Mar-16	Limestone leachbed	11,263	Sqft	NF Greens Run	FOC	050200040705	Greens Run-Cheat River
2016	Sep-16	Alternate water	300	Ft	Indian Creek	WVCA	050500020703	Upper Indian Creek
2016	Sep-16	Alternate water	700	Ft	Indian Creek	WVCA	050500020705	Upper Indian Creek
2012	Mar-16	Alternate water	1	IU	Knapp Creek	WVCA	050500030202	Headwaters Knapp Creek

Fiscal yr	Date	BMP	Number	Unit	Stream	Org	HUC12	HUC_Names
2012	Apr-16	Fencing	488	Ft	Knapp Creek	WVCA	050500030202	Headwaters Knapp Creek
Fiscal yr	Date	BMP	Number	Unit	Stream	Org	HUC12	HUC_Names
2012	Apr-16	Septic-repair	9	IU	Knapp Creek	WVCA	050500030202	Headwaters Knapp Creek
2012	Apr-16	Septic-replace	5	IU	Knapp Creek	WVCA	050500030202	Headwaters Knapp Creek
2013	Mar-16	Stream restoration	4,861	Ft	Knapp Creek	WVCA	050500030203	Outlet Knapp Creek
2015	Mar-16	Irrigation water	600	Ft	Spring Creek	WVCA	050500030302	Outlet Spring Creek
2016	Sep-16	Nutrient management	800	Ac	Spring Creek	WVCA	050500030302	Outlet Spring Creek
2016	Sep-16	Fencing	5,000	Ft	Slabcamp Run	WVCA	050500030408	Slabcamp Run-Greenbrier River
2016	Sep-16	Nutrient management	2	Ac	Slabcamp Run	WVCA	050500030408	Slabcamp Run-Greenbrier River
2012	Apr-16	Alternate water	12	IU	Second Creek	WVCA	050500030701	Upper Second Creek
2012	Apr-16	Fencing	2,470	Ft	Second Creek	WVCA	050500030701	Upper Second Creek
2016	Mar-16	Nutrient management	897.7	Ac	Second Creek	WVCA	050500030701	Upper Second Creek
2016	Mar-16	Pond construction	300	Sqft	Second Creek	WVCA	050500030701	Upper Second Creek
2012	Apr-16	Grazing system	100	Ac	Second Creek	WVCA	050500030703	Lower Second Creek
2012	Apr-16	Nutrient management	387.5	Ac	Second Creek	WVCA	050500030703	Lower Second Creek
2012	Mar-16	Pond construction	300	Sqft	Second Creek	WVCA	050500030703	Lower Second Creek
2014	Apr-16	Alternate water	7	IU	Milligan Creek	WVCA	050500030903	Milligan Creek-Greenbrier River
2014	Apr-16	Fencing	21,528	Ft	Milligan Creek	WVCA	050500030903	Milligan Creek-Greenbrier River
2014	Apr-16	Grazing system	421	Ac	Milligan Creek	WVCA	050500030903	Milligan Creek-Greenbrier River
2016	Mar-16	Nutrient management	3,567	Ac	Milligan Creek	WVCA	050500030903	Milligan Creek-Greenbrier River
2016	Sep-16	Grazing system	2,000	Ft	Griffith Creek	WVCA	050500030905	Griffith Creek-Greenbrier River
2014	Apr-16	Septic-repair	3	IU	Sewell Creek	WVCA	050500050604	Sewell Creek
2016	Sep-16	Fencing	3,100	Ft	Mill Creek	WVCA	050500050605	Mill Creek-Meadow River
2016	Sep-16	Alternate water	300	Ft	Meadow Creek	WVCA	050500050606	Meadow Creek-Meadow River
2015	Jun-16	AMD treatment system	1	IU	Morris Creek	WVCA	050500060306	Hughes Creek-Kanawha River
2015	Jun-16	Floating baffles	3	IU	Morris Creek	MCWA	050500060306	Hughes Creek-Kanawha River
2015	Jun-16	Diversion trench	1	IU	Morris Creek	MCWA	050500060306	Hughes Creek-Kanawha River
2015	Jun-16	Sludge collection pond	43,560	Sqft	Morris Creek	MCWA	050500060306	Hughes Creek-Kanawha River
2015	Jun-16	Limestone leachbed	100	Sqft	Morris Creek	MCWA	050500060306	Hughes Creek-Kanawha River
2016	Apr-16	Erosion control	0.2	Ac	Poplar Fork	WVCA	050500080305	Poplar Fork
2016	Mar-16	Erosion control	1.2	Ac	Hurricane Creek	WVCA	050500080306	Hurricane Creek
2016	Mar-16	Erosion control	1	Ac	Buffalo Creek	WVCA	050500080308	Buffalo Creek-Kanawha River
2016	Sep-16	Nutrient management	25	Ac	Bear Creek	WVCA	050702040403	Bear Creek-Big Sandy River
2016	Sep-16	Streambank stabilization	145	Ft	Whites Creek	WVCA	050702040404	Whites Creek
2016	Sep-16	Fencing	900	Ft	Guyan Creek	WVCA	050901010705	Guyan Creek
2016	Sep-16	Nutrient management	24.0	Ac	Fourpole Creek	WVCA	050901011006	Fourpole Creek

Priority areas	
Statewide/other	

Appendix 2. Pollutant load reductions

Fiscal yr	Date	Pollutant	Load reduction	Unit	Stream	Org	HUC12	HUC_Names
2014	Apr-16	Fecal coliform	1.6E+13	cfu	Sleepy Creek	WVCA	020700040201	Upper Sleepy Creek
2014	Mar-16	Fecal coliform	1.7E+13	cfu	Sleepy Creek	WVCA	020700040202	Middle Fork Sleepy Creek
2016	Sep-16	Sediment	112.8	tons/yr	Middle Fk Sleepy Creek	WVCA	020700040202	Middle Fork Sleepy Creek
2015	Apr-16	Fecal coliform	5.9E+12	cfu	Mill Creek	CVI	020700040905	Mill Creek-Opequon
2016	Apr-16	Nitrogen	8	lbs/yr	Middle Creek	WVCA	020700040906	Middle Creek-Opequon
2016	Apr-16	Phosphorus	4	lbs/yr	Middle Creek	WVCA	020700040906	Middle Creek-Opequon
2016	Apr-16	Sediment	2.8	tons/yr	Middle Creek	WVCA	020700040906	Middle Creek-Opequon
2015	Apr-16	Fecal coliform	6.3E+12	cfu	Tuscarora Creek	CVI	020700040907	Tuscarora Creek
2016	Apr-16	Nitrogen	1	lbs/yr	Hoke Run	WVCA	020700040909	Hoke Run-Opequon
2016	Apr-16	Phosphorus	1	lbs/yr	Hoke Run	WVCA	020700040909	Hoke Run-Opequon
2016	Apr-16	Sediment	0.5	tons/yr	Hoke Run	WVCA	020700040909	Hoke Run-Opequon
2016	Apr-16	Nitrogen	2	lbs/yr	Rattlesnake Run	WVCA	020700041106	Rattlesnake Run-Potomac
2016	Apr-16	Phosphorus	1	lbs/yr	Rattlesnake Run	WVCA	020700041106	Rattlesnake Run-Potomac
2016	Apr-16	Sediment	0.7	tons/yr	Rattlesnake Run	WVCA	020700041106	Rattlesnake Run-Potomac
2016	Apr-16	Nitrogen	2	lbs/yr	Flowing Springs Run	WVCA	020700070304	Flowing Springs Run-Shenandoah
2016	Apr-16	Phosphorus	1	lbs/yr	Flowing Springs Run	WVCA	020700070304	Flowing Springs Run-Shenandoah
2016	Apr-16	Sediment	0.7	tons/yr	Flowing Springs Run	WVCA	020700070304	Flowing Springs Run-Shenandoah
2016	Apr-16	Nitrogen	5,210	lbs/yr	Sweet Spring Creek	WVCA	020802010301	Sweet Spring Creek-Cove Creek
2016	Apr-16	Phosphorus	7,467	lbs/yr	Sweet Spring Creek	WVCA	020802010301	Sweet Spring Creek-Cove Creek
2013	Mar-16	Fecal coliform	5.1E+12	cfu	South Fk Potts Creek	WVCA	020802010401	South Fk Potts Creek-NF Potts Creek
2016	Apr-16	Nitrogen	156,610	lbs/yr	South Fk Potts Creek	WVCA	020802010401	South Fk Potts Creek-NF Potts Creek
2016	Apr-16	Phosphorus	89,230	lbs/yr	South Fk Potts Creek	WVCA	020802010401	South Fk Potts Creek-NF Potts Creek
2012	Dec-16	Acidity	56.1	tons/yr	Lambert Run	WVU/GWF	050200020602	Limestone Run-West Fork
2012	Dec-16	Metals-Aluminum	94	lbs/yr	Lambert Run	WVU/GWF	050200020602	Limestone Run-West Fork
2012	Dec-16	Metals- Iron	62,862	lbs/yr	Lambert Run	WVU/GWF	050200020602	Limestone Run-West Fork
2012	Dec-16	Metals-Manganese	427	lbs/yr	Lambert Run	WVU/GWF	050200020602	Limestone Run-West Fork
2012	Dec-16	Acidity	20.3	tons/yr	Kanes Creek	FODC	050200030201	Headwaters Deckers Creek
2012	Dec-16	Metals- Aluminum	3,700	lbs/yr	Kanes Creek	FODC	050200030201	Headwaters Deckers Creek
2012	Dec-16	Metals- Iron	3,500	lbs/yr	Kanes Creek	FODC	050200030201	Headwaters Deckers Creek
2013	Feb-16	Acidity	48.5	tons/yr	West Run	WVU	050200030309	West Run-Monongahela River
2013	Feb-16	Metals- Aluminum	6,052	lbs/yr	West Run	WVU	050200030309	West Run-Monongahela River
2013	Feb-16	Metals- Iron	12,477	lbs/yr	West Run	WVU	050200030309	West Run-Monongahela River
2013	Feb-16	Metals- Manganese	138	lbs/yr	West Run	WVU	050200030309	West Run-Monongahela River
2012	Sep-16	Metals- Aluminum	14	lbs/yr	Beaver Creek	WVDEP	050200040603	Beaver Creek-Little Sandy Creek
2012	Sep-16	Metals- Iron	27	lbs/yr	Beaver Creek	WVDEP	050200040603	Beaver Creek-Little Sandy Creek
2012	Mar-16	Acidity	8.6	tons/yr	Muddy Creek	FOC	050200040703	Muddy Creek
2012	Mar-16	Metals- Aluminum	1,600	lbs/yr	Muddy Creek	FOC	050200040703	Muddy Creek
2012	Mar-16	Metals- Iron	100	lbs/yr	Muddy Creek	FOC	050200040703	Muddy Creek
2014	May-16	Acidity	13.4	tons/yr	NF Greens Run	FOC	050200040705	Greens Run-Cheat River
2013	Feb-16	Acidity	11.4	tons/yr	NF Greens Run	FOC	050200040705	Greens Run-Cheat River

Fiscal yr	Date	Pollutant	Load reduction	Unit	Stream	Org	HUC12	HUC_Names
2014	Mar-16	Metals- Aluminum	1,176	lbs/yr	NF Greens Run	FOC	050200040705	Greens Run-Cheat River
2013	Feb-16	Metals- Aluminum	620	lbs/yr	NF Greens Run	FOC	050200040705	Greens Run-Cheat River
2014	Mar-16	Metals- Iron	3,834	lbs/yr	NF Greens Run	FOC	050200040705	Greens Run-Cheat River
2013	Feb-16	Metals- Iron	1,120	lbs/yr	NF Greens Run	FOC	050200040705	Greens Run-Cheat River
2016	Sep-16	Sediment	300	tons/yr	Indian Creek	WVCA	050500020703	Upper Indian Creek
2016	Sep-16	Sediment	150	tons/yr	Indian Creek	WVCA	050500020705	Upper Indian Creek
2012	Apr-16	Fecal coliform	4.0E+11	cfu	Knapp Creek	WVCA	050500030202	Headwaters Knapp Creek
2013	Mar-16	Fecal coliform	7.3E+11	cfu	Knapp Creek	WVCA	050500030203	Outlet Knapp Creek
2013	Mar-16	Nitrogen	31.8	lbs/yr	Knapp Creek	WVCA	050500030203	Outlet Knapp Creek
2013	Mar-16	Phosphorus	117	lbs/yr	Knapp Creek	WVCA	050500030203	Outlet Knapp Creek
2013	Mar-16	Sediment	1,874.3	tons/yr	Knapp Creek	WVCA	050500030203	Outlet Knapp Creek
2016	Sep-16	Nitrogen	12,000	lbs/yr	Spring Creek	WVCA	050500030302	Outlet Spring Creek
2016	Sep-16	Phosphorus	40,000	lbs/yr	Spring Creek	WVCA	050500030302	Outlet Spring Creek
2016	Sep-16	Sediment	10	tons/yr	Spring Creek	WVCA	050500030302	Outlet Spring Creek
2016	Sep-16	Sediment	6,600	tons/yr	Slabcamp Run	WVCA	050500030408	Slabcamp Run-Greenbrier River
2012	Apr-16	Fecal coliform	7.5E+12	cfu	Second Creek	WVCA	050500030701	Upper Second Creek
2016	Apr-16	Nitrogen	334,863	lbs/yr	Second Creek	WVCA	050500030701	Upper Second Creek
2012	Mar-16	Nitrogen	235,113	lbs/yr	Second Creek	WVCA	050500030701	Upper Second Creek
2016	Apr-16	Phosphorus	102,986	lbs/yr	Second Creek	WVCA	050500030701	Upper Second Creek
2012	Mar-16	Phosphorus	17,236	lbs/yr	Second Creek	WVCA	050500030701	Upper Second Creek
2016	Apr-16	Sediment	10	tons/yr	Second Creek	WVCA	050500030701	Upper Second Creek
2012	Mar-16	Sediment	4	tons/yr	Second Creek	WVCA	050500030701	Upper Second Creek
2012	Apr-16	Fecal coliform	6.5E+11	cfu	Second Creek	WVCA	050500030703	Lower Second Creek
2012	Mar-16	Nitrogen	99,750	lbs/yr	Second Creek	WVCA	050500030703	Lower Second Creek
2012	Mar-16	Phosphorus	85,750	lbs/yr	Second Creek	WVCA	050500030703	Lower Second Creek
2012	Mar-16	Sediment	10	tons/yr	Second Creek	WVCA	050500030703	Lower Second Creek
2014	Mar-16	Fecal coliform	2.1E+12	cfu	Milligan Creek	WVCA	050500030903	Milligan Creek-Greenbrier River
2016	Apr-16	Nitrogen	6,272	lbs/yr	Milligan Creek	WVCA	050500030903	Milligan Creek-Greenbrier River
2016	Apr-16	Phosphorus	64	lbs/yr	Milligan Creek	WVCA	050500030903	Milligan Creek-Greenbrier River
2016	Sep-16	Sediment	600	tons/yr	Griffith Creek	WVCA	050500030905	Griffith Creek-Greenbrier River
2014	Apr-16	Fecal coliform	4.2E+10	cfu	Sewell Creek	WVCA	050500050604	Sewell Creek
2016	Sep-16	Sediment	1,140	tons/yr	Mill Creek	WVCA	050500050605	Mill Creek-Meadow River
2016	Sep-16	Sediment	300	tons/yr	Meadow Creek	WVCA	050500050606	Meadow Creek-Meadow River
2015	Dec-16	Acidity	2.2	tons/yr	Morris Creek	MCWA	050500060306	Hughes Creek-Kanawha River
2015	Dec-16	Metals- Aluminum	24	lbs/yr	Morris Creek	MCWA	050500060306	Hughes Creek-Kanawha River
2015	Dec-16	Metals-Iron	4,911.8	lbs/yr	Morris Creek	MCWA	050500060306	Hughes Creek-Kanawha River
2016	Apr-16	Sediment	1.1	tons/yr	Poplar Fork	WVCA	050500080305	Poplar Fork
2016	Apr-16	Sediment	14.9	tons/yr	Hurricane Creek	WVCA	050500080306	Hurricane Creek
2015	Mar-16	Sediment	14.9	tons/yr	Hurricane Creek	WVCA	050500080306	Hurricane Creek
2016	Apr-16	Sediment	31.5	tons/yr	Buffalo Creek	WVCA	050500080308	Buffalo Creek-Kanawha River
2015	Mar-16	Sediment	17.4	tons/yr	Buffalo Creek	WVCA	050500080308	Buffalo Creek-Kanawha River
2016	Sep-16	Nitrogen	4,000	lbs/yr	Bear Creek	WVCA	050702040403	Bear Creek-Big Sandy River
Fiscal yr	Date	Pollutant	Load reduction	Unit	Stream	Org	HUC12	HUC_Names

Fiscal yr	Date	Pollutant	Load reduction	Unit	Stream	Org	HUC12	HUC_Names
2016	Sep-16	Phosphorus	853.4	lbs/yr	Bear Creek	WVCA	050702040403	Bear Creek-Big Sandy River
2016	Sep-16	Sediment	89	tons/yr	Whites Creek	WVCA	050702040404	Whites Creek
2016	Sep-16	Sediment	2.6	tons/yr	Guyan Creek	WVCA	050901010705	Guyan Creek
2016	Sep-16	Nitrogen	27	lbs/yr	Fourpole Creek	WVCA	050901011006	Fourpole Creek
2016	Sep-16	Phosphorus	1,083	lbs/yr	Fourpole Creek	WVCA	050901011006	Fourpole Creek

Priority areas	
Statewide/other	

Appendix 3. WIB/WVCA staff activities and statewide programs

Watershed Improvement Branch (WIB)

Potomac Basin Coordinator (PBC)

BEHI and bank pinning

The PBC supported the Back Creek §319 project by supervising an intern's streambank assessment of two tributaries and helping with bank pinning a site on Back Creek for a planned restoration project. The PBC supported the Tuscarora Creek §319 project by co-facilitating project team meetings, measuring erosion at last year's bank pinning site, and participating in an outreach event. For the Mill Creek §319 project, the PBC helped to identify a sediment reduction project, which CVI and the WV Division of Highways (WVDOH) successfully implemented. The PBC also helped with bank pinning on potential future project sites.

The PBC supports other watershed groups through the *Stream Partners Program*, including a newly-forming Friends of Bullskin Run group in Jefferson County; see the video on their webpage at: *www.bullskinrun.org*. She served as a project liaison for native tree planting projects at a public river access site, an industrial park and church in Romney, and at Burlington United Methodist Family Services. The PBC helped the Stormwater Specialist to plan and conduct a stormwater retrofit training in February for City of Romney and WVDOH staff. The PBC also served on the steering committee of a regional stormwater forum with Chesapeake Stormwater Network in November.

In 2016, the PBC facilitated bi-monthly meetings of *West Virginia's Chesapeake Bay Tributary Team* and coordinated the annual submittal of nonpoint source BMP data to the Chesapeake Bay Program, as well as the refinement of West Virginia's historical BMP data in the Chesapeake Bay Watershed Model. The PBC investigated future project opportunities that will reduce nutrients and sediment from nonpoint sources including dirt roads in the Blue Ridge Mountain portion of the Shenandoah River watershed, a parking lot project at Eastern West Virginia Community College, and various nonpoint sources in the towns of Bayard and Piedmont.

Northern Basin Coordinator (NBC)

Buckhannon River Watershed Association: BRWA completed their Swamp Run 1 project. They obtained a design for their Herods Run project, and they submitted a proposal for a Swamp Run 2 project. They monitored their past and current projects. The BRWA Project Team held three meetings over the year. WVDNR stocked brook trout into Smooth Rock Lick. The NBC convened, and summarized the project team meetings. The NBC supported BRWA by joining them in the field for monitoring, pre-bids, engineer visits, and construction inspection. He also helped OAMLR evaluate a feature of the Swamp Run 2 project for AML eligibility.

Friends of Blackwater: FOB got a WBP approved, tried to execute one NPS agreement, and applied for a second. They have a worker capable of carrying out the work, including monitoring, analyzing, writing proposals, cooperating with diverse agencies, and, hopefully, hiring engineers and contractors as well. Their major obstacles remain the nature of the problem they face and the uncooperative landowner. The NBC supported the group by monitoring their North Fork sites and helping revise their WBP.

Friends of the Cheat: FOC is conducting two design-build projects for AMD remediation. They worked with USEPA on a story board for *Sovern Run*. FOC is developing three WBPs. The NBC supported FOC by attending various milestones, including pre-bids and engineer meetings, and discussed what §319 projects to apply for. The NBC attends *River of Promise* project team meetings.

Friends of Deckers Creek: FODC completed one AMD project and almost completed a second this year. They are working with the contractor to correct leaks at the second. They have additional projects in the pipeline which are progressing. As with FOC, the NBC supported FODC by attending various milestones, such as pre-bids, site visits and final inspections. Also, the NBC attended their quarterly Deckers Creek Restoration Team meetings.

The NBC helped streamlined a request to increase §319 funding on one of their proposals that allowed them to add an extra, more effective BMP to their Ingrand project. I. The NBC requested data from them for *STORET*. They have done part of this work, namely producing a Quality Management Plan.

Guardians of the West Fork Watershed: With NMLRC and GWF, the NBC is monitoring the Lambert Run site 7 project and documenting its appearance and effectiveness. The NBC met and spoke with that project's neighbors to discuss its performance and the teams plans to make it work even better.

Save the Tygart Watershed Association: STTWA is treating AMD by supporting other parts of WVDEP who are dosing streams with alkaline materials. STTWA monitors both the Three Fork Creek watershed, where WVDEP's OAMLR has installed four lime dosers, and the Sandy Creek watershed, where the Office of Special Reclamation has installed two in-stream dosers in addition to the forfeited mine permits where they treat water.

STTWA is also working with OAMLR and the WVDNR to treat Beaver Creek with limestone sand. The NBC supports STTWA by attending their meetings, joining them in the field to talk with various agencies, and by helping them maintain all their water monitoring data.

West Run Watershed Association: The WRWA worked with NMLRC and others to complete the Morgantown Airport AMD project. The NBC supported them by attending various site inspections and conducting a final site inspection.

Non-watershed group work: The NBC shared with watershed associations information on grants, trainings and other opportunities every one to two weeks; Entered data from semi-annual reports into GRTS; participated in focused conservation approach meetings; participated in source water protection meetings; participated in interagency review of Army Corps Regional General Permit for abandoned mine reclamation; reviewed §319 proposals before and after submission from watershed groups; supports the WPP through participation in monthly calls and as a resource provider; participated in and prepped materials for WIB grant recipient training; and reviewed *Quality Assurance Project Plans* (QAPPs) and Quality Management Plans (QMPs).

Western Basin Coordinator (WBC)

The Western Basin Coordinator (WBC) assisted two groups with §319 project implementation. The CRG Project Proposal was accepted and they have received $126,000 for installing and pumping septic tanks to reduce fecal coliforms within Angel Fork and Browns Creek. WVDEP's Watershed Assessment Branch (WAB) and the WBC continue to work with CRG on their fecal monitoring and analysis of their results. The WBC assisted CRG with an outreach event coined "Coal River Clean Stream Project" where the public was invited to speak with the Health Department, septic installers, and WVDEP's On-Site Loan Program (OSLP) and WIB. Two applications have been submitted to CRG for septic tank replacements.

MCWA §319 Upper Mainstem Project has been revamped with new limestone, baffle curtains, and check dams. The system is currently functioning to remove AMD-metals and neutralize the water's pH before entering Morris Creek. The WBC worked with WVDEP's OAMLR to begin collecting load reductions for a period of six months. Two samples have been collected, a report will be compiled by MCWA after the study.

Two §319 AGOs are ongoing with FOH. One is for sampling on Hursher's Run and the other is for baseline water quality monitoring on the North Fork of the Hughes River. The North Fork of the Hughes River is where over 10,000 residents received drinking water and many NPS source issues are impacted the stream. This grant allows FOH to establish a baseline that can be shared with the community to ensure their stream is healthy and safe for drinking.


Rain barrel workshop at WVDEP

The WBC outreach includes working with local watershed groups and schools to organize and present water education at outreach events including WVDEP Earth Day, Girl Scouts Aqua Badge, Marshall University Water Festival, Ritchie County Middle School Water Festival, Nicholas County Water Festival, Homeschool Water Festival at North Bend State Park, Coal River Group Water Festival, Morris Creek Water Festival, and the Mill Creek Adventure Day. Additionally, The WBC collaborated with the City of Charleston's Stormwater Department to host seven rain barrel workshops in Kanawha County and presented an interactive stormwater exhibit at Charleston's FestivALL.

***Southern Basin Coordinator (SBC)**:* The new SBC worked with many of the watershed associations in the area on a variety of projects. The SBC received training and attended several informational sessions to expand his knowledge on NPS project opportunities.

§319 projects

The first project the SBC became involved in was the Summerlee AMD Passive Treatment System at the headwaters of Wolf Creek, Fayette County. PAN has been the steward of this project since its inception and continues to direct the installation of the phased construction. Partnerships with WVDEP's OAMLR, and OSM have helped fund the reclamation and treatment of a "gob" pile of about 80 acres in size. Phase II of the three phase project was completed in the fall of 2016 which included the installation of two terraced iron formations (TIF's) and two auto-flushing vertical flow ponds. Post construction water monitoring is underway and the final phase of the treatment facility will be installed in 2017-2018.

The SBC worked with WVCA on post project water monitoring of several creeks in the Greenbrier Valley. These included sampling on Kitchen Creek, Second Creek and Knapp Creek. WVCA, in partnership with local farmers, have been installing livestock exclusion stream buffers and rotational grazing fencing for the last few years. The post project monitoring and data analysis are on-going.

The SBC completed the final inspection on the Helios Park AGO project in Richwood. This project was a partnership between the WVU Extension office and the New River Regional Development Authority. It is a demonstration of modern green building techniques in an urban park allowing water to infiltrate more slowly into the ground thus reducing runoff pollution.

Source water

Starting in the spring, the SBC was part of several regional planning partnerships to develop Source Water Protection Plans for drinking water providers. These plans were developed to provide an early warning system in the event of a spill or impairment to water quality upstream of drinking water intakes. Many public meetings were held to discuss the benefits of these plans as well as engage the public in being active monitors of the watersheds that contribute to their drinking water. This planning resulted in approved Source Water Protection plans for the communities of Fayetteville, Lewisburg, Mt. Hope and Kanawha Falls.


Source water protection meeting (Fayetteville)

Outreach

In late summer, The SBC fostered a partnership with the *US Forest Service* (USFS), *Greenbrier River Watershed Association* (GRWA), and the Greenbrier Episcopal School to plan and administer a river snorkeling event on the Greenbrier River in Ronceverte. This event hosted seventh and eighth graders in an interactive learning experience like none other. The "immersive" learning environment in a river succeeded in engaging the kids to learn about water quality issues and ways they can promote healthy watersheds.

Stormwater Specialist (SWS)

The implementation of adequate stormwater management practices reduces the amount of pollutants entering our waters and decreases peak flows during rain events. The SWS promotes Low Impact Development (LID) and the implementation of BMPs to reduce runoff and treat stormwater that does enter our streams. The position is funded through the *Chesapeake Bay Regulatory and Accountability Program* (CBRAP) and focuses on developed areas within the CB watershed. Working with both regulated and unregulated programs and projects, the SWS provides technical and compliance assistance.

Planning and Implementation: The SWS assists local governments, NGOs, Home Owner Associations (HOAs), Professional Engineers (PEs), and interested parties with the adoption of LID concepts and the implementation of BMPs. Site specific guidance provides stormwater management options for numerous projects. The SWS represents West Virginia in the Urban Stormwater Workgroup and the Land Use Workgroup to guide implementation and reporting efforts within the CB watershed. The SWS inspects BMPs and administers the WV BMP and Land Use Change Tracking and Reporting database used to submit stormwater BMP data to the Chesapeake Bay Program through the *Environmental Information Exchange Network*.

Outreach and Education: The SWS presents at and attends numerous meetings and events to promote LID and BMPs. Presentations at local, regional, and national meetings deliver design and implementation methods and challenges. Site visits are frequently used as educational opportunities to inform people involved of not only potential solutions to site specific stormwater issues, but also general concepts that can be applied elsewhere.

§319 Program: The SWS works with various agencies and organizations on the development and implementation of BMPs. Considering the primary service area, and that §319 funding is limited and competitive, the SWS tries to use CBRAP and Chesapeake Bay Implementation Grant (CBIG) money for activities within the Chesapeake Bay watershed. The goals overlap well and the benefits to the streams are actualized regardless of the source for funding. In 2016 CBIG funded five swales and raingardens for businesses and sub-divisions, as well as urban canopy initiatives, primarily in Berkeley and Jefferson county (*photo-right*).

Installation of a Water Quality Swale at the Duffields train station parking lot in Jefferson County

Project WET

Seven *Project WET* educator workshops were held in Mercer, Cabell, Mineral, Taylor, Monongalia, and Kanawha counties in the spring and summer of 2016. 139 educators became certified in the WET curriculum. One *Wonder of Wetlands* workshop was held in Kanawha County at wetland outside of Charleston, WV; 25 teachers were certified. Also through the Project WET program 2,500 students attended *water festivals* in Putnam, Braxton, Wyoming, Ritchie, Roane, Kanawha, Cabell, Fayette, and Nicholas Counties. The Project WET position was vacant after July.

WV Save Our Streams

WV Save Our Streams (SOS) conducted ***17 monitoring*** workshops. Workshops were completed at Roane Jackson technical school, in partnership with numerous watershed groups, with NGOs and schools such as TMI, Elkins Middle, Montessori and more. SOS assumed the role of instructor bringing live specimens to various water festivals across the state. Outreach events include Trout Unlimited's (TU's) *Trout in the Classroom*, Seneca Discovery Day, *Envirothon*, *WV Science Teachers Association* (WVSTA), 13 water festivals, Wild School, five outdoor classrooms, Cheat Fest, HOBO deployment, Monongahela Forest snorkel event, and several wetland activities. Partnerships remain strong with TMI, TU, WVDNR, WVDEP's *WAB*, WVCA, academia and many more. SOS continues its role as instructor in WVDNR's Master Naturalist Program, Envirothon, WVSTA, and at the first West Virginia *CitSci* conference. The newest partnership formed is *Fishing Report WV* (FRWV). FRWV featured SOS in a recent *magazine article*; and SOS input was critical in the development of a new angler driven stream clean-up program. The program uses existing services from WVDEP's *Rehabilitation Environmental Action Plan Programs*, and leverages additional support from TU, businesses, anglers, watershed groups etc.

Facebook page

FODC watershed wall mural

Facebook is an online community that WIB uses to promote environmental projects, grants, events, awards, news, webinars, workshops and other learning and mentoring opportunities.

As of December 31, 2016, *WIB's Facebook* presence included 434 new members, a 41.7% increase, and 2,387 *Likes*. This is an 8.7% increase in the number of likes per post.

WV Conservation Agency

§319 and state match efforts

1. Assisted with streams monitoring on 49 stations in 43 streams.
2. Reviewed and/or provided advice with writing 6 sediment and erosion control plans.
3. Provided technical advice regarding stormwater management quality and/or quantity issues to five clients.
4. Provided three stormwater workshops across the state reaching 92 individuals. WVCA also provided educational information about state and federal programs to the Pocahontas County Water Well Clinic where 35 were in attendance.
5. Provided technical assistance to 22 agricultural producers with the development, protection, stabilization and/or maintenance of riparian areas or with resource management advice that protected surface waters reducing an estimated 9,314.36 tons of soil reduction on an estimated 26,873 linear ft. of stream.
6. Developed 16 conservation plans for farmers under Farm Bill Programs.
7. Provided 46 educational programs to schools, community groups, and others on nonpoint source and water quality issues reaching 3,111+ individuals.
8. Wrote, reviewed and/or revised 11 nutrient management plans managing 422,408 lb. Nitrogen and 182,508.4 lb. Phosphorus on 1,392.3 acres.
9. Provided project management for 12 §319 projects in 2016: Cherry Run, Sleepy Creek, Elk Run, Back Creek, Knapp Creek, Milligan Creek, Second Creek, Kitchen Creek, South Fork Potts Creek, Sewell Creek, Snake Run and White Sulphur Springs hatchery wetland.


Rain barrel workshop at Brookside Farms

Outreach

The *Watershed Resource Center* (WRC) continued its efforts toward providing training and information transfer on NPS pollutions and prevention throughout the state. A training workshop was held at the 2016 WV Construction & Design Exposition on Potential Pitfalls Associated with Oil & Gas in the Northwest Region of WV with 56 in attendance. An educational display was developed and exhibited with information on available programs and resources with over 500 visitors stopping in for information. WRC continues to expand its reach through social media, expanding the outcome of outreach events and attendance at events and trainings. *WRC* continues its support of the *West Virginia Watershed Network* (*WVWN*) through support of Watershed Celebration Day, *WVWN* web page, *WaterNet*, listserve and relevant announcements. The WRC is a committee member for the SPP, and the *Carla Hardy Project CommuniTree Program*. WVCA assisted with and organized seven agricultural education field days reaching 581 individuals throughout the state.

Appendix 4. Project status with financial information

FY12 §319 Funds	Available	Awards	Spent	Balance	Match	Spent	Type	Status
Base Program	**$642,891**							
WVDEP		$455,616	$337,120	$118,496	$303,744	$1,025,274	PRO	C
WVCA		$200,000	$200,000		$133,334	$133,334	PRO	C
FOLG demo rain garden		$15,000	$12,023	$2,977	$13,070	$13,064	AGO	C
FOC project recon and O&M plan		$20,000	$19,091	$909	$14,000		AGO	C
Piney Creek Pet waste stations		$3,000	$3,000			$1,421	AGO	C
FOC project implementation guide		$12,500	$11,987	$513	$8,350		PLA	C
Davis Creek HOBO monitoring		$3,124	$3,124		$1,265		AGO	C
Elk CD stream restoration and workshop		$359	$359		$17,150	$239	AGO	C
FODC Clean Creeks Program		$17,000	$17,000		$19,719		AGO	C
GRWA Fish Hatchery SW Wetland		$20,000	$20,000		$13,333	$13,334	AGO	C
FOC Sustainability - education		$20,000	$19,994		$43,340	$26,636	AGO	C
Incremental Program	**$1,084,109**							
James River agriculture BMPs		$214,841	$214,841		$226,176	$143,352	PRJ	C
Kitchen Creek III		$70,517	$24,795	$45,722	$44,012	$16,390	PRJ	C
Milligan Creek agriculture BMPs		$123,060	$123,060		$82,040	$82,040	PRJ	C
Upper Elk NSCD design		$21,000	$21,000		$14,000		PLA	C
Fayette Square stormwater		$131,420	$120,051	$11,369	$56,066	$54,613	PRJ	C
Roaring Creek Mars Portal Kittle HW AMD		$43,967	$43,967		$126,121		PRJ	C
Lick Run Watershed Based Plan		$15,090	$15,077	$13	$11,983	$10,894	PRJ	C
Knapp Creek Restoration and Monitoring		$100,000	$100,000		$66,668	$71,812	PRJ	C
West Run AMD Remediation WVU		$145,214	$145,214				PRJ	C
Swamp Run - Left Fork Buckhannon		$219,000	$219,000		$357,193		PRJ	C
Total	**$1,727,000**	**$1,084,109**	**$1,670,703**		**$1,194,371**	**$379,101**	**21**	
FY13 §319 Funds	**Available**	**Awards**	**Spent**	**Balance**	**Match**	**Spent**	**Type**	
Base Program	**$594,184**							
WVDEP		$405,853	$279,458	$126,395	$281,999	$2,275,782	PRO	A
WVCA		$190,000	$150,000	$40,000	$133,334	$138,492	PRO	A
Watershed Plan Tracking EPA in-kind		$10,000		$10,000	$6,667			C
Beaver Creek Big Bear Re-engineering		$58,250	$58,250		$40,302		PLA	C
The Mountain Institute		$20,000	$17,293	$2,707	$13,336	$10,322	AGO	C
Morris Creek Stream Monitoring		$4,000	$4,000		$4,854	$4,854	AGO	C
Friends of Hughes River Monitoring		$3,700	$3,657	$43	$4,969	$1,776	AGO	C
Helios Park, Richwood, NRGA		$37,018	$37,018		$26,150		AGO	C
Rain barrels		$4,508		$4,508			OTH	A
Incremental Program	**$1,042,816**							
Sleepy Creek Phase 2		$70,200	$70,200		$43,000	$47,483	PRJ	C
Knapp Creek		$162,662	$33,216	$129,446	$107,334	$65,371	PRJ	A
Second Creek Karst		$120,500	$120,500		$89,500	$80,344	PRJ	C
Upper Muddy Creek Phase 2.1		$222,709	$222,709		$148,473		PRJ	C
Roaring Creek Portal 5		$2,427	$0	$2,427	$99,562		PRJ	A
Ingrand Mine & VH #3		$284,585	$284,412	$173	$187,000		PRJ	C
Summerlee Phase 1.2		$29,733	$29,733		$66,120	$63,933	PRJ	C
Swamp Run - Left Fork Buckhannon					$357,193		PRJ	A
Snake Run - pending EPA approval		$150,000	$1,538	$148,462	$107,500	$1,029	PRJ	A
		$1,042,816	$762,309	$280,507				
Total	**$1,637,000**		**$1,311,985**		**$1,717,293**	**$258,160**	**17**	
FY14 §319 Funds	**Available**	**Awards**	**Spent**	**Balance**	**Match**	**Spent**	**Type**	
NPS Program	**$747,223**							
WVDEP		$483,811	$322,989	$160,822		$2,207,719	PRO	A
WVCA		$200,000	$114,664	$85,336	$70,666	$55,582	PRO	A
Watershed Plan Tracking EPA in-kind		$10,000	$10,000				PLA	C
WVRC monitoring AGO		$20,000	$20,000			$23,093	AGO	C

Latta's Stormwater		$34,600	$34,600			$20,292	AGO	**C**
Stream restoration monitoring - CVI		$20,000		$20,000			AGO	A
App WS stream monitoring - Mt. Inst.		$20,000		$20,000			AGO	A
FOB restoration planning		$10,000	$10,000			$11,653	AGO	C
WVRC WQ monitoring		$20,000	$20,000		$13,854	$18,869	AGO	C
Source Water Planning - Fayette County		$10,000	$4,000	$6,000			AGO	A
Lamberts Run WBP		$56,043	$14,782	$41,261	$42,192		PLA	A
WCD - WVCA		$1,500		$1,500			WCD	A
TMI Experienced Learning		$20,000		$20,000	$13,336		AGO	A
Watershed Project	**$1,002,899**							
Sovern England AMD - FOC		$252,368	$27,642	$224,726	$170,656		PRJ	A
Greens Run Railroad Refuse		$105,000	$98,485	$6,515			PRJ	A
Kanes Creek South Upgrade		$112,750	$18,140	$94,610	$74,200		PRJ	A
Revitalization of Valley Point 12		$163,100	$55,430	$107,670	$107,800		PRJ	A
Sleepy Creek - Phase 3		$74,600	$19,063	$55,537	$50,000	$8,617	PRJ	A
Milligan Cree /Davis Springs 2		$150,000	$150,000		$99,755	$90,991	PRJ	C
Finley Run - FOB		$64,000	$5,402	$58,598	$43,000		PRJ	A
Sewell Creek Septics - WVCA		$53,100	$13,584	$39,516	$35,401	$11,035	PRJ	A
Total	**$1,750,122**	**$974,918**	**$925,196**		**$729,128**		**21**	
FY14 Stream Restoration Funds	**Request**	**Spent**	**Balance**	**Match**			**Type**	
Muddy Creek Schwab 2.1 - 319 match	$57,605	$57,511		$317,327			PRJ	C
Beaver Creek Reengineering - 319 match	$40,302	$40,302		$58,250			PRJ	C
Winding Gulf Stream Restoration CVI	$35,132	$19,301	$15,831				PRJ	A
Total	**$133,039**						**3**	
FY15 §319 Funds	**Available**	**Awards**	**Spent**	**Balance**	**Match**	**Spent**	**Type**	
NPS Program	**$619,631**							
WVDEP		$278,986	$278,986		$242,799	$4,735,254	PRO	C
WVCA		$116,000	$72,847	$43,153	$77,334		PRO	A
FOC Big Sandy WS planning		$84,000	$27,048	$56,952	$56,500		PLA	A
Opequon Creek Tree Maintenance		$3,000	$3,000				AGO	C
FODC Clean Creek Program		$12,000	$9,306	$2,694			AGO	A
WVRC Source Water Protection Planning		$15,000	$15,000			$10,432	AGO	C
Hursher's Run Monitoring - Hughes River		$5,000	$332	$4,668			AGO	A
AMD and WW research - WVU		$18,000	$17,881	$119			AGO	C
FOH Source Water Monitoring		$20,000	$6,200	$13,800	$13,416		AGO	A
Piney Creek WSA Pet Waste Campaign		$4,000	$1,854	$2,146	$3,300		AGO	A
WVCA Back Creek Porous Pavers		$20,000		$20,000	$14,000		AGO	A
WVCA Anthony Creek stabilization		$20,000		$20,000	$13,334		AGO	A
Watershed Project	**$1,017,378**							
Tuscarora Creek Phase 2 - CVI		$56,523	$21,388	$35,135	$33,880		PRJ	A
Mill Creek Opequon Phase 2 - CVI		$161,801	$18,363	$143,438	$93,802	$5,377	PRJ	A
Morris Creek Upper Mainstem		$49,265	$48,664	$601	$50,670		PRJ	A
Pase Active Treatment - FOC		$101,387	$10,488	$90,899	$67,500		PRJ	A
Valley Highwall Upgrade - FODC		$170,500	$6,708	$163,792	$113,433		PRJ	A
Summerlee - Phase 2		$163,412	$163,412		$140,108		PRJ	A
YMCA land restoration - Piney Creek		$20,145	$7,764	$12,381	$13,800		PRJ	A
Elks Run Watershed Phase 2 - WVCA		$68,200	$1,685	$66,516	$45,780		PRJ	A
Herods Run, Buckhannon - WVU		$226,145	$68,522	$157,623	$162,010		PRJ	A
Total	**$1,637,009**	**$1,613,364**	**$779,446**		**$1,141,666**		**21**	
FY16 §319 Funds	**Available**	**Awards**	**Spent**	**Balance**	**Match**	**Spent**	**Type**	
NPS Program	**$643,448**							
WVDEP		$420,448	$297,089	$123,359	$280,324		PRO	A
WVCA		$127,000	$11,183	$115,817	$84,667	$133,976	PRO	A
Watershed Plan Tracking EPA in-kind		$10,000	$10,000		$6,667			A
NF Greens Run WBP - FY 15 carryover		$25,516	$1,768	$23,748	$17,000		PLA	A
Muddy Creek WBP - FY 15 carryover		$60,484	$2,669	$57,815	$40,400		PLA	A
Friends of Blackwater monitoring		$12,986		$12,986	$8,670		AGO	A

FODC clean creek program		$12,000	$2,262	$9,738	$8,018		AGO	A
FOC state of the watershed		$15,000		$15,000	$10,000		AGO	A
Goodnews Mtneer Garage rain gardens		$3,000	$2,066	$934	$4,300		AGO	A
WVRC volunteer monitoring		$18,000	$1,364	$16,636	$37,680		AGO	A
WVRC Source Water Community Engagement		$17,000		$17,000	$14,500		AGO	A
Watershed Projects	**$1,099,895**							
Browns Creek - Coal River		$126,000	$1,009	$124,991	$97,500		PRJ	A
Beaver Creek AMD - FOC		$175,100	$4,758	$170,342	$157,025		PRJ	A
Sandy Run Renovation - FODC		$223,500	$1,431	$222,069	$166,000		PRJ	A
Beckley Little League - PCWA		$54,291		$54,291	$36,195		PRJ	A
Second Creek WSA - WVCA		$127,600		$127,600	$85,568		PRJ	A
Back Creek - WVCA		$209,450		$209,450	$218,650		PRJ	A
Swamp Run #2 - WRI		$183,954	$5,050	$178,904	$100,000		PRJ	A
Total	**$1,743,343**	**$1,821,329**	**$340,649**		**$1,373,164**		PRJ	A

Legend

PRO	Program
PLA	Planning
PRJ	Project
AGO	Additional grant opportunity
	GRTS links
Status: A (active); C (complete)	

Appendix 5. Sovern Run story map

Treating Acid Mine Drainage in Sovern Run, West Virginia

Overview

A story map highlighting the successes of passive treatments for acid mine drainage in Sovern Run Watershed, West Virginia

by apruzins_EPA

Last Modified: November 14, 2016

Web Mapping Application

Sovern 62 includes a steel slag leachbed, open limestone channels and a series of settling ponds, including a final wetland polishing pond. The steel slag and leachbeds add alkalinity to neutralize pH, the limestone channels encourage oxidation, and the ponds and wetland capture metal precipitates. This photo shows the constructed wetland.

Acid mine drainage (AMD) from abandoned coal mines impaired West Virginia's Sovern Run. Thus, WVDEP added the 4.7-mile-long stream to its Clean Water Act section 303(d) list of impaired waters in 1998. Project partners have installed numerous passive AMD treatment systems, which have significantly reduced the metals and acidity loadings into Sovern Run. This story map highlights the major successes of the Sovern Run project. For more detailed information on this project *Click-Here*.

Note: The story board will be published online soon. USEPA thanks *WVDEP* and *FOC* for providing data, photographs, information, support for this project, and most of all for working to restore Sovern Run Watershed and beyond.

Appendix 6. Management plan updates – pollutant reduction

Clean Water Act §319 guidelines require that all State NPS Programs revise their management plans (MP). West Virginia's NPS revised MP was approved in September of 2014, one of the first to be approved in the Mid-Atlantic region. The MP includes short-term (annual) and long-term (5-10-15 years), objectives, and strategies to protect and restore water quality, strengthen partnerships, and establish a balanced approach that emphasizes statewide and watershed restoration opportunities. *Table 13* below shows the pollution reduction progress after two-years. West Virginia's NPS Program partners have exceeded the nutrients and sediment 5-year target goals. This is largely due to WVCA's statewide agricultural enhancement programs.

***Table 13**. Long-term pollutant reduction progress*

Pollutant	Unit	Totals	Target load reductions			Progress
			5-year	10-year	15-year	
Acidity	tons/yr	258	300	600	900	86.0%
Aluminum	lbs/yr	29,961	37,800	75,600	113,400	79.3%
Iron	lbs/yr	121,168	95,200	190,400	285,600	> 5yr
Manganese	lbs/yr	565	7,000	14,000	21,000	8.1%
Total metals	lbs/yr	151,684	140,000	280,000	420,000	> 5yr
Nitrogen	lbs/yr	1,251,701	280,000	560,000	840,000	> 15yr
Phosphorus	lbs/yr	726,075	220,000	440,000	660,000	> 15yr
Total nutrients	lbs/yr	1,977,776	500,000	1,000,000	1,500,000	> 15yr
Sediment	tons/yr	19,165	6,000	12,000	18,000	> 15yr
Fecal coliform	cfu	1.58E+14	1.70E+15	3.30E+15	5.00E+15	9.3%

Totals = (2015 + 2016)

Note: Per 6.2.d of 47CSR2 (Requirements Governing Water Quality Standards) the Manganese criteria shall only apply within 5-miles immediately upstream of known water supplies used for human consumption. In many cases this rule eliminates the need for Manganese reductions because there are no public or private water supplies within 5-miles of NPS projects.

Note: The target loads were determined by evaluating past performance, and projecting realistically into the future.

Appendix 7. Statewide water quality summary

Introduction

The goal of WVDEP's probabilistic monitoring program is to provide statistically unbiased estimates of stream condition throughout a region (i.e., watershed, ecoregion or state) without assessing every stream mile in that region. This summary provides an analyses water quality data collected from 313 sites, from 2010 – 2015.

The target population for these efforts was small to medium sized (*1st - 4th order*) wadeable streams. Ninety-eight percent of West Virginia's stream miles are of this size class and approximately 70% of these are wadeable. The design used for this summary allows DEP to characterize overall water quality conditions at an ecoregion scale (*Figure 1*), basin scale (*Figure 2*), and statewide. The major basins are groups of four to six 8-digit HUC watersheds that provide data sufficient to develop estimates of condition with small confidence boundaries.

Figure 6. West Virginia Ecoregions

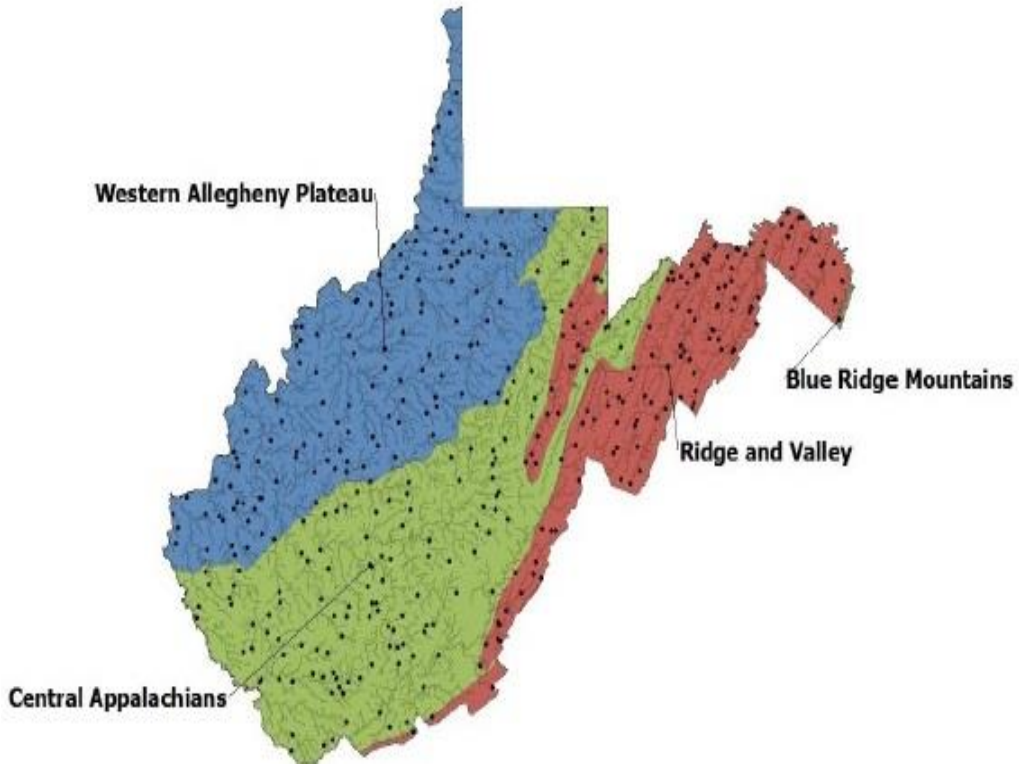
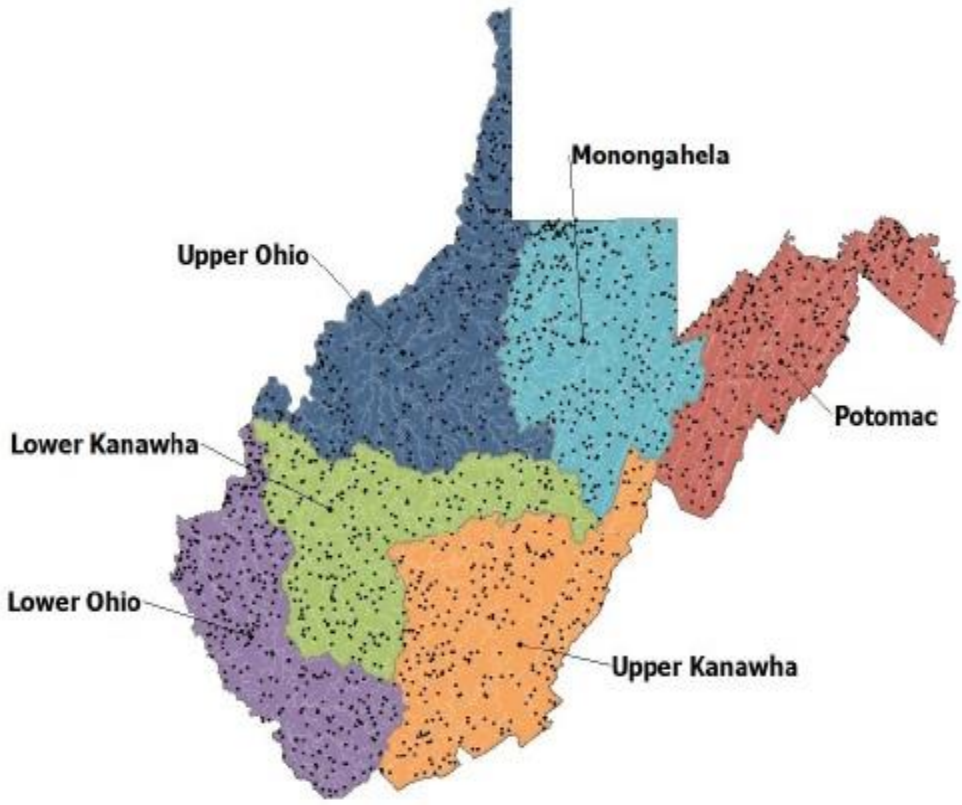


Table 14. WQ indicator categories

Biological	**Habatat**
Genus level macro-invertebrate IBI	*Overall habitat condition*
Water quality	
Conductance	*Acidity*
Sulfate	*Phosphorus*
Bacteria	

The selected sites are assessed using three broad categories of aquatic integrity indicators: biological community quality; water quality; and habitat quality. From these, several individual indicators (*Table 1)* were chosen to help illustrate the condition of West Virginia's rivers and streams. They are presented for statewide, the ecoregions and six basins.

Figure 7. West Virginia major basins



Biological conditions

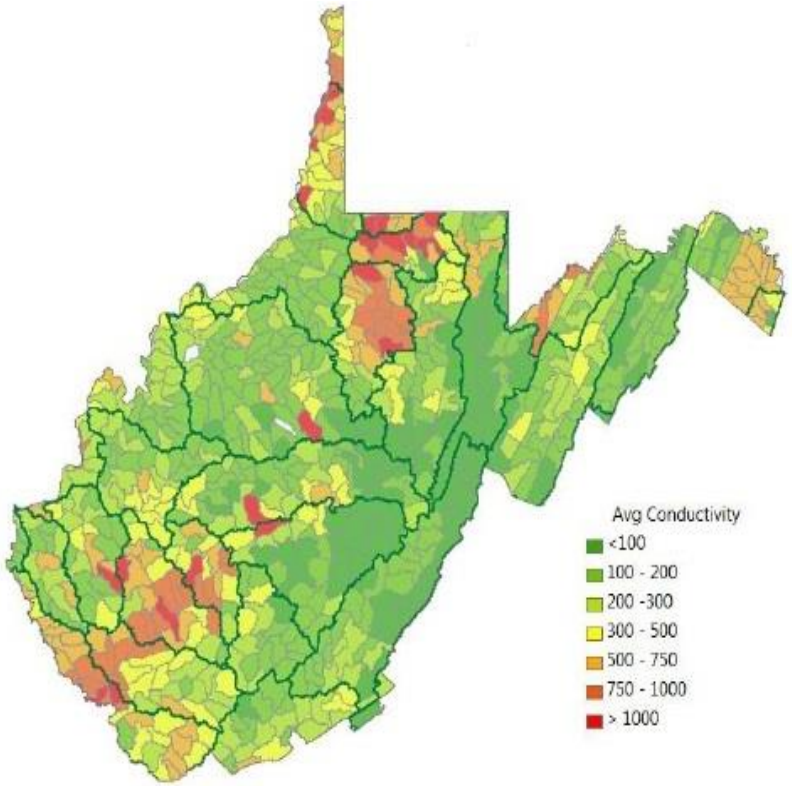
These organisms provide reliable information on water and habitat quality in streams and have been used as indicators all over the world for nearly 100 years. They are extremely diverse and exhibit a wide range of tolerances to pollutants. Furthermore, they serve as an excellent tool for measuring overall ecological health, especially when summarized into a single index of biological integrity.

Based on the data utilized in this summary and a comparison reference conditions, 64.3%of wadeable stream miles have scores equal to or above an acceptable threshold (i.e., generally in good biological condition) statewide. Ridge and Valley has the highest percentage of streams with healthy aquatic ecosystems, with 82.4%. The Western Allegheny Plateau ecoregion scores lowest with an estimated 55.8% of stream miles comparable to reference. The percent of stream miles in the Central Appalachians scoring above the acceptable threshold is estimated to be 63.3%. Among basins, the Upper Kanawha had the highest percent of streams miles (70.8) above the reference threshold, while the Lower Ohio had the fewest (45.7).

Conductivity

Conductivity, or specific conductance, is a measure of how well water conducts electricity which is determined by what and how much is dissolved in the water. In certain areas, conductivity is naturally elevated because of calcium and other minerals dissolved from limestone and other soluble rocks. In others, it is high because of added pollution from a variety of sources.

Figure 8. Average conductance by basins



In general, West Virginia streams have relatively low conductivity – with 80% of wadeable stream miles statewide having late spring /early summer levels below 300 uS/cm. Conductance was variable throughout the ecoregions, with the high conductance streams often associated with coal mining. The map in *Figure 3* shows average specific conductivity by 12-digit HUC watersheds using all available data (not limited to probabilistic data). The higher conductivity values in the eastern panhandle is attributable to the limestone geology of the area.

Sulfate

Streams receiving mine drainage may be impaired by low pH and/or elevated concentrations of metals, including iron, aluminum, and manganese. Other dissolved ions such as sulfate may also be present in concentrations above background levels. A sulfate concentration greater than 50 mg/L was used to identify probabilistic sites influenced by mine drainage. Following this guideline, approximately 18.5% of the stream miles statewide are influenced by mine drainage; observed on an ecoregional basis, mine drainage influences a greater proportion of stream miles in the coal rich Central Appalachians (30.5%).

Bacteria

Many West Virginia streams contain elevated levels of fecal coliform bacteria. Contributors to the problem include leaking or overflowing sewage collection systems, illegal homeowner sewage discharges by straight pipes or failing septic systems, and runoff from urban or residential areas and agricultural lands. Based on probabilistic data, 14.0% of stream miles in the state have fecal coliform bacteria levels that exceed the criterion of 400 colonies/100mL.

The proportions of stream miles exceeding the criterion were considerably lower in the Central Appalachians at 7.7% and Ridge and Valley Ecoregions at 5.7%. It should be noted that DEP's probabilistic monitoring is performed at baseflow conditions. Because samples are not collected during storm runoff events, bacteria levels that may increase under these higher flow conditions are not represented in the results. The Upper Ohio and Lower Ohio basins had the highest percent of stream miles exceeding the bacteria criterion with 22.9% and 20.3%, respectively.

Acidity

Aquatic life communities in the headwater sections of many West Virginia streams continue to be impacted by low pH, and thus, acidic water quality. The impairment is most prevalent in watersheds with soils of low buffering capacity and most often caused by acid precipitation and less often (but potentially more severely) by acid mine

drainage. An evaluation of data indicates that approximately 7.9% of the stream miles in the state have pH values below 6.0. Most of the stream miles identified as impacted by acidic waters are in the Central Appalachians Ecoregion,

Phosphorus

A large proportion of total phosphorus (TP) from our probabilistic efforts have results that are below quantifiable reporting limits of the analytical labs. With nutrients considered one of the country's most widespread pollutants, having so many results below detectable levels are overall a good thing. From the data, we know that the Western Allegheny Plateau has the highest percentage of stream miles with TP greater than 50 ug/L (7.3%) as well as the lowest percentage of stream miles with TP below the lowest detection level (33.1%) and that approximately two thirds of stream miles in the Upper Kanawha basin have TP below the lowest detection limit of 10 ug/L.

Habitat conditions

For the habitat evaluation, select conditions from EPA's Rapid Bioassessment Protocol (RBP) were measured. These include sedimentation, embeddedness, riparian zone and bank conditions. The complete RBP protocol consists of 10 qualitative habitat conditions scored (0-20). These are combined to determine an overall condition, and rated as good, moderate or poor. Based on the data, just 9.9% of stream miles statewide have good habitat quality, 73.5% of stream miles have moderate habitat quality, and 16.6% of stream miles have poor habitat quality. While these categorical thresholds are somewhat arbitrary, they do provide a good comparison of habitat conditions between geographic areas.

On an ecoregional basis, the Ridge and Valley had the highest proportion of stream miles rated in the good category for overall habitat quality at 19.9%. Additionally, this ecoregion had the least number of stream miles rated as poor for overall habitat quality. Total habitat quality scores are lower in the Western Allegheny Plateau. The presence of more widespread development and factors such as higher rates of soil erosion in this ecoregion are potential causes. Additionally, the percentage of stream miles with poor habitat quality (28.4%) is substantially higher in this ecoregion. The Upper Kanawha basin stands out as having the highest percentage of stream miles (35.1%) with good overall habitat. This basin includes large portions of the Monongahela National Forest and several undisturbed wilderness areas. The Upper and Lower Ohio basins have almost no miles in good condition and over a quarter of their stream miles in poor condition.

It is important to consider that approximately 90% of stream miles in the state are in the moderate or poor habitat categories. This indicates that most of the state's stream miles have at least some degree of habitat degradation.

For more details go to: *http://www.dep.wv.gov/WWE/getinvolved/sos/Pages/wqstatewide.aspx*

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West Virginia Department of Environmental Protection
Watershed Improvement Branch
Nonpoint Source Program

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