WATERSHED REPORTS

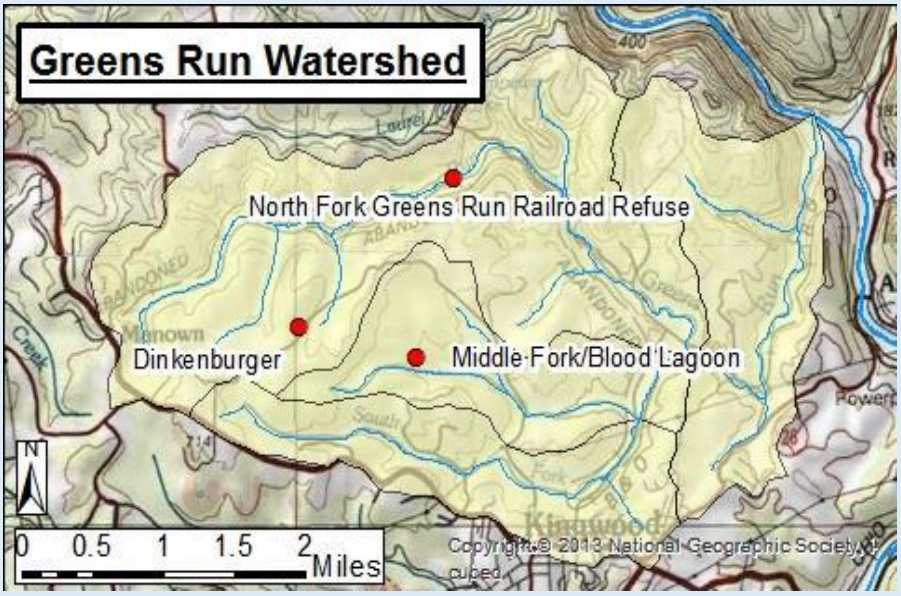
This section provides updates on WBP progress. Highlights includes AMD remediation efforts in the Greens Run and Lambert Run watersheds, agricultural BMPs targeting bacteria reductions in Milligan Creek, NWQI and other agricultural BMPs to reduce bacteria in Knapp Creek, and an update on Back Creek, our active Watershed Protection Plan (WPP).

For additional project information search EPAs Grant Records Tracking System (GRTS) public access portal (Note: These records will be up-to-date by the end of July 2018), the NPS project highlight section at the link below; and, look for a future success story from the Tuscarora Creek watershed – coming soon.

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

Watershed description

The Greens Run subwatershed, located in the lower Cheat River watershed, is comprised of three main forks: The North Fork, the Middle Fork, and the South Fork. The South Fork and Middle Fork of Greens Run are severely impacted by AMD. The North Fork is also impaired by AMD. Multiple AMD treatment projects implemented by FOC have improved water quality. A WBP is now being developed for the North Fork (NF). It is expected to be completed by late 2018 early 2019.



Goals

The most recent TMDL for the entire Greens Run watershed lists allowable loads of 8,154 lbs/yr of aluminum and 57,093 lbs/yr of iron. The goal is of the NF Greens Run WBP is to design and construct enough passive treatment systems that will discharge neutral pH water and reduce toxic metal concentrations at or below WQ-standards.

Ultimately the watershed will improve to the point where re-colonization by fish and aquatic invertebrates is possible.

Partnerships

Local landowners are key to the success of FOC's efforts. Much of the problem areas are on private property, which makes access challenging at times. Thus far FOC has been successful, with only minor set-backs, working with and satisfying the needs of landowners. The primary funding resources for most of these projects have been provided by §319 and WCAP, so OSM and WVDEP are important partners and play a role in oversight, as well as technical and financial assistance.

WVDEP's Abandoned Mine Lands (AML) provided funding the earlier years through their stream restoration fund (SRF) program. SRF was monies collected in part through bonds and enforcement activities. This funding source is no longer available. AML also completed land reclamation projects at many sites, thus stabilizing the site making it more suitable for passive treatment projects.

Project highlights

All projects in the watershed were passive and somewhat similar in design with limestone channels, leachbeds and constructed wetlands. The variables were site specific and in many cases the site

lacked adequate space to build large treatment systems. Another hurdle was the limited funding available, thus projects were complete in phases and often the life of the project from start to finish was greater than eight years. The exception was the most recent project. Three projects have been completed in the watershed. Summary construction cost, descriptions and results are provided below.

Blood Lagoon			**Dinkenburger**		**Railroad Refuse**
1995	2002	2007	2003	2011	2015
$250k	$62.8k	$224k	(unknown)	$113.6k	$271.5k
Very little improvement in pH but metals (**Al** and **Fe**) decreased by 11.7 and 15.3% to concentrations of < 1 mg/L.			Very little pH improvements but metals (**Al** and **Fe**) were reduced 69 and 96% but average metal concentrations are > 7 mg/L.		pH improved from 3 to > 7. Metals (**Al** and **Fe**) decreased nearly 98% and their average concentration is 3 mg/L.

Recent WQ analysis at the mouth of Greens Run continue to show low pH with an increasing trend in metal loadings.

Blood Lagoon: In 1995 anoxic limestone drains (ALDs) were installed to treat AMD at the seep; these clogged in one-year. In 2002 a steel slag pond was added but filled with sludge within five-years. Additional components such as leachbeds and setting ponds were added and the system is operational.

Dinkenburger: FOC added a small dike to improve the portal that AML added during a previous landscape restoration. The portal discharges into a leachbed and limestone channel. A large 2005 storm caused damage and clogged the system, which was improved in 2011. It is performing as expected.

Railroad Refuse: Site was reclaimed by AML in 2003. FOC recently added limestone and oxidation channels, auto-flushing leachbed, settling ponds and a constructed wetland. The system is performing much better than anticipated.

The most recent WQ results (system out) for all three projects are provided below:

Project sites	pH	Acid load lbs/day	Al load lbs/day	Fe load lbs/day
Blood Lagoon WQ: 09/2017	2.7	59.7	4.4	5.8
Dinkenburger WQ: 06/2017	3.0	15.6	1.7	0.43
Railroad Refuse WQ: 06/2018	7.9	-4.3	0	0.01

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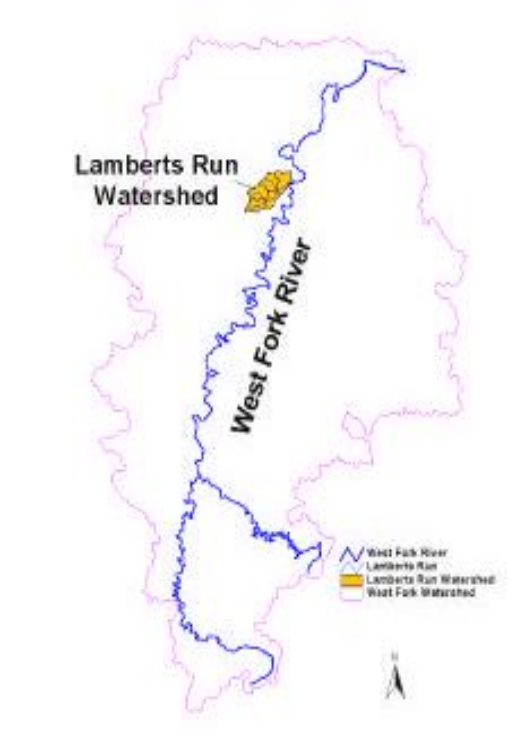
Watershed description



Lambert Run is a small tributary to the West Fork River north of (downstream from) Clarksburg, WV. It drains an eight square-mile, mostly forested watershed in Harrison County. For decades, its water ran muddy red with iron from abandoned coal mines. In 2004, WVDEP, West Virginia University (WVU), and the GWF prepared a watershed based plan (WBP) for Lambert Run. The WBP identified nine sources of mine drainage and calculated that if the pollution from most of them were eliminated, Lambert Run would look better and would meet water quality standards for iron, aluminum, and manganese.

The WBP was based on the TMDL analysis for the West Fork River from 2002, which broke the Lambert Run watershed into five subwatersheds, and set goals for reducing the pollution loads in each of them.

Goals

The WBP found sources of pollution that far exceeded the amount of pollution that had to be eliminated to make the streams meet standards, except for subwatershed 1901. This SWS is the farthest downstream, and is immediately downstream from SWS 1902, where site #7 adds 70% of the iron pollution for the entire watershed. If there were sources of pollution to be found there, they would become clear once the other sites were addressed.

Partnerships/funding

Projects were funded through CWA's §319 funds through WVDEP's WIB, matched with funds from OSM's WCAP. In some cases, WVDEP paid additional funds. One project was funded as a compensatory mitigation project. A citizens' group, GWF, contributed many hours of labor developing and overseeing each of the projects.

Site	FY	§319	Match	Matching source
3	2004	$106,654	$78,489	OSM
5	2004	$146,334	$97,614	OSM
8	2004	$142,024	$99,159	OSM
9	2004	$233,043	$425,703	Mitigation agreement
6	2009	$149,721	$100,000	OSM
7	2011	$384,376	$256,622	State funds, OSM

Partners for the project included WVU, NMLRC, OSM-WCAP, WVDEP, through its Stream Restoration Program, GWF and a compensatory mitigation agreement with High Tech Corridor Development, LLC.

Project highlights

Sub-watershed (SWS)	1901	Site	1902	Site	1903	Site	1904	Site	1905
Fe reduction needed (lbs/yr)	8,900		1,400		7,300		2,000		2,500
Project loads (lbs/yr)		#7	303,400	#5	17,700	#8	8,440	#1	8,400
				#6	23,000	#9	69,000	#2	8,500
								#3	1,400
Totals			**-302,000**		**-33,400**		**-75,440**		**-15,800**

Site #4 produces visible acid mine drainage, but its load could not be measured because it often dries out.

The table above provides a snapshot of the iron load reductions. Although it appears reductions are much greater than TMDL allocations, there is still more work to do. Further analysis of the biological response and additional WQ sampling is planned for the near future. Expectations are high because the results from recent measurements throughout the watershed are at or near WQ standards.

Mouth of Lambert Run 2007

Mouth of Lambert Run 2016

Site #7, by far the largest source of pollution, was completed late in 2015. The partners overcame many obstacles to complete the project, including several weeks of heavy rain and inaccurate utility surveys. The project relies on wetland plants to remove iron from the water, and those plants are growing. During the summer, the system has removed up to 95% of the iron it has received. During the dormant season, it has performed less well. If continued plant growth does not improve its winter performance, additional measures will be taken.

Note: The mouth of Lambert Run now runs clear.

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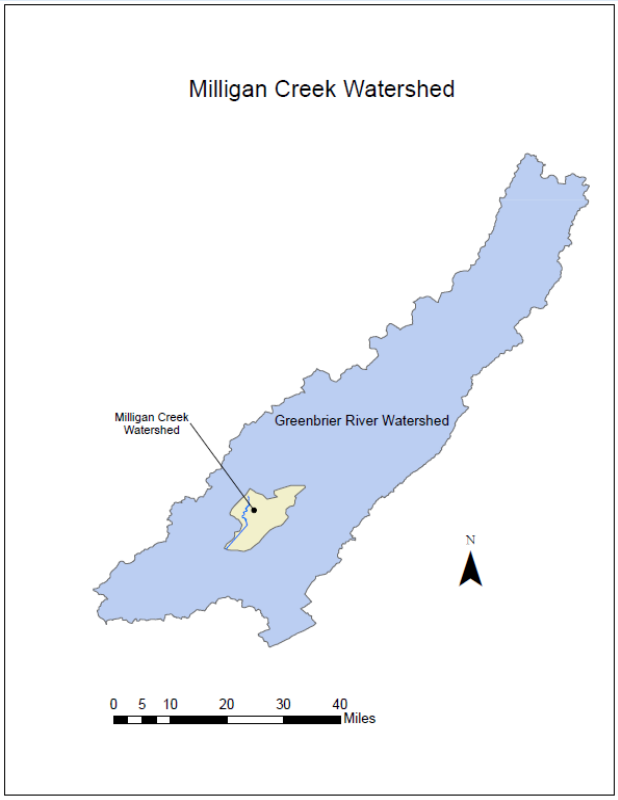
The Lambert Run WBP is currently under revision with an expected completion date of fall or winter 2018. For more information contact: Melissa.O'Neal@mail.wvu.edu.

Watershed description



The Milligan Creek Watershed lies within the Greenbrier River Watershed of Greenbrier County, West Virginia. The watershed is 12 miles long with a combination of surface water flow and karst ground water flow throughout the watershed. This area consists mostly of grassland pasture used for livestock production.

Milligan Creek was placed on the 303(d) list in 1996 due to fecal coliform bacteria contamination due to undetermined sources. A TMDL was developed for the creek in 2008, which allocated fecal coliform loads to agricultural land uses, and recommended reductions in fecal coliform loading.

Goals

The goal for the WBP is a reduction in bacteria loads from agriculture by excluding livestock access to streams, installing alternative livestock grazing and watering systems, and protecting riparian areas.

To meet reductions, specific farms will be targeted to exclude livestock from the waterways both directly adjacent to the stream and from karst influences.

Partnerships

WVCA was the local contact and contact manager. The other partners work together to conduct education and outreach and provide technical and financial assistance to the public and landowners in the watershed.

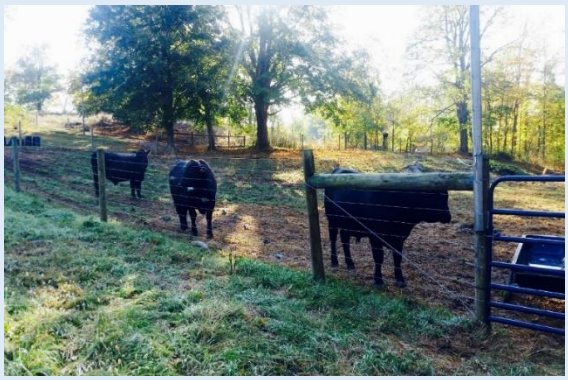
1. Greenbrier Valley Conservation District
2. WVU Extension Service
3. Natural Resources Conservation Service
4. Farm Service Agency
5. U.S. Fish and Wildlife Service
6. Trout Unlimited
7. West Virginia Department of Environmental Protection
8. Greenbrier River Watershed Association

Project highlights

Four projects have been completed resulting in BMPs implementation on 15 different farms. Landowners have very been cooperative; neighbors talking to neighbors have been the most effective outreach tool. A summary of the BMP implementation is provided below.

Milligan Creek SWS	BEST MANAGEMENT PRACTICES								Resutls	
	Pipeline (Ft)	Alt Water	Pumping Plant	Exclusion Fence (Ft)	Division Fence (Ft)	Heavy Use Protection	Nutrient Mgt Plan (Ac)	Grazing Plan (Ac)	AU	Bacteria LRs
2275				6,480					100	8.71E+11
2273	50	1		300			17	17	40	3.48E+11
2272	1,325	1		3,985			96	96	65	5.66E+11
2271	200	2		3,000					65	5.66E+11
2273	300	2		1,000					100	8.71E+11
2272	114				1,889				20	1.74E+11
2272	913	4		307					65	5.66E+11
2275	8,414	12		4,283	17,078				200	1.74E+12
2272	1,007	1		1,340	233				15	1.31E+11
2272	5,467	13	2	5,840					900	7.84E+12
2272	586	1		2,514	3,329		151		120	1.05E+12
2271		1	1	2,847			113	113	61	5.31E+11
2273		5				5	163	163	440	3.83E+12
2273	100	2	2	408	12,696	1	328	328	37	3.22E+11
2273	1,428	6	1	2,818	11,518		205	205	45	3.92E+11
	19,904	**51**	**6**	**28,642**	**46,743**	**6**	**1,073**	**922**	**2,173**	**1.89E+13**

Alt water: Troughs, springs, tanks, ponds and wells



Livestock in a rotational grazing system eyeing up fresh pasture.

Pipeline being installed on grade along Milligan Creek in the Bungers Mill area.

Project cost summary

FY	§319	Match
2010	33k	22k
2012	123k	82k
2013	53k	33.3k
2014	150k	99.8k
Totals	**359k**	**237.1k**

Contacts

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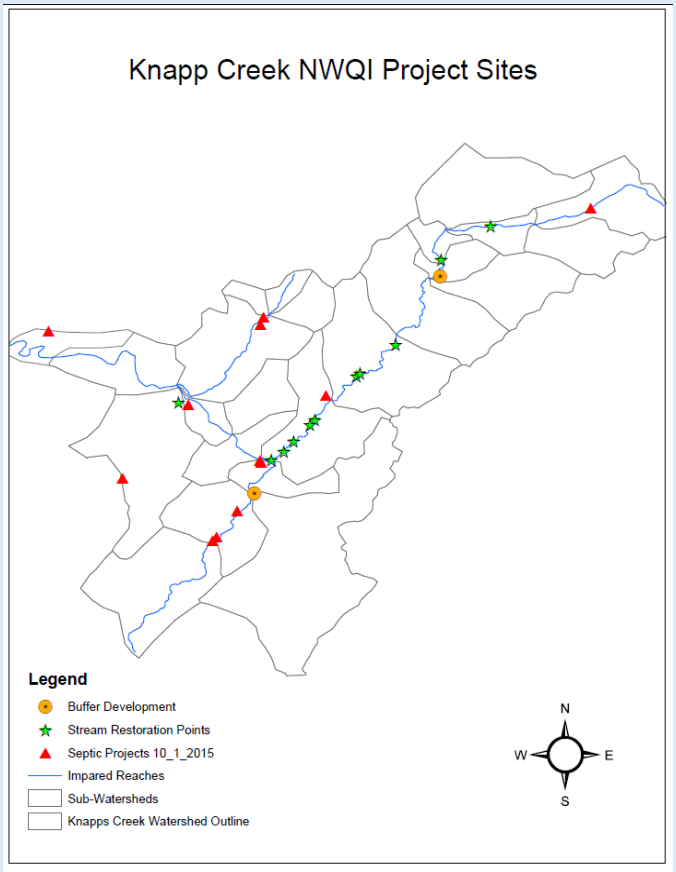
Watershed description



The Knapp Creek Watershed lies within the Greenbrier River Watershed of Pocahontas County, West Virginia. The watershed is 26.3 mile long beginning at Marlinton. This area consists mostly of grassland pasture used for beef cattle operations. There is little to no public sewer, requiring most of the homes in the area to utilize private septic systems. In this very rural community, most of the homes are older with less than adequate septic facilities.

Goals

The 2008 Greenbrier River TMDL identified bacteria as the major impairments in the basin. Past evaluations by NRCS and more recently WVCA, identified soil loss from farm lands as a significant nonpoint source contributor.

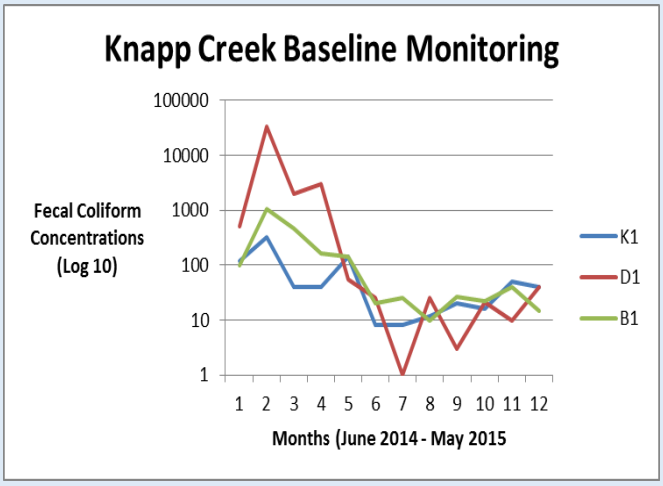
Partnerships

NRCS has been working to improve the area since 1999 after a management plan was developed in respond to flooding and other land use issues. The agency is now more focused partnering with WVDEP, WVCA and landowners to reduce nonpoint sources of pollution. Within the last several years NWQI funding has been important and has resulted in additional projects and has emphasized monitoring to better evaluate impacts. NWQI is no longer an option for this basin; however, work continues being funded with CWA §319, WVCA statewide Agricultural Enhancement programs, and USDA Farm Bill, and US Fish and wildlife Service programs.

Project highlights

Since the WBP approval in 2012, two §319 projects have been completed; prior to the WBP another §319 project focusing on stream restoration projects was completed. Since 2012 WVCA using §319 watershed funds and NRCS NWQI funding have completed restoration and extensive monitoring in the basin. A before and after photo of a natural stream restoration project reach is provided on the next page.

	Units	Types
Projects statistics	25	Septic system repaired/replaced/pumped
	13,042 feet	Restoration w/buffers, tree planting, fencing and crossings
	33 Acres	Buffer establishment



Thus far approximately 3.10E+12 cfu of fecal coliform bacteria and 1,745 tons/year of sediment have been reduced.

Using NWQI, volunteer and WVCA/WVDEP staff focused monitoring efforts were completed throughout the watershed. Monitoring results were inconclusive in some sub-watersheds. While there was no direct evidence that conservation practices are impacting fecal coliform bacteria levels, there is a consistent downward trend in the overall levels in all impaired streams.

Before

After

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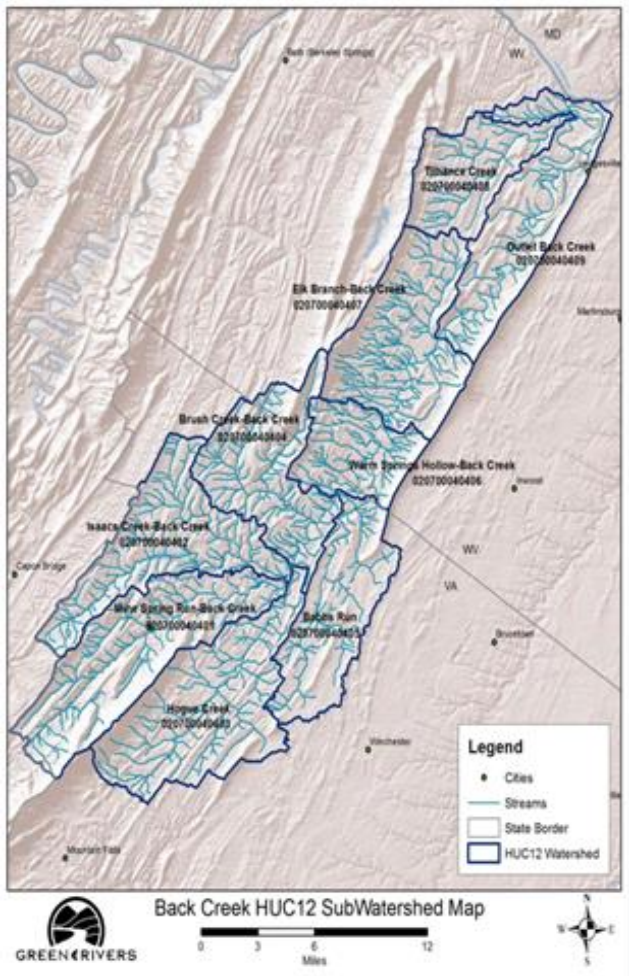
Project cost summary

FY	§319	Match
2012	100k	66.7k
2013	162.6k	107.3k
Totals	**262.6k**	**174k**

Watershed Description



Back Creek Watershed, of the Potomac Direct Drains watershed, flows in Berkeley and Morgan county West Virginia and Frederick County VA. It drains 274 square miles at the confluence with the Potomac River. The watershed is comprised of distinctive, high-quality, cold and warm water streams, and unique shale bedrock outcrop topography.

Back Creek is one of the few watersheds in the Eastern Panhandle that does not have water quality impairments on the WV 303(d) list of impaired waters. The watershed is described by WVDNR as a "High Quality Recreational Stream" for fishing, swimming, canoeing and kayaking. It is unique in its large areas of undeveloped and forested land. Rare, threatened, and endangered species have been documented in ecosystems throughout the WV portion of the watershed.

The WPP developed for Back Creek was approved by EPA in June, 2014.

Goals

To preserve water quality in the Back Creek Watershed through implementation of the Back Creek Watershed Protection Plan. For the stakeholders to become more familiar with the water quality issues within Back Creek. To enable financial and technical assistance to facilitate improvement strategies and restoration projects.

Partnership efforts

Blue Heron Environmental Network (BHEN) collects data to formally establish Back Creek as a Wild and Scenic River. They have also held Save Our Streams monitoring workshop, various trash cleanups, and quarterly meetings. Cooperative efforts WVCA, in partnership with the Eastern Panhandle Conservation District, WVDNR, WVDOF and WVDEP have helped move our project goals along.

Project highlights

Within the current grant we are working to promote land conservation through conservation easements on priority agricultural parcels, reduce erosion by 0.92 tons of sediment/year through restoration of 915 ft. of eroding streambanks, perform a dirt and gravel roads assessment, conduct water quality monitoring, and promote the protection plan with education and outreach.

There was approximately 1,100 sq. ft. of existing impervious pavement removed, and porous pavers installed at the public access. Articulated concrete block and gravel was purchased and filter fabric was donated by DNR. Filter fabric was laid where the impervious surface had been taken up. Then, 6 inches of state 57 gravel sub-base was laid and measured. The articulated concrete block paver units were then placed on the gravel and gravel was poured to fill the paver units. These porous pavers allow rain water to filter through rather than running off the surface. The pavers better manage stormwater compared to conventional pavement by stopping erosion and reducing sediment and other pollutants from being transported into Back Creek.

To assist with reducing erosion two Sycamore and two Silver Maple trees were planted around the access. To help educate the public, signage has been purchased and will be placed at the access in the Spring.

The following pollution reductions are estimated based on efficiencies assigned to Porous Pavement by the Chesapeake Bay model and baseline loads in Back Creek calculated by TetraTech.

		Estimated Reductions (lbs/acre)		
Practice	Size (acres)	Nitrogen	TSS	Phosphorous
Shanghai Porous Pavers	0.05	0.69	31.07	0.05

Current and future watershed projects will focus on riparian buffer conservation easements and natural stream restoration projects. One project is currently underway (FY16) and another phase (FY18) will begin soon.

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