FRIENDS OF
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Updates to
Watershed Based Plan

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WATERSHED DESCRIPTION

Deckers Creek flows approximately 24 miles through, and drains approximately 64 square miles (40,960 acres) in Preston and Monongalia counties West Virginia (Figure 1). The watershed contains 14 streams that are named on USGS 7.5' topographic maps, and a number of other unnamed or informally named tributaries (Figure 2). Types of nonpoint pollution in the Deckers Creek watershed include acid mine drainage (AMD), fecal coliform bacteria, sediment, and lead (Christ and Pavlick, 2006). Quantity and diversity of aquatic ecosystems (benthic macroinvertebrates and fish) match the pattern of degradation throughout the watershed and its tributaries. The West Virginia 303(d) list of impaired streams indicates degradation by acidity, metals, and fecal coliform bacteria. The emphasis of the updated WBP will be on acidity and metals related to resource extraction activities, with a summary of fecal coliform contamination. Further research will be required to quantify loads of fecal coliform, sediment, and lead, but each are discussed within the updated Watershed Based Plan (WBP). There are no official impairments for sediment; and WVDEP is currently conducting monitoring for a lead TMDL.

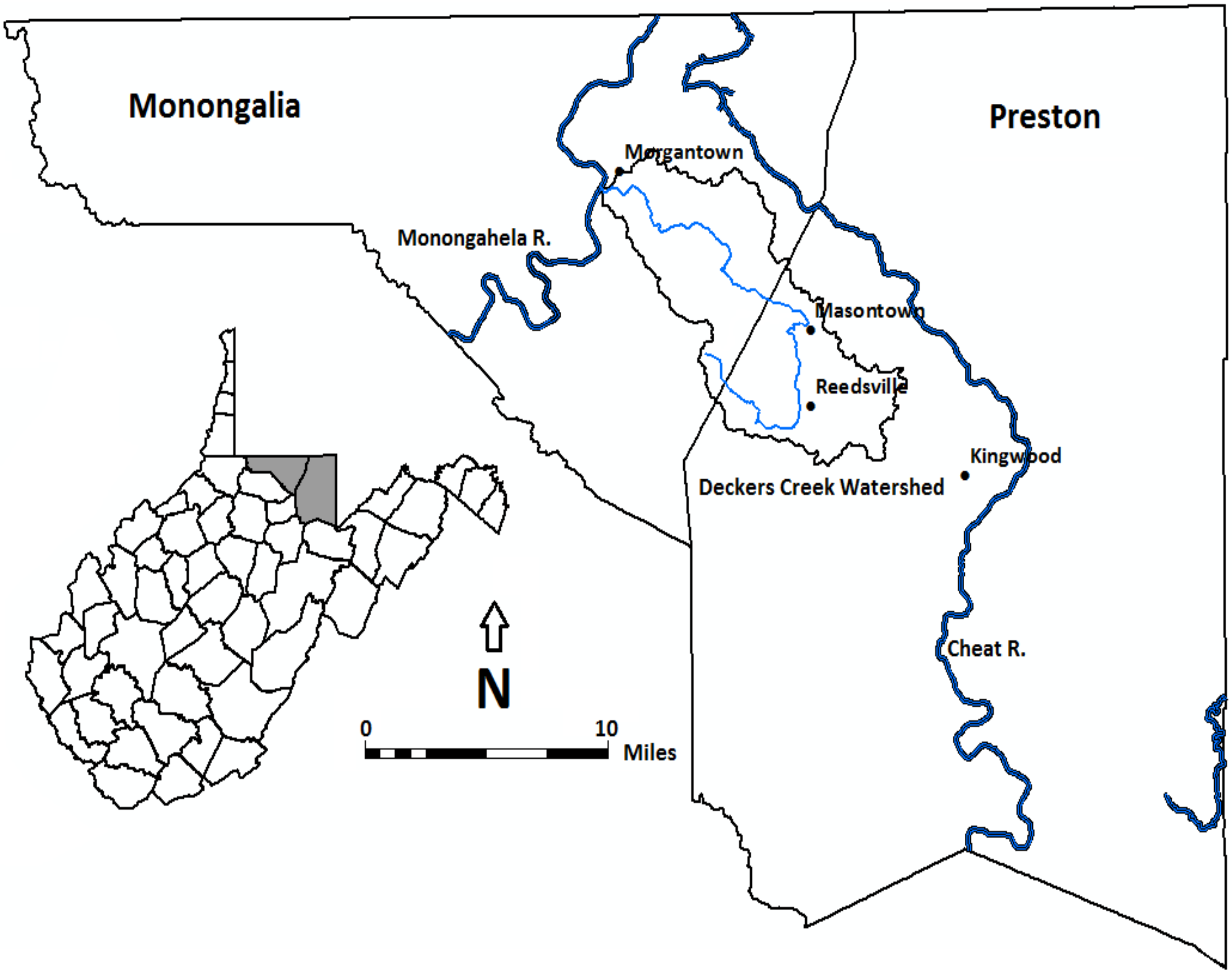


Figure 1: Location of the Deckers Creek watershed, discharging into the Monongahela River.

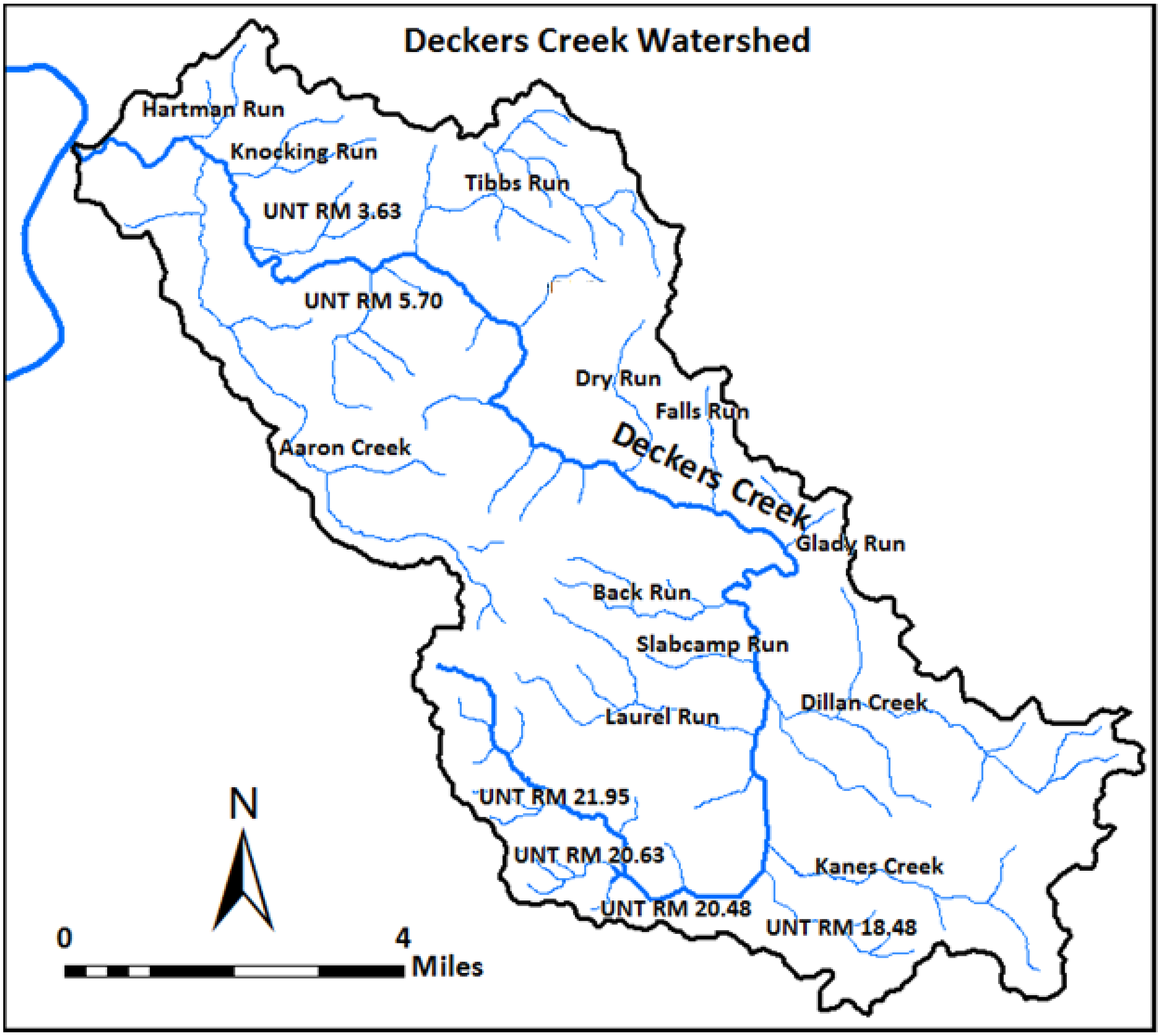


Figure 2: Streams in the Deckers Creek watershed.

Forest covers the majority of land within the Deckers Creek Watershed (Figure 3). The watershed is most heavily settled in and near Morgantown and has smaller population centers and agricultural land in the Preston County portion of the watershed. The Chestnut Ridge portion of the watershed is dominated by unsettled and forested land and the agricultural pastureland of Preston County is mainly grass land. In Monongalia County, part of the city of Morgantown drains to Deckers Creek. In Preston County, part of Masontown and all of Reedsville drain to Deckers Creek. The unincorporated towns of Brookhaven, Richard, Dellslow, Rock Forge, Sturgisson, Greer and Mountain Heights in Monongalia County and Arthurdale in Preston County also lie within the watershed.

The West Virginia Soil Conservation Agency and the United States Soil Conservation Service implemented measures to protect portions of Preston County land from flooding. Flood prevention measures include five impoundments, and two additional impoundments were built for water fowl habitat. Impoundments in the Deckers Creek Watershed are referred to as Upper Deckers Creek Impoundment #1-7 (UDCI#). In addition, approximately six miles of stream was channelized (Christ and Pavlick, 2006).

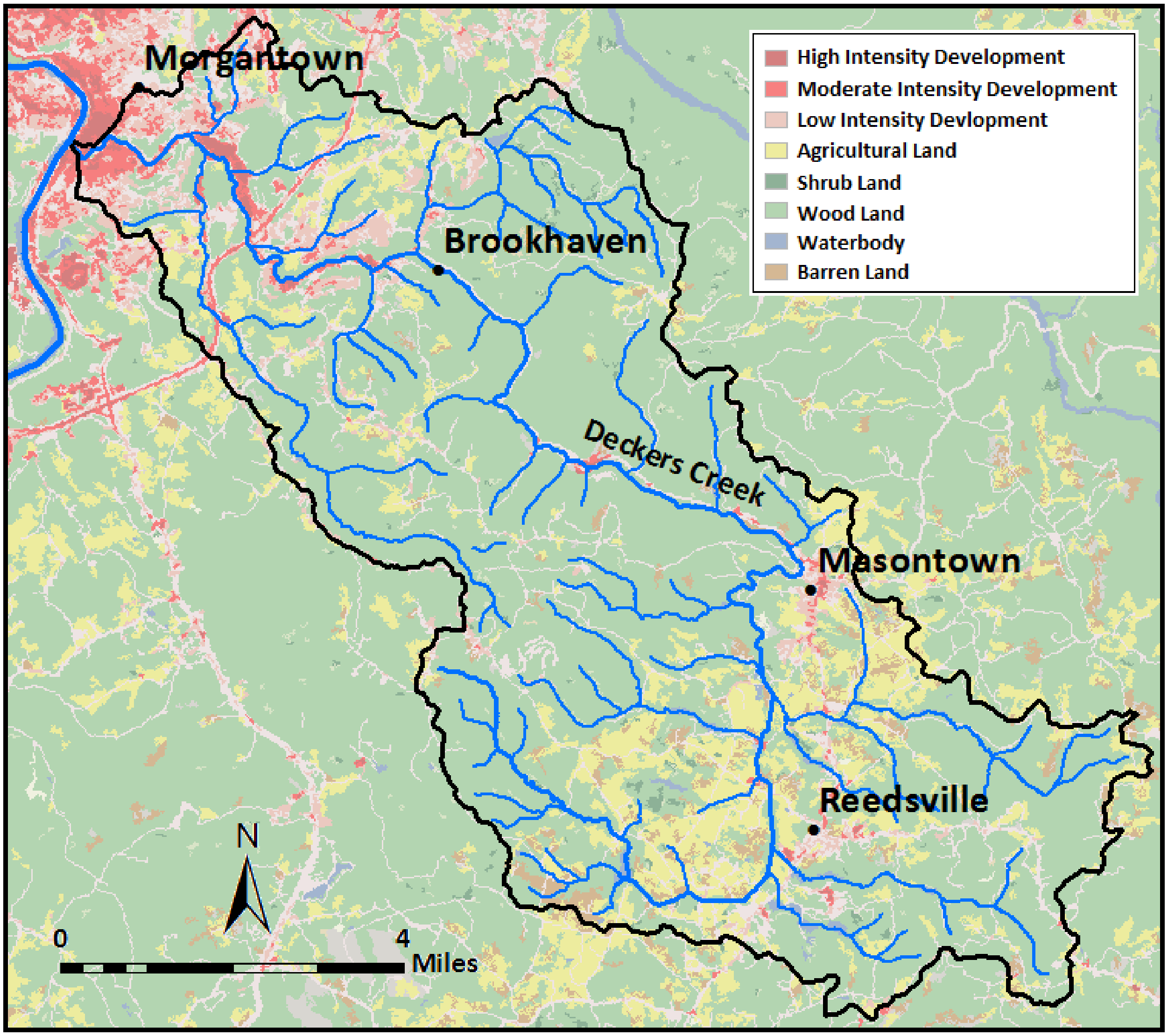


Figure 3: Land use within the Deckers Creek Watershed, West Virginia, 2011.

Deckers Creek headwaters originate at approximately 2,100 feet above sea level in Monongalia County, WV. The creek then flows east toward Arthurdale, north from Reedsville to Masontown, and west, cutting a gorge through the Chestnut Ridge anticline, ultimately ending at the Monongahela River in Morgantown, at 797 feet above sea level.

Geology in the Deckers Creek watershed consists mainly of sandstone and shale, with minimal limestone and alluvium exposures, and subsurface coal throughout (Figure 4). Bisecting the watershed in a northeast to southwest trend is the Chestnut Ridge anticline, an open fold of the Allegheny Mountains. Deckers Creek has incised a gorge across the anticline exposing Mississippian age Greenbrier limestone along the gorge section. This is the only location in the watershed with a substantial exposure of limestone and it is also the location of Greer Limestone and Deckers Creek Limestone Companies. The resistant cap rock of the Chestnut Ridge anticline is the Pennsylvanian Pottsville formation, consisting of well cemented conglomeritic sandstone.

The remaining sandstones and shale of the Deckers Creek watershed overlying the Mississippian Greenbrier Limestone range in age from upper Mississippian Mauch Chunk Group, through Pennsylvania Pottsville Group, Allegheny Formation, Conemaugh Group, and Monongahela Group. It is in the Allegheny Group that the most heavily mined coal bed in the Deckers Creek watershed, the Upper Freeport, is located. Additional Allegheny group coals consist of the Lower Freeport and Upper and Lower Kittanning coals. The Conemaugh Group contains the Bakerstown coal. The Monongahela group contains the Pittsburgh coal bed which was mined only in the western most extent of the watershed.

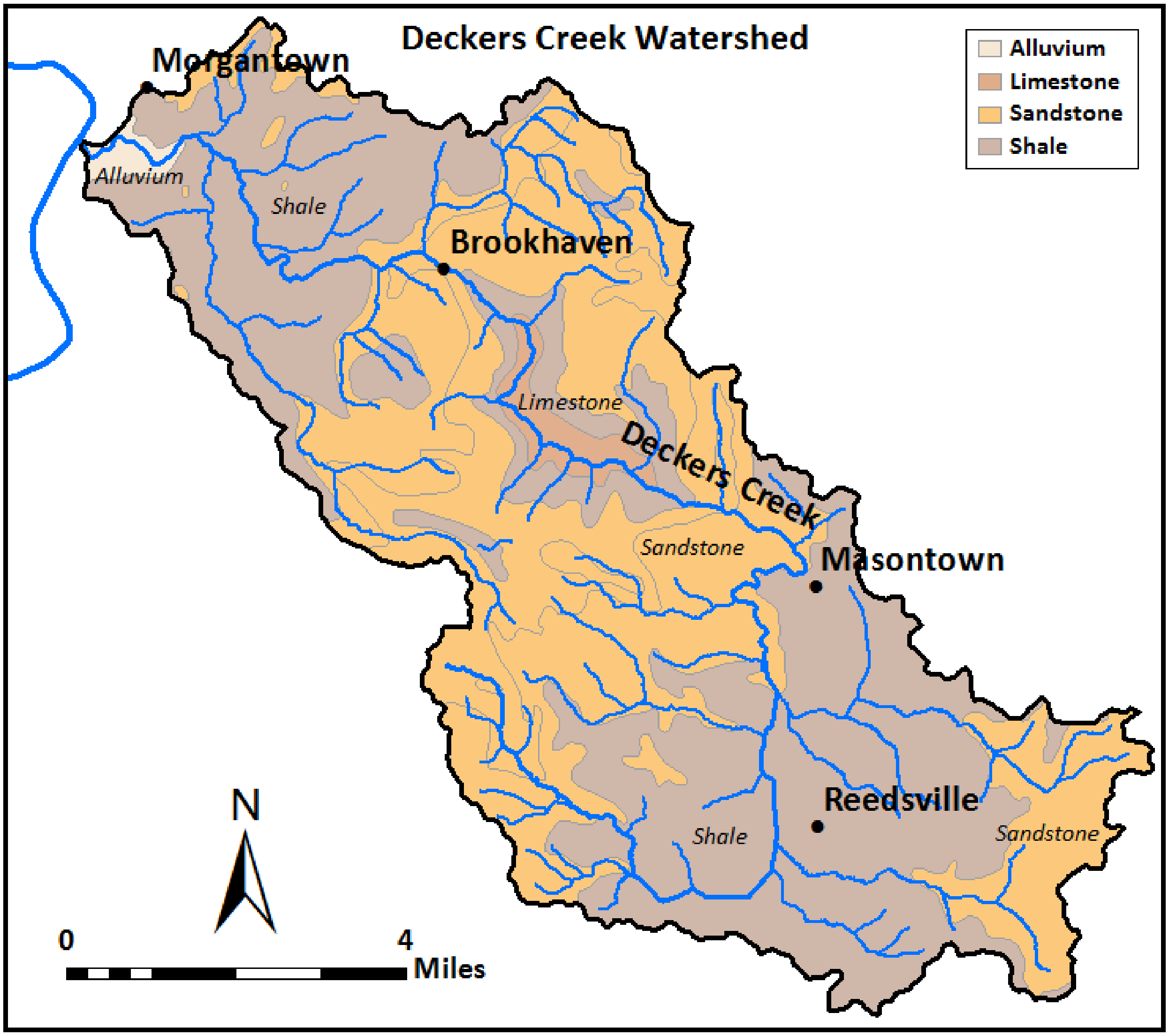


Figure 4: Surface geology within the Deckers Creek Watershed, West Virginia.

Since implementation of a U.S. Environmental Protection Agency (EPA) watershed based plan for the Deckers Creek Watershed in 2006, progress has been made in treating contamination sources and improving water quality within the Deckers Creek Watershed. Currently seven FODC operated AMD remediation sites exist within the watershed with several proposals submitted for continued future improvements.

Currently Friends of Deckers Creek (FODC) maintains the following AMD remediation sites:

1. Valley Highwall #3 (VH3)
2. Valley Point #12 (VP12)
3. Kanes Creek South Site #1 (KCS1)
4. Kanes Creek South Site #3 (KCS3)
5. Kanes Creek Successive Alkalinity Producing System (KCSAPS)
6. Satcher Pre-Treatment Pond (SPTP)
7. Slabcamp Ancillary (SlabAnc)

In addition to seven AMD remediation sites maintained by FODC, approximately forty other improvement projects have been completed by local, state, and federal entities including WV Department of Environmental Protection (WVDEP) Office of Abandoned Mine Lands and Reclamation (OAMLR), WVDEP Office of Special Reclamation (OSR), Office of Surface Mining (OSM), Natural Resource Conservation Service (NRCS), WV Conservation Agency (WVCA), and WV Department of Natural Resources (WVDNR).

Best management practices (BMPs) within Deckers Creek Watershed are designed to maintain contaminant levels below the WV water quality standards (Tables 1 & 2). BMPs consist of flushing limestone leach beds, vertical flow ponds, aerobic and anaerobic wetlands, sulfate reducing bioreactors, open limestone channels, steel slag beds, and active calcium hydroxide dosers. In addition, Patriot Mining Company currently operates an active AMD treatment facility at the Old Reliable Mine, Preston County, WV. As a result of constructed treatment practices, load reductions have been observed downstream as well as improved diversity and quantity of benthic macroinvertebrate and fish populations.

The Clean Creek Program (CCP) implemented by FODC in 2002 monitors thirteen sites along the Deckers Creek mainstem and tributaries. Chemical data is collected quarterly and biological data is collected annually. The data show trends consistent with improved water quality in the watershed as a result of a decade of remediation activities (Figures 5 and 6).

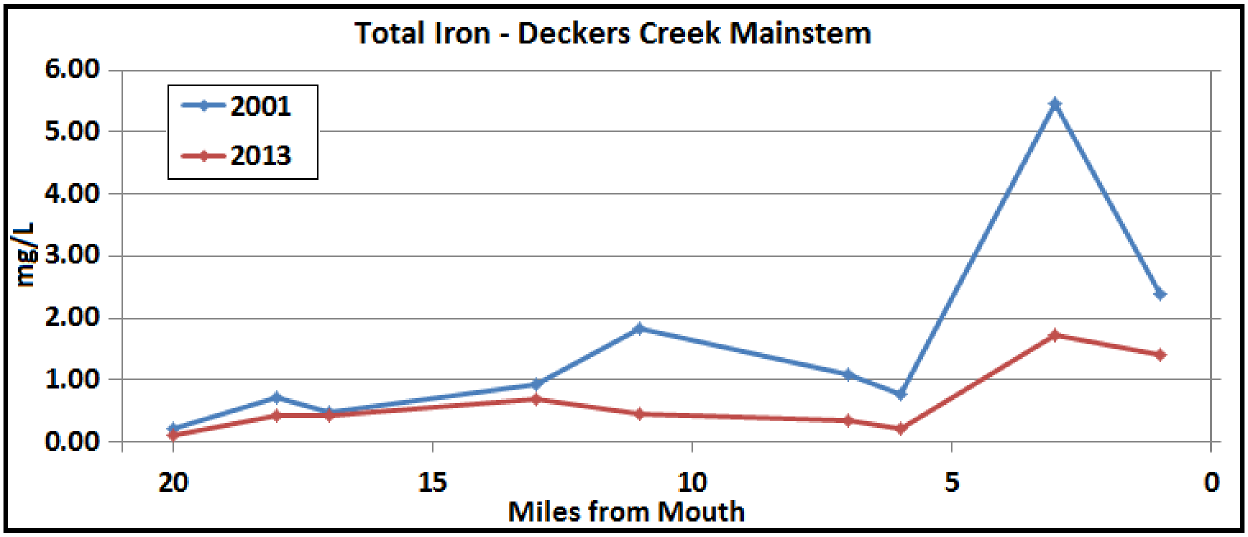


Figure 5: Comparison of iron data from 2001 and 2013 illustrating improved water quality in Deckers Creek mainstem.

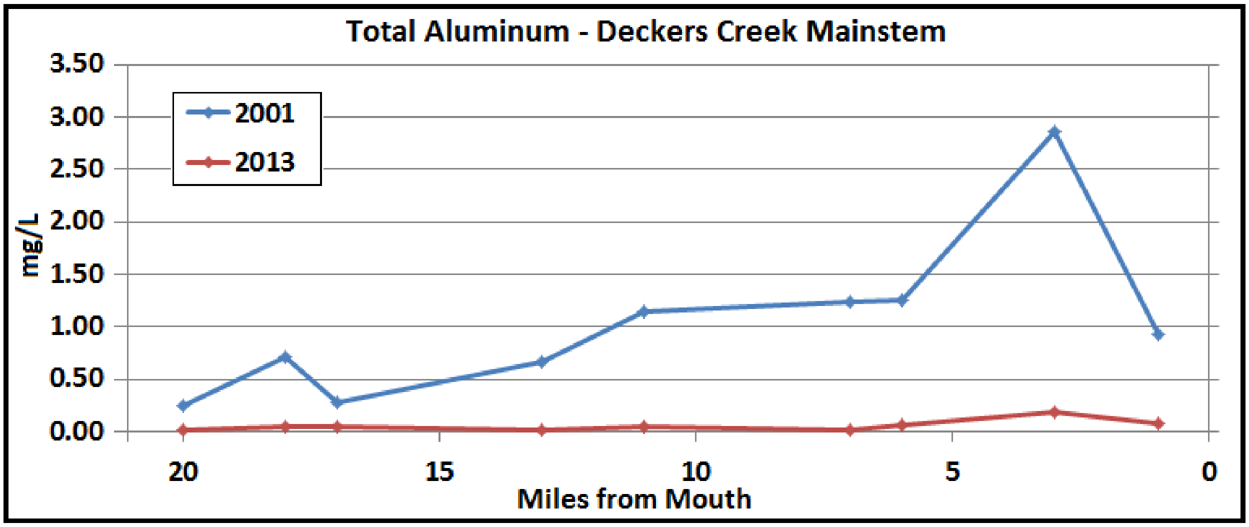


Figure 6: Comparison of aluminum data from 2001 and 2013 illustrating improved water quality in Deckers Creek mainstem.

WATER QUALITY STANDARDS

POLLUTANT	USE DESIGNATION				
	Aquatic Life				Human Health
	Warmwater Fisheries		Troutwaters		Contact Recreation/Public Water Supply
	Acute[a]	Chronic[b]	Acute[a]	Chronic[b]	
Aluminum, dissolved (µg/L)	750	750	750	87	--
Iron, total (mg/L)	--	1.5	--	1.0	1.5
Manganese, total (mg/L)	--	--	--	--	1.0[c]
Dissolved oxygen	Not less than 5 mg/L at any time	Not less than 5 mg/L at any time	Not less than 6 mg/L at any time	Not less than 6 mg/L at any time	Not less than 5 mg/L at any time
pH	No values below 6.0 or above 9.0	No values below 6.0 or above 9.0	No values below 6.0 or above 9.0	No values below 6.0 or above 9.0	No values below 6.0 or above 9.0
Fecal coliform bacteria	**Human Health Criteria** Maximum allowable level of fecal coliform content for Primary Contact Recreation (either MPN [most probable number] or MF [membrane filter counts/test]) shall not exceed 200/100 mL as a monthly geometric mean based on not less than 5 samples per month; nor to exceed 400/100 mL in more than 10 percent of all samples taken during the month.				

Table 1: Water quality standards for contaminant sources in Deckers Creek Watershed (WVDEP 2014).

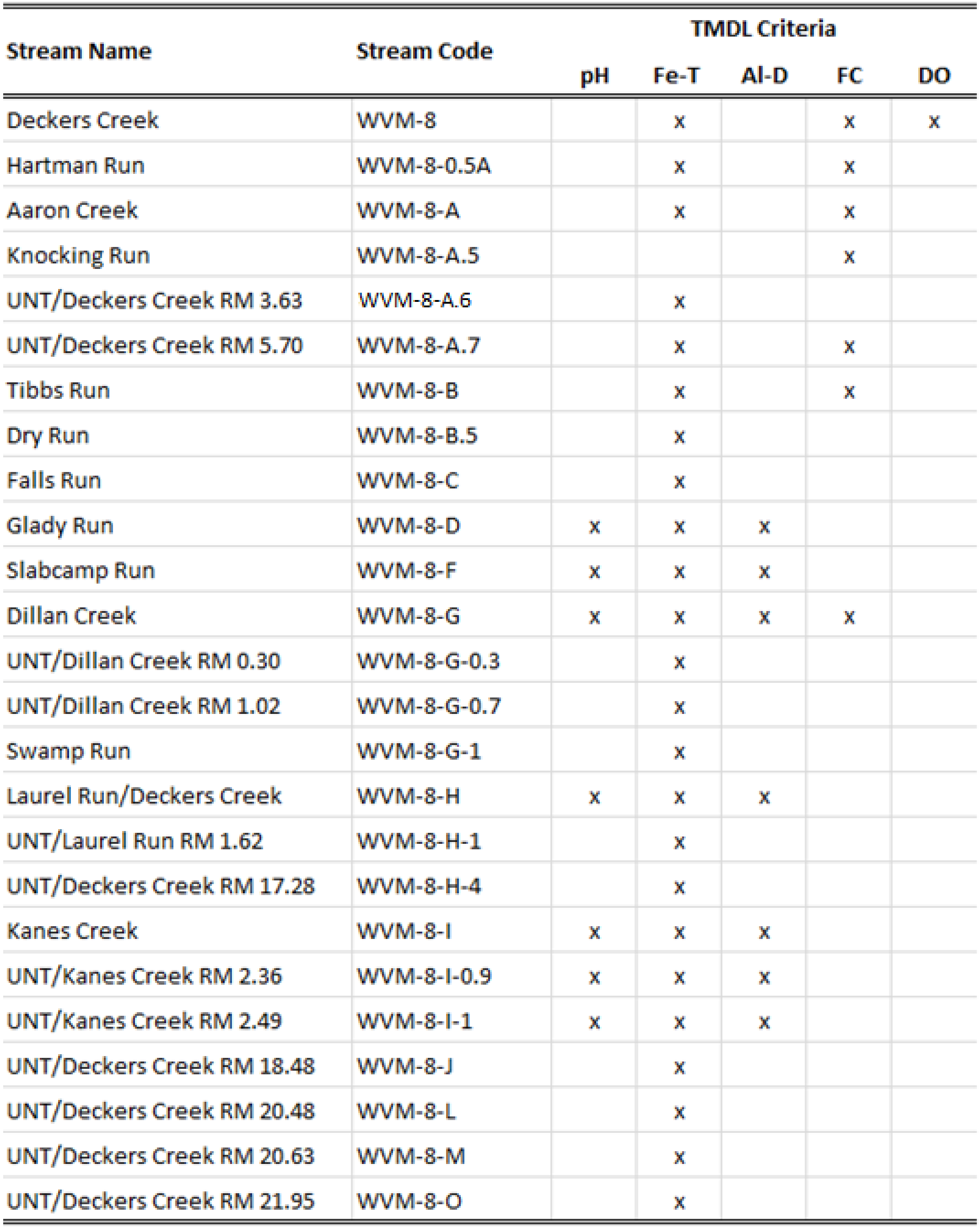
[a] One-hour average concentration not to be exceeded more than once every 3 years on average.
[b] Four-day average concentration not to be exceeded more than once every 3 years on average.
[c] Not to exceed 1.0 mg/L within the five-mile zone upstream of known public or private water supply intakes used for human consumption.
Source: 47 CSR, Series 2, *Legislative Rules, Department of Environmental Protection: Requirements Governing Water Quality Standards.*

Water Quality Criterion	Designated Use	Criterion Value	TMDL Endpoint
Total Iron	Aquatic Life, warmwater fisheries	1.5 mg/L (4-day average)	1.425 mg/L (4-day average)
Total Iron	Aquatic Life, troutwaters	1.0 mg/L (4-day average)	0.95 mg/L (4-day average)
Dissolved Aluminum	Aquatic Life, warmwater fisheries	0.75 mg/L (1-hour average)	0.7125 mg/L (1-hour average)
Dissolved Aluminum	Aquatic Life, troutwaters	0.087 mg/L (4-day average)	0.0827 mg/L (4-day average)
Total Manganese	Public Water Supply	1.0 mg/L (within 5 upstream miles of a public water intake)	0.95 mg/L
pH	Aquatic Life	6.00 Standard Units (Minimum)	6.02 Standard Units (Minimum)
Fecal Coliform	Water Contact Recreation and Public Water Supply	200 counts / 100 mL (Monthly Geometric Mean)	190 counts / 100 mL (Monthly Geometric Mean)
Fecal Coliform	Water Contact Recreation and Public Water Supply	400 counts / 100 mL (Daily, 10% exceedance)	380 counts / 100 mL (Daily, 10% exceedance)

Table 2: TMDL endpoints (WVDEP, 2014).

ELEMENT A: CAUSES AND SOURCES OF POLLUTION

The TMDL's (WVDEP, 2014) describe required load reductions to reduce impairment in the Deckers Creek watershed caused by violation of pH (acidity), iron, aluminum (dissolved), and fecal coliform contamination and dissolved oxygen deficiency. The TMDL plan calls for reductions in the pollutant loads from subwatersheds contributing to these segments (Table 3).



Stream Name	Stream Code	TMDL Criteria				
		pH	Fe-T	Al-D	FC	DO
Deckers Creek	WVM-8		x		x	x
Hartman Run	WVM-8-0.5A		x		x	
Aaron Creek	WVM-8-A		x		x	
Knocking Run	WVM-8-A.5				x	
UNT/Deckers Creek RM 3.63	WVM-8-A.6		x			
UNT/Deckers Creek RM 5.70	WVM-8-A.7		x		x	
Tibbs Run	WVM-8-B		x		x	
Dry Run	WVM-8-B.5		x			
Falls Run	WVM-8-C		x			
Glady Run	WVM-8-D	x	x	x		
Slabcamp Run	WVM-8-F	x	x	x		
Dillan Creek	WVM-8-G	x	x	x	x	
UNT/Dillan Creek RM 0.30	WVM-8-G-0.3		x			
UNT/Dillan Creek RM 1.02	WVM-8-G-0.7		x			
Swamp Run	WVM-8-G-1		x			
Laurel Run/Deckers Creek	WVM-8-H	x	x	x		
UNT/Laurel Run RM 1.62	WVM-8-H-1		x			
UNT/Deckers Creek RM 17.28	WVM-8-H-4		x			
Kanes Creek	WVM-8-I	x	x	x		
UNT/Kanes Creek RM 2.36	WVM-8-I-0.9	x	x	x		
UNT/Kanes Creek RM 2.49	WVM-8-I-1	x	x	x		
UNT/Deckers Creek RM 18.48	WVM-8-J		x			
UNT/Deckers Creek RM 20.48	WVM-8-L		x			
UNT/Deckers Creek RM 20.63	WVM-8-M		x			
UNT/Deckers Creek RM 21.95	WVM-8-O		x			

Table 3: Deckers Creek watershed streams with TMDLs developed.
pH=acidity, Fe-T=total iron, Al-D=dissolved aluminum, FC=fecal coliform, DO=dissolved oxygen.

Acid Mine Drainage

In oxygen deficient coal forming environments iron and sulfur are concentrated into iron sulfide minerals. These minerals are geologically contained until exposed to groundwater and oxygen by mining related land disturbances. Oxygen rich groundwater dissolves the iron sulfide minerals resulting in an acidic, iron rich solution referred to as AMD. The acidic solution further dissolves aluminum from clays and manganese from carbonates and carbonate cemented mudstones (Larson and Mann, 2005).

West Virginia has experienced nearly two centuries of coal mining creating a network of mined voids and surface disturbances. Discharges from underground and surface mines create various safety, environmental, and economic concerns. AMD has the potential to contaminate the regional watershed and damage public and private property. Metal precipitates associated with AMD have the potential to destroy aquatic habitat and be toxic to aquatic organisms. The burden of remediation of legacy mine sites often falls upon the relevant states and local watershed organizations.

Underground mining, as opposed to surface mining, typically results in large pools that evolve from juvenile, to steady-state, to mature. The mine water evolution is observed both in the chemistry and hydrology. Juvenile mine water occurs as a mined void floods as a result of groundwater infiltration and is typically highly acidic and rich in iron and aluminum. Upon discharging, mine pools often achieve steady-state in which hydrology and chemistry stabilize. Finally, mine water reaches maturity as mineral resources are depleted within the mine void, typically resulting in less acidic water dilute in metals. This occurrence of partially flooded underground mines is observed within the Deckers Creek watershed at the Richard Mine, and is likely the current hydrogeological status of several other flooded mines in the Deckers Creek watershed such as the underground mines of the Masontown Coal Fields including the Burke Mine, T&T Energy No.1 Mine, and the Reliable Coal Company Kanes Creek Mine (now Arch Coal).

In the Deckers Creek watershed, coal from the Upper Kittanning, Lower and Upper Freeport, Bakerstown and Pittsburgh beds has been mined. AMD generated at Deckers Creek coal mine sites falls into three categories: permitted mine discharges, bond forfeiture sites (BFS), and abandoned mine lands (AML).

Only one coal mine and two limestone mines in the watershed falls into the permitted discharge category. AMD is generated at the coal mining site, but the water is treated before it is discharged off the site, under regulation by National Pollutant Discharge Elimination System (NPDES) permits (Table 4). Seven coal mines have had permits revoked and fall into the BFS category. The WVDEP has taken over responsibility for treating AMD at these BFS (Table 5). Finally, there are 69 AML sites in the Deckers Creek watershed listed as 69 Problem Area (PA) descriptions (Tables 6 & 7; Christ and Pavlick, 2006). AMLs result from mining operations ceased prior to the Surface Mining Control and Reclamation Act (SMCRA) of 1977, have no liable owner, and are the burden of the state or qualified watershed groups. SMCRA provided for the collection of funds by states for the sake of solving problems created by these mines. AMD sources on AMLs and BFSs are considered nonpoint sources in the TMDL (WVDEP, 2014). However, WVDEP is committed to treating effluent from BFS to meet the NPDES permits held by the original mining company. Therefore, the inventory of AMD sources comprises AML sites that produce AMD and additional sources identified by citizens, including FODC, but some AMD sites may not be listed officially as AMLs.

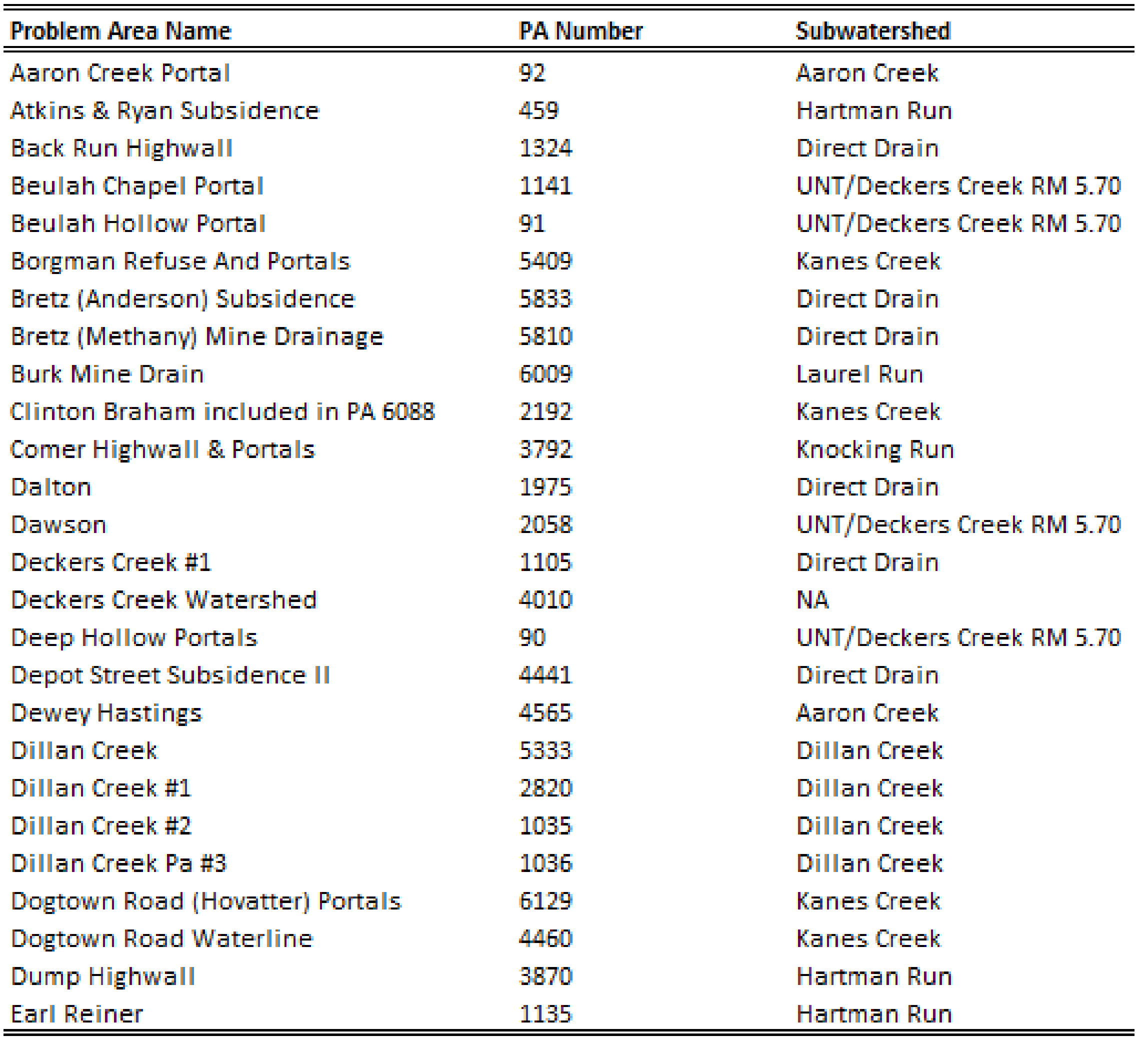
This WBP identifies three priority levels for AMD sources (Table 8; Figure 7). High-priority sources are those that must be addressed in order to reduce pollutant loads enough to delist all the segments in the watershed according to current information. Moderate sites degrade water quality and aquatic ecosystems, but contribute lower acidity and metals loads than high priority sites. Low-priority sites also contribute AMD, but are not clearly responsible for impairing any entire segment (Table 9). This plan calls for remediation at all high and moderate priority sources, and continued monitoring to determine whether low-priority sources must also be addressed. Many of the AMLs are not known to discharge any AMD, and are omitted from the list of sources.

PERMIT_ID	PERMITTEE	FACILITY	TYPE	PER_STATUS
E004100	PATRIOT MINING COMPANY INC	MINE # 1	Coal Underground	New
Q004674	GREER LIMESTONE COMPANY	NA	Quarry	Renewed
Q101992	GREER LIMESTONE COMPANY	NA	Quarry	Renewed
Q200705	DECKER'S CREEK LIMESTONE COMPANY	Deckers Creek Mine	Quarry	Renewed
Q101792	DECKER'S CREEK LIMESTONE COMPANY	QUARRY	Quarry	Renewed

Table 4: Permitted mining operations in the Deckers Creek watershed (WVDEP TAGIS, 2014).

PERMIT_ID	PERMITTEE	FACILITY	TYPE	PER_STATUS
U014782	DECONDOR COAL COMPANY INC	MOUNTAIN RUN MINE # 5	Coal Underground	Revoked
S103286	ED-E DEVELOPMENT CO INC	NA	Coal Surface Mine	Revoked
S003383	HILLCREST CONSTRUCTION CO INC	NA	Coal Surface Mine	Revoked
S102886	PINNACLE MINING CO OF N WV	NA	Coal Surface Mine	Revoked
S006285	PINNACLE MINING CO OF N WV	NA	Coal Surface Mine	Revoked
S001782	VALLEY MINING CO, INC	NA	Coal Surface Mine	Revoked
O007782	WOCAP ENERGY RESOURCES, INC	NA	Other	Revoked

Table 5: Bond Forfeiture Sites (BFS) in the Deckers Creek watershed (WVDEP TAGIS, 2014).



Problem Area Name	PA Number	Subwatershed
Aaron Creek Portal	92	Aaron Creek
Atkins & Ryan Subsidence	459	Hartman Run
Back Run Highwall	1324	Direct Drain
Beulah Chapel Portal	1141	UNT/Deckers Creek RM 5.70
Beulah Hollow Portal	91	UNT/Deckers Creek RM 5.70
Borgman Refuse And Portals	5409	Kanes Creek
Bretz (Anderson) Subsidence	5833	Direct Drain
Bretz (Methany) Mine Drainage	5810	Direct Drain
Burk Mine Drain	6009	Laurel Run
Clinton Braham included in PA 6088	2192	Kanes Creek
Comer Highwall & Portals	3792	Knocking Run
Dalton	1975	Direct Drain
Dawson	2058	UNT/Deckers Creek RM 5.70
Deckers Creek #1	1105	Direct Drain
Deckers Creek Watershed	4010	NA
Deep Hollow Portals	90	UNT/Deckers Creek RM 5.70
Depot Street Subsidence II	4441	Direct Drain
Dewey Hastings	4565	Aaron Creek
Dillan Creek	5333	Dillan Creek
Dillan Creek #1	2820	Dillan Creek
Dillan Creek #2	1035	Dillan Creek
Dillan Creek Pa #3	1036	Dillan Creek
Dogtown Road (Hovatter) Portals	6129	Kanes Creek
Dogtown Road Waterline	4460	Kanes Creek
Dump Highwall	3870	Hartman Run
Earl Reiner	1135	Hartman Run

Table 6: Problem Areas (PA), Deckers Creek watershed (OSM, 2006; Christ and Pavlick, 2006).

Problem Area Name	PA Number	Subwatershed
Elkins Coal & Coke Mining Facility	5120	Direct Drain
Gladys Run Strips	1734	Glady Run
Harold Rehe	2225	Direct Drain
Hartman Run Drainage	1099	Hartman Run
Hartman Run Drainage II	6008	Hartman Run
Hawkins Mine Discharge	3455	Kanes Creek
Kanes Creek Area Waterline	5064	Kanes Creek
Kanes Creek North	1732	Dillan Creek
Kanes Creek South	2003	Kanes Creek
Kanes Creek South Reclamation Project	5900	Kanes Creek
Kanes Creek Tipple	2002	Kanes Creek
Laurel Run #1	2005	Laurel Run
Masontown (Fullenberger) Subsidence II	5011	Direct Drain
Masontown (Polce) Subsidence	5203	Direct Drain
Masontown Subsidence	4373	Direct Drain
McKinney Cave Road (Taylor) Subsidence	6108	SlabcampRun
Mellons Chapel Portal	89	UNT/Deckers Creek RM 5.70
Morgan Mine Road AMD	5990	Kanes Creek
Morgan Mine Road Mine Fire	6045	Kanes Creek
Morgantown (Dorinzi) Subsidence	4639	Hartman Run
Morgantown (Hartman Run) Subsidence	6134	Hartman Run
Morgantown Airport Subsidence	4145	Hartman Run
Mount Vernon Strip	1323	Laurel Run
Neil Braham included in PA 6088	2191	Kanes Creek
Ponderosa Pines Opening	1143	Aaron Creek
Reedsville (Baniak) Subsidence	6137	Dillan Creek
Reedsville (Conner) Subsidence	5539	UNT/Deckers Creek RM 17.28
Richard Refuse	1142	Direct Drain
Sabraton (Hriblan) AMD	5815	Direct Drain
Sabraton (Huggins) Portal	4919	Knocking Run
Sandy Run Highwall, Portals	6088	Kanes Creek
Slab Camp - Friends Of Deckers Ck.	5902	Slabcamp Run
Slabcamp Run #2	1999	Slabcamp Run
Superior Hydraulics	3738	Direct Drain
Superior Hydraulics	4024	Direct Drain
Tibbs Run #2 Portal	2452	TibbsRun
Tibbs Run Portals And Tipple	2011	TibbsRun
Union PSD Subsidence	460	TibbsRun
Upper Deckers Creek - Impoundment 5	4863	Kanes Creek
Valley Highwall #3	3068	Kanes Creek
Valley Point #12	1456	Kanes Creek
Woodland U.M. Church Subs.	5533	Hartman Run
WV (Monongalia) FEA	954061	Hartman Run

Table 7: Problem Areas (PA), Decker Creek Watershed (OSM, 2006; Christ and Pavlick, 2006), continued.

Stream Name	Stream Code	AMD Source	Priority Level	Net Acidity Load (lbs CaCO3/day)	Al Load (lbs/day)	Fe Load (lbs/day)
Deckers Creek	WVM-8	Richard	High	1988.01	196.43	508.89
		Dalton	Moderate	No Data	No Data	No Data
		RckFrgHT	Low	-1.97	0.00	0.12
		RckFrgPVC	Low	2.44	0.01	0.54
		RckFrgRD	Low	12.69	0.35	1.20
		Brdg5AMD	High	79.62	4.88	19.85
		Goat1A	Low	1.02	0.09	0.00
		Goat1B	Low	1.30	0.14	0.01
		Bretz Matheny	High	No Data	No Data	No Data
Hartman Run	WVM-8-0.5A	HrtMonGen	Low	-0.12	0.01	0.05
		Mlgrweir	Moderate	62.18	2.38	10.31
Aaron Creek	WVM-8-A	AaronAMD	Moderate	901.83	0.68	0.68
UNT/Deckers Creek RM 5.70	WVM-8-A.7	Valley Mining	Low	22.19	0.95	0.05
		Beulah Chapel	Low	16.53	0.75	0.07
Falls Run	WVM-8-C	FallsAMD	Low	No Data	No Data	No Data
Glady Run	WVM-8-D	Glady Run Strips	Moderate	No Data	No Data	No Data
Back Run	WVM-8-E	BckRnDiv	Low	0.13	0.01	0.03
Slabcamp Run	WVM-8-F	SLANCINL	Moderate	11.85	0.81	0.38
		OLC 250	High	130.23	10.19	0.85
		OLC 300	High	71.32	4.99	1.91
		OLC 400	Moderate	0.86	0.05	0.14
		OLC 650	High	79.44	5.57	5.02
		OLC 750	High	115.12	9.04	5.74
Dillan Creek	WVM-8-G	DILJLCLV	Moderate	19.73	1.09	0.03
		DILCLV01	Moderate	10.04	0.52	0.20
		DILCLV02	High	744.31	52.98	31.96
		DILDVRSN	High	550.39	54.88	7.01
		DilCR253	High	792.78	54.21	27.48
Kanes Creek	WVM-8-I	MMRAMD	High	112.81	5.04	10.51
		Blanket Drain #2	High	83.11	1.92	14.69
		VP12A	High	114.57	5.94	16.33
		VP12B	High	29.95	1.70	3.31
		VH3 Upgrades	High	59.95	2.07	4.34
		KCS1Feed	High	28.12	1.01	2.70
		KCS2Culv	Low	-7.24	0.01	0.06
UNT/Kanes Creek RM 2.36	WVM-8-I-0.9	KCS3123	High	56.68	4.29	3.57
		KCS34Dis	High	54.15	4.11	6.09
UNT/Kanes Creek RM 2.49	WVM-8-I-1	SPTP	Moderate	194.32	4.37	11.50
		SandySeep	Moderate	78.65	3.93	3.02
		Nbraham	Low	5.72	0.43	0.09
Laurel Run/Deckers Creek	WVM-8-H	Burke Road AMD	High	3294.66	117.45	35.91
UNT/Deckers Creek RM 17.28	WVM-8-H-4	ZinnAMD	Low	-45.62	0.29	1.33

Table 8: Priority level and calculated loads for AMD sources in Deckers Creek watershed.

Subwatershed	AMLIS Code	Site
Kanes Creek	5409	Borgman Refuse and Portals
Laurel Run	2005	Laurel Run #1
Laurel Run	1323	Mount Vernon Strip
Tibbs Run	2452	Tibbs Run #2 Portal
Tibbs Run	2011	Tibbs Run Portals and Tipple
Deep Hollow	91	Beulah Hollow Portal
Knocking Run	3792	Comer Highwall & Portals
Deckers (Aaron to Hartman)	5815	Sabraton (Hriblan) AMD

Table 9: Additional low priority AMD sources in the Deckers Creek watershed (OSM, 2006; Christ and Pavlick, 2006).

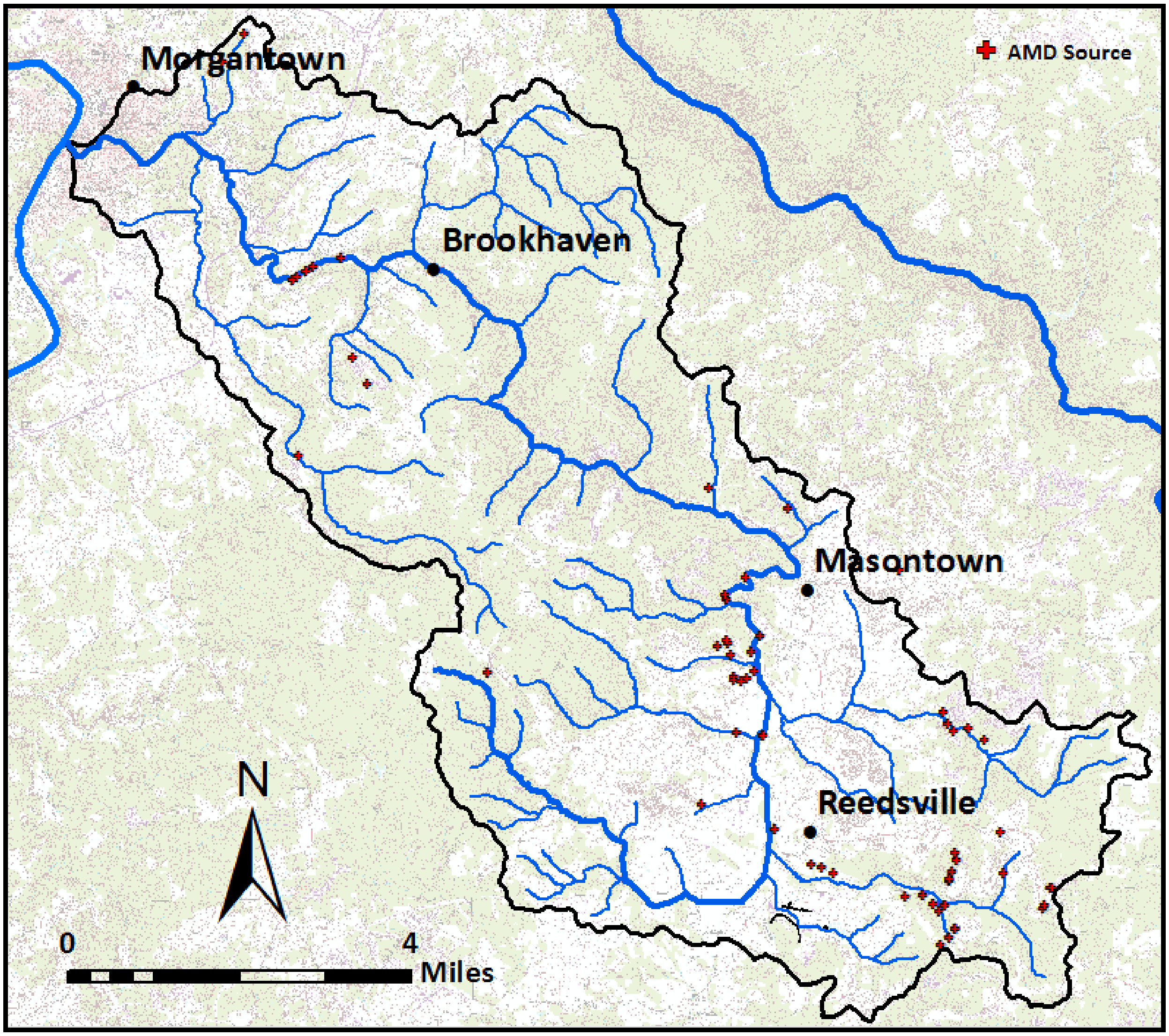


Figure 7: Location of prioritized AMD sources within Deckers Creek Watershed.

FODC possesses a Microsoft Access database containing over 55,000 data points sampled during 1994-2014. Point source and subwatershed loads were calculated from the average of all data available for each point source or site representative of a subwatershed.

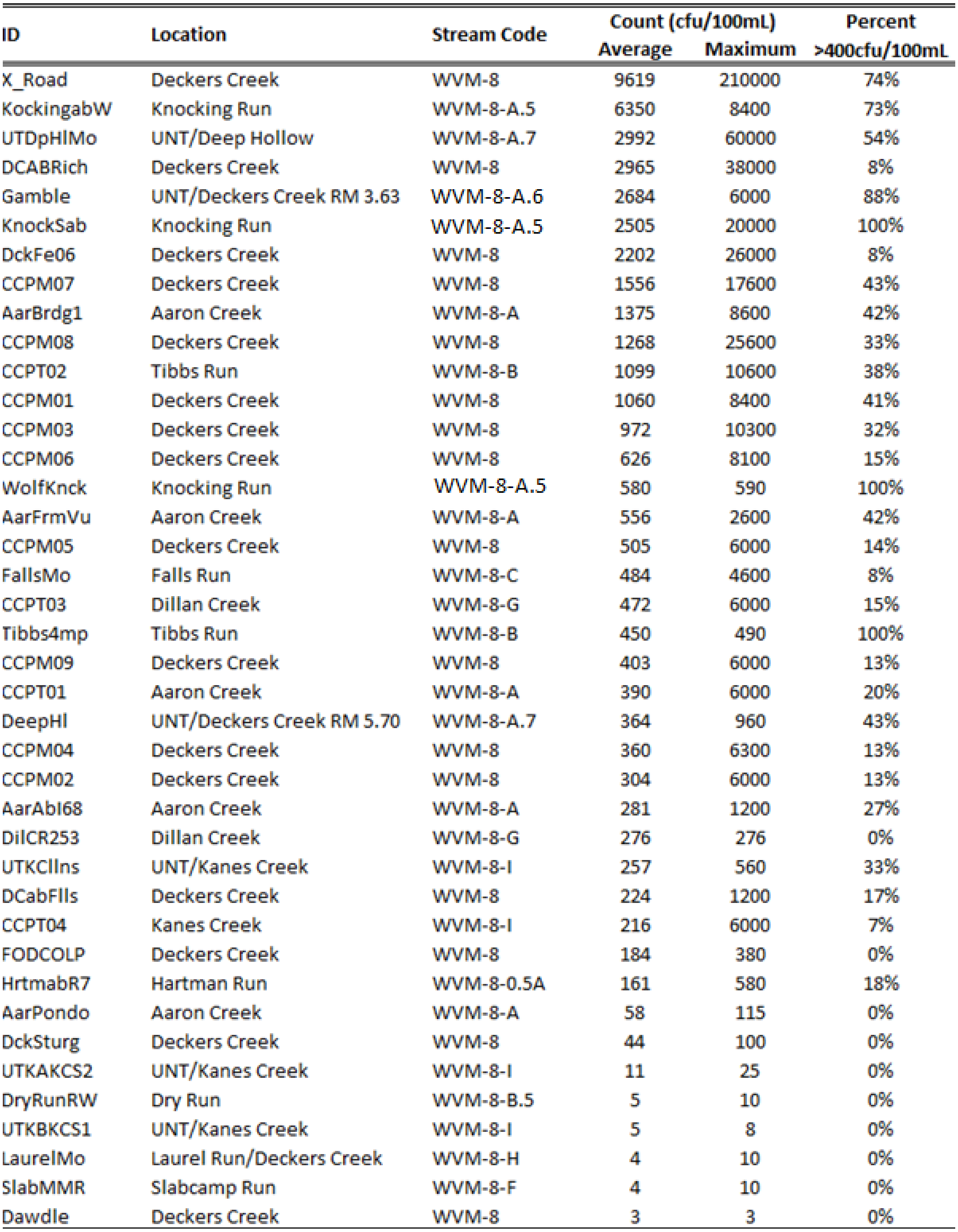
The 2002 TMDL had allocated loads for manganese within the Deckers Creek watershed. However, Deckers Creek and its subwatersheds consistently showed compliance with manganese water quality thresholds and loads close to target loads. Reductions were not necessary to meet compliance and therefore manganese is not listed as an impairing contaminant in Deckers Creek in the 2014 TMDL. In addition, in 2002 manganese standards were revised to be applicable only within a five mile stream length of a public water intake. Currently, no Deckers Creek waterbodies, segments, or tributaries are utilized as public water supply.

Fecal Coliform Bacteria

As of 2014, Deckers Creek is on the state 303(d) list for fecal coliform impairment, and data collected by FODC (Tables 10 & 11; Figure 8) indicate several tributaries and 19.1 miles of the mainstem where fecal coliform counts have exceeded 400 cfu / 100 mL, a component of the fecal coliform water quality criterion. While a one-time sample does not officially violate the fecal coliform bacteria standard, observations above 400 cfu / 100 mL are a health risk and impairment of this tributary is likely. WVDEP lists a stream as impaired if fecal coliform bacteria counts exceed 400 cfu/mL in10% or more of the samples.

ID	Description	Location	Stream Code	Count (cfu/100mL)
CCPM07	Kingwood Pike	Deckers Creek	WVM-8	5231
CCPT02	Tibbs Run	Tibbs Run	WVM-8-B	4082
CCPM08	Airstrip	Deckers Creek	WVM-8	3851
DcKMCR	Deckers at McKinney	Deckers Creek	WVM-8	2586
CCPM06	Masontown	Deckers Creek	WVM-8	1455
SwmpSnDa	Swamp Run at County Road	Swamp Run	WVM-8-G-1	1248
Gamble	Gamble Run Mouth	UNT/Deckers Creek RM 3.63	WVM-8-A.6	732
CCPT03	Dillan Creek	Dillan Creek	WVM-8-G	677
HartmnMo	Hartman Mouth	Hartman Run	WVM-8-0.5A	637
KnockingMo	Knocking Mouth	Knocking Run	WVM-8-A.5	492
DckMo	Deckers Creek Mouth	Deckers Creek	WVM-8	480
CCPT01	Aaron Creek	Aaron Creek	WVM-8-A	408
AarGB	Aaron at Green Bag Road	Aaron Creek	WVM-8-A	359
UTDpHlMo	Beulah Mouth	UNT/Deckers Creek RM 5.70	WVM-8-A.7	299
CCPT04	Kanes Creek	Kanes Creek	WVM-8-I	292
CCPM01	Valley Crossing	Deckers Creek	WVM-8	268
CCPM03	Dellslow	Deckers Creek	WVM-8	221
RckFrgCV	Rock Forge Discharge	Deckers Creek	WVM-8	202
Slbcmp01	Slabcamp Run Mouth	Slabcamp Run	WVM-8-F	187
CCPM02	Sabraton	Deckers Creek	WVM-8	141
CCPM09	Zinn Chapel	Deckers Creek	WVM-8	101
CCPM05	Countyline	Deckers Creek	WVM-8	80
DillCR253	Dillan Creek at County Road	Dillan Creek	WVM-8-G	78
CCPM04	The Gorge	Deckers Creek	WVM-8	61
UTFairfx	Fairfax Mouth	UT/Deckers RM 18.48	WVM-8-J	49
DryRunMo	Dry Run Mouth	Dry Run	WVM-8-B.5	32
KCMMR	Kanes Creek Morgan Mine Road	Kanes Creek	WVM-8-I	26
LaurelMo	Laurel Run Mouth	Laurel Run/Deckers Creek	WVM-8-H	5

Table 10: Fecal coliform data collected June 19, 2014. Dotted line separates sites exceeding the measurement of 400 cfu/100mL, permitted to occur in less than 10% of samples.



ID	Location	Stream Code	Count (cfu/100mL) Average	Count (cfu/100mL) Maximum	Percent >400cfu/100mL
X_Road	Deckers Creek	WVM-8	9619	210000	74%
KockingabW	Knocking Run	WVM-8-A.5	6350	8400	73%
UTDpHlMo	UNT/Deep Hollow	WVM-8-A.7	2992	60000	54%
DCABRich	Deckers Creek	WVM-8	2965	38000	8%
Gamble	UNT/Deckers Creek RM 3.63	WVM-8-A.6	2684	6000	88%
KnockSab	Knocking Run	WVM-8-A.5	2505	20000	100%
DckFe06	Deckers Creek	WVM-8	2202	26000	8%
CCPM07	Deckers Creek	WVM-8	1556	17600	43%
AarBrdg1	Aaron Creek	WVM-8-A	1375	8600	42%
CCPM08	Deckers Creek	WVM-8	1268	25600	33%
CCPT02	Tibbs Run	WVM-8-B	1099	10600	38%
CCPM01	Deckers Creek	WVM-8	1060	8400	41%
CCPM03	Deckers Creek	WVM-8	972	10300	32%
CCPM06	Deckers Creek	WVM-8	626	8100	15%
WolfKnck	Knocking Run	WVM-8-A.5	580	590	100%
AarFrmVu	Aaron Creek	WVM-8-A	556	2600	42%
CCPM05	Deckers Creek	WVM-8	505	6000	14%
FallsMo	Falls Run	WVM-8-C	484	4600	8%
CCPT03	Dillan Creek	WVM-8-G	472	6000	15%
Tibbs4mp	Tibbs Run	WVM-8-B	450	490	100%
CCPM09	Deckers Creek	WVM-8	403	6000	13%
CCPT01	Aaron Creek	WVM-8-A	390	6000	20%
DeepHl	UNT/Deckers Creek RM 5.70	WVM-8-A.7	364	960	43%
CCPM04	Deckers Creek	WVM-8	360	6300	13%
CCPM02	Deckers Creek	WVM-8	304	6000	13%
AarAbl68	Aaron Creek	WVM-8-A	281	1200	27%
DilCR253	Dillan Creek	WVM-8-G	276	276	0%
UTKCllns	UNT/Kanes Creek	WVM-8-I	257	560	33%
DCabFlls	Deckers Creek	WVM-8	224	1200	17%
CCPT04	Kanes Creek	WVM-8-I	216	6000	7%
FODCOLP	Deckers Creek	WVM-8	184	380	0%
HrtmabR7	Hartman Run	WVM-8-0.5A	161	580	18%
AarPondo	Aaron Creek	WVM-8-A	58	115	0%
DckSturg	Deckers Creek	WVM-8	44	100	0%
UTKAKCS2	UNT/Kanes Creek	WVM-8-I	11	25	0%
DryRunRW	Dry Run	WVM-8-B.5	5	10	0%
UTKBKCS1	UNT/Kanes Creek	WVM-8-I	5	8	0%
LaurelMo	Laurel Run/Deckers Creek	WVM-8-H	4	10	0%
SlabMMR	Slabcamp Run	WVM-8-F	4	10	0%
Dawdle	Deckers Creek	WVM-8	3	3	0%

Table 11: Long-term fecal coliform data collected 2006-2012.

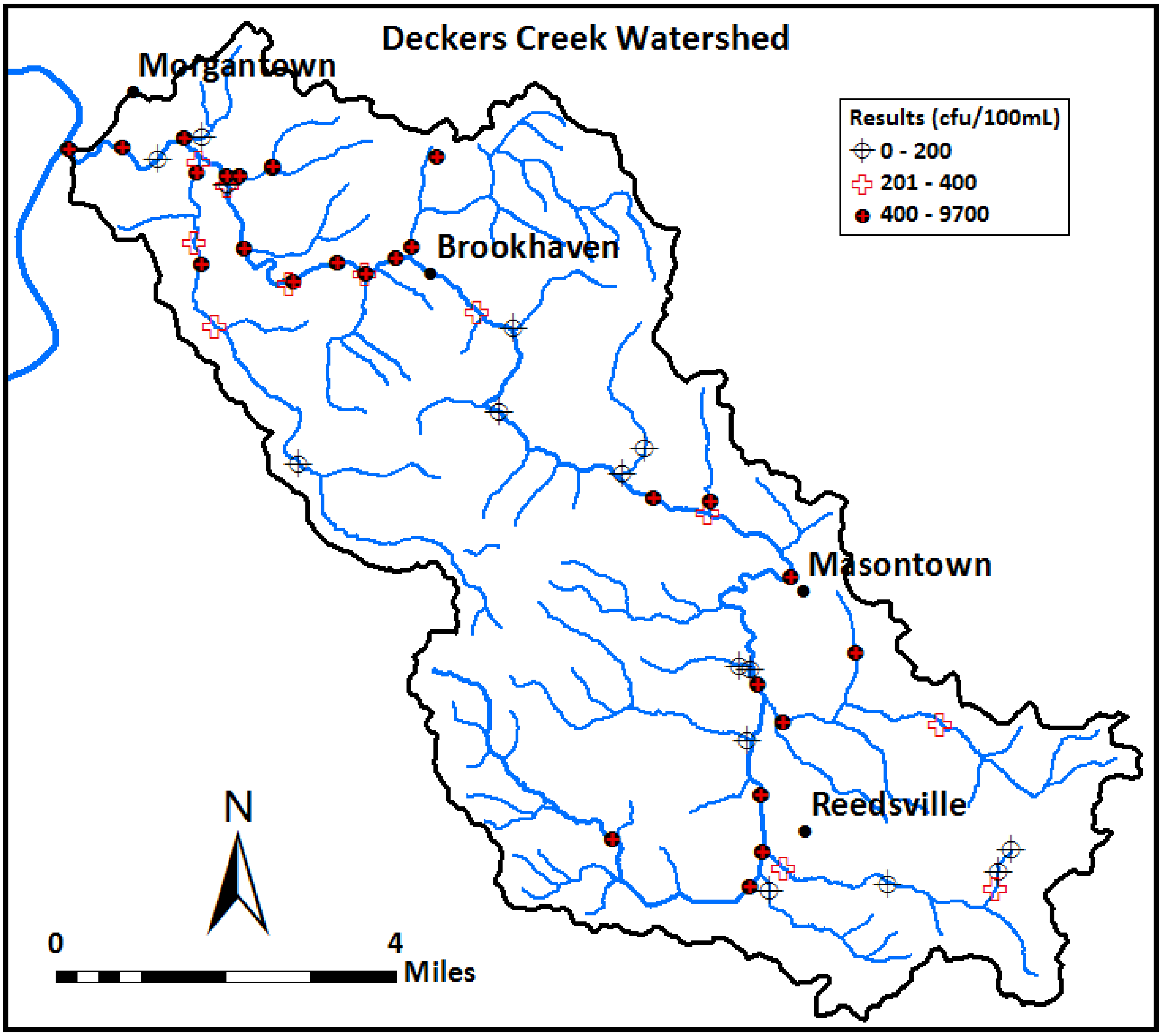


Figure 8: Fecal coliform monitoring sites in Deckers Creek Watershed.

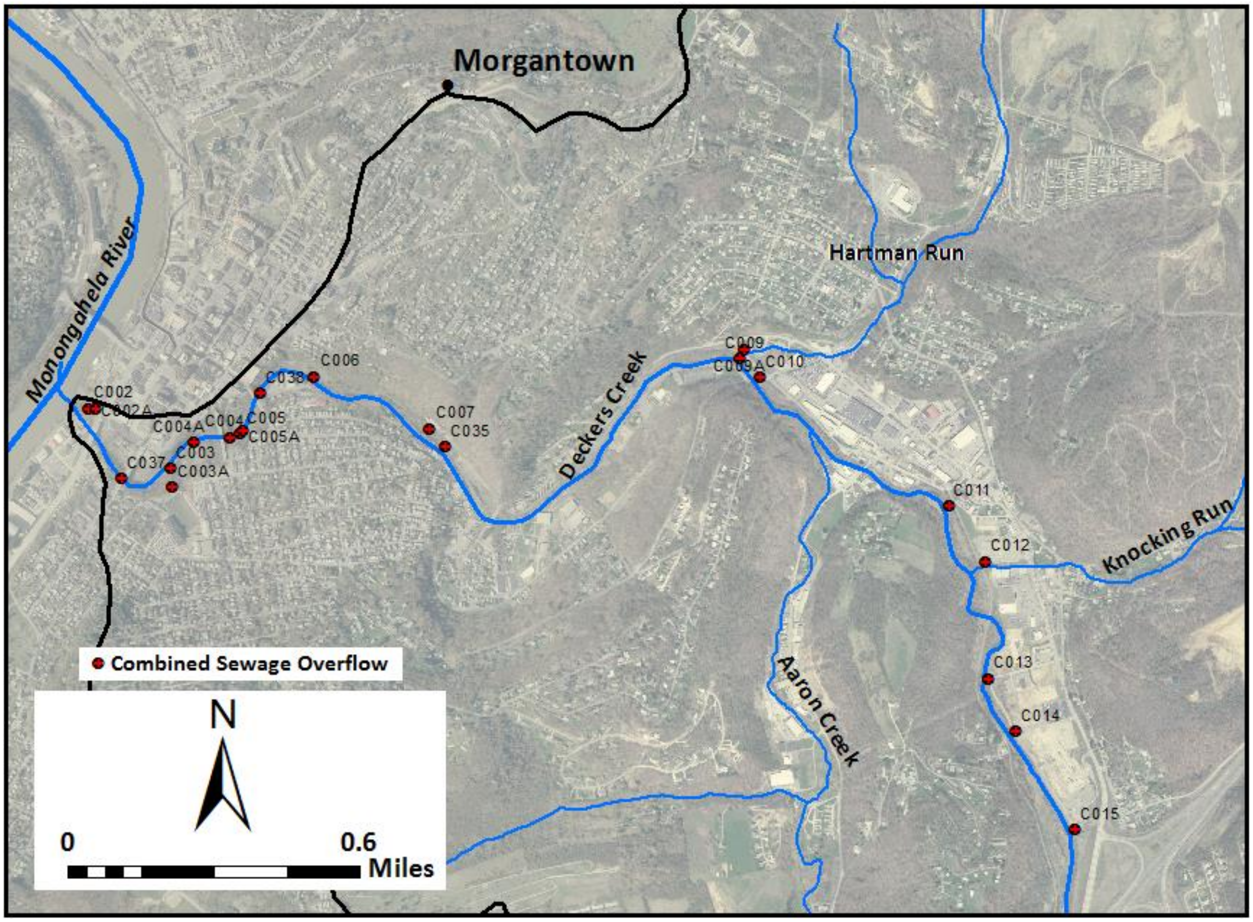


Figure 9: Permitted combined sewage overflows within Morgantown city limits.

From (Christ and Pavlick, 2006):

Point sources have accounted for some of the fecal coliform pollution, and those problems have been addressed by the permit holders. The Morgantown Utility Board has approximately 22 combined sewer overflows (CSOs) that discharge to the lower 3.2 miles of Deckers Creek (Figure 9). The Masontown sewage treatment plant has released untreated water when storm water entering the system has exceeded capacity.

Both entities have taken steps to eliminate these discharges. A number of package plants in the watershed have also discharged water into Deckers Creek with high fecal coliform bacteria levels as evident in the notices of violations issued for improper maintenance of systems under their NPDES permit. There are thirty home aeration units discharging into Deckers Creek. Proper operation and maintenance of these systems will determine whether or not they will have an impact on bacteria levels. Permitted point sources are not covered under this plan, but their locations will be used for planning related to addressing nonpoint sources of fecal coliform bacteria pollution.

Nonpoint sources of fecal coliform bacteria to streams that may be impaired have included residences, businesses or whole communities with failed septic systems or straight pipes, livestock with direct access to streams, and possibly wildlife areas. Because of suspicions that failing septic systems and straight pipes have been the major nonpoint sources of fecal coliform in Deckers Creek and its tributaries, a comprehensive assessment of the watershed was completed.

The wastewater assessment involved merging a number of data sets to determine the types of wastewater treatment for each home and business and to identify possible problem areas. Maps of centralized systems (Morgantown, Masontown, and Reedsville), package plants, home aeration units (HAUs) and individual septic system locations were used with fecal coliform bacteria data collected for the Friends of Deckers Creek Clean Creek Program and during the spring and summer 2006 to accompany this assessment. All of this information was mapped using a geographic information system (GIS) to identify the watersheds most likely impacted by wastewater pollution. Conversations with the Monongalia and

Preston County sanitarians and other knowledgeable local people about suspected problem areas and field surveys of specific stream segments provided additional information to support the GIS-based analysis.

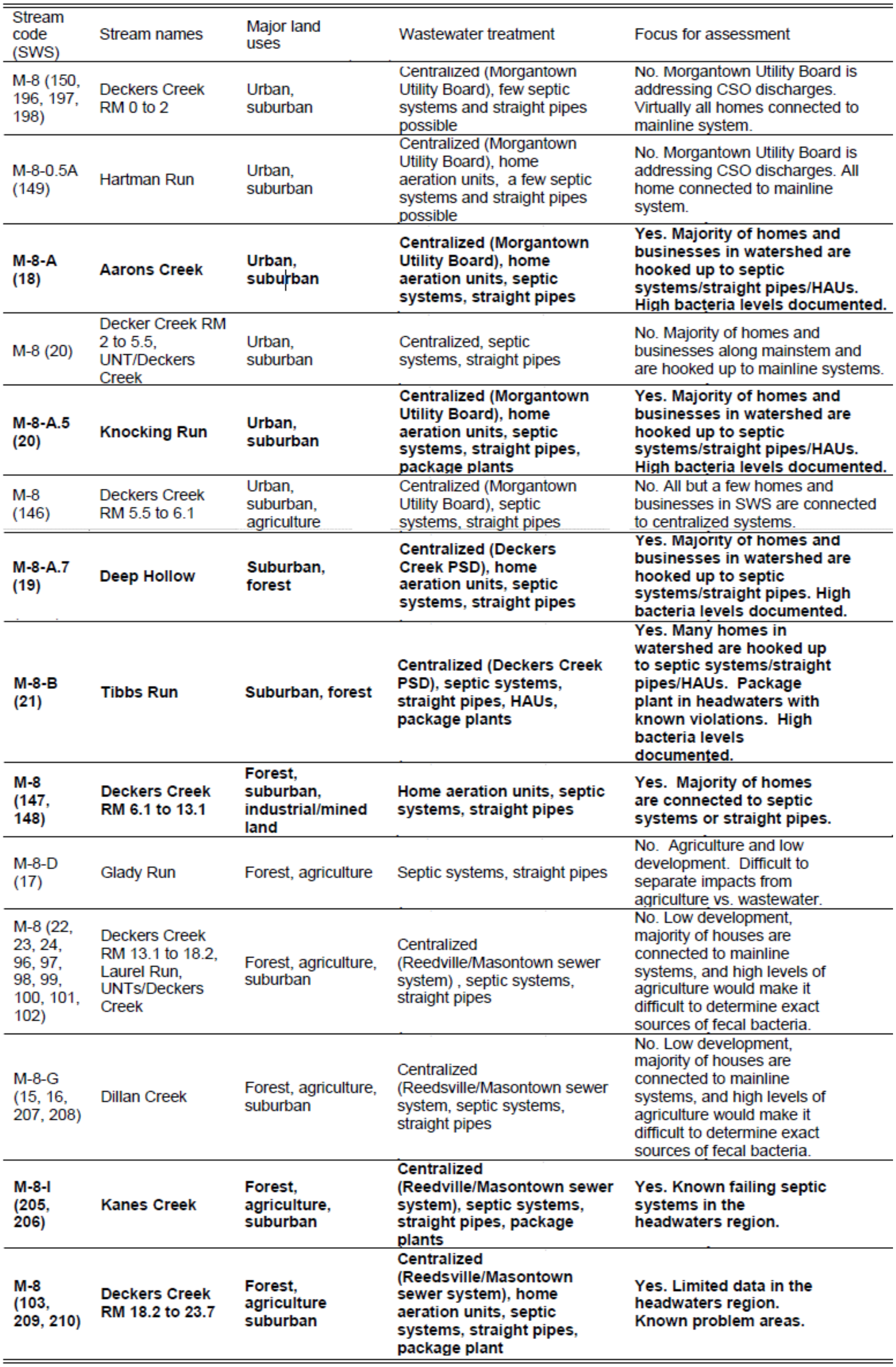
Some data quality issues existed, specifically with the location of HAUs and septic systems. When permits are issued for HAUs, the location of these sites is recorded and sent to the WVDEP. In some instances the coordinates provided are inaccurate. HAUs are also entered into WVDEP's database by landowner name, not location. Trying to match landowners with HAU permits was often difficult due to changes in property owners and data issues with GIS analysis. As wastewater issues are addressed in each subwatershed, further research into the location of each home aeration unit will have to be completed.

The septic system permit records kept by the county health departments do not highlight the exact locations of each system. Many permit applications only list the closest town and a rural route number for the system location. Only recently has the WVDEP required county health departments to document locations of new permitted septic systems. Given the resources available for this assessment, it was not possible to fully research and identifies the exact location of each individual septic system in the watershed. Instead it is assumed that homes not connected to package plants, mainline systems, or home aeration units are either connected to an individual septic system or a straight pipe. Stream walks were used to rule out the presence of straight pipes in certain watersheds, but not every mile of stream was walked in the targeted SWSs.

To narrow the focus of the assessment, only highly developed watersheds and those with known problem areas were extensively surveyed through stream walks, fecal coliform bacteria sampling, and additional GIS analysis. Also watersheds where 100% of the wastewater is being managed by the Morgantown Utility Board were not extensively assessed. CSOs are the major source of fecal bacteria in these segments of Deckers Creek and MUB is working to alleviate all associated impacts.

Table 12 provides an overview of the major land uses and wastewater treatment systems in each subwatershed. A brief reasoning for choosing to focus on specific segments during the wastewater assessment is also provided. Upon completion of the assessment, five subwatersheds were deemed target watersheds for addressing wastewater pollution sources through this Watershed Based Plan. These subwatersheds are in bold in Table 12.

In watersheds with agriculture and forest as the dominant land uses, fecal coliform bacteria pollution may be associated with wildlife and livestock. Cattle excrement can contain *Escherichia coli* (i.e., *E. coli*), *Cryptosporidium* spp., and *Giardia* spp., among other pathogens (Higgins et al. 2011). These many impairments caused by cattle can lead to the degradation of an otherwise healthy stream. When resources become available, it is recommended that these subwatersheds be explored more thoroughly to determine the extent of fecal coliform bacteria impairment through additional data collection and source tracking.



Stream code (SWS)	Stream names	Major land uses	Wastewater treatment	Focus for assessment
M-8 (150, 196, 197, 198)	Deckers Creek RM 0 to 2	Urban, suburban	Centralized (Morgantown Utility Board), few septic systems and straight pipes possible	No. Morgantown Utility Board is addressing CSO discharges. Virtually all homes connected to mainline system.
M-8-0.5A (149)	Hartman Run	Urban, suburban	Centralized (Morgantown Utility Board), home aeration units, a few septic systems and straight pipes possible	No. Morgantown Utility Board is addressing CSO discharges. All home connected to mainline system.
M-8-A (18)	**Aarons Creek**	**Urban, suburban**	**Centralized (Morgantown Utility Board), home aeration units, septic systems, straight pipes**	**Yes. Majority of homes and businesses in watershed are hooked up to septic systems/straight pipes/HAUs. High bacteria levels documented.**
M-8 (20)	Decker Creek RM 2 to 5.5, UNT/Deckers Creek	Urban, suburban	Centralized, septic systems, straight pipes	No. Majority of homes and businesses along mainstem and are hooked up to mainline systems.
M-8-A.5 (20)	**Knocking Run**	**Urban, suburban**	**Centralized (Morgantown Utility Board), home aeration units, septic systems, straight pipes, package plants**	**Yes. Majority of homes and businesses in watershed are hooked up to septic systems/straight pipes/HAUs. High bacteria levels documented.**
M-8 (146)	Deckers Creek RM 5.5 to 6.1	Urban, suburban, agriculture	Centralized (Morgantown Utility Board), septic systems, straight pipes	No. All but a few homes and businesses in SWS are connected to centralized systems.
M-8-A.7 (19)	**Deep Hollow**	**Suburban, forest**	**Centralized (Deckers Creek PSD), home aeration units, septic systems, straight pipes**	**Yes. Majority of homes and businesses in watershed are hooked up to septic systems/straight pipes. High bacteria levels documented.**
M-8-B (21)	**Tibbs Run**	**Suburban, forest**	**Centralized (Deckers Creek PSD), septic systems, straight pipes, HAUs, package plants**	**Yes. Many homes in watershed are hooked up to septic systems/straight pipes/HAUs. Package plant in headwaters with known violations. High bacteria levels documented.**
M-8 (147, 148)	**Deckers Creek RM 6.1 to 13.1**	**Forest, suburban, industrial/mined land**	**Home aeration units, septic systems, straight pipes**	**Yes. Majority of homes are connected to septic systems or straight pipes.**
M-8-D (17)	Glady Run	Forest, agriculture	Septic systems, straight pipes	No. Agriculture and low development. Difficult to separate impacts from agriculture vs. wastewater.
M-8 (22, 23, 24, 96, 97, 98, 99, 100, 101, 102)	Deckers Creek RM 13.1 to 18.2, Laurel Run, UNTs/Deckers Creek	Forest, agriculture, suburban	Centralized (Reedville/Masontown sewer system) , septic systems, straight pipes	No. Low development, majority of houses are connected to mainline systems, and high levels of agriculture would make it difficult to determine exact sources of fecal bacteria.
M-8-G (15, 16, 207, 208)	Dillan Creek	Forest, agriculture, suburban	Centralized (Reedsville/Masontown sewer system, septic systems, straight pipes	No. Low development, majority of houses are connected to mainline systems, and high levels of agriculture would make it difficult to determine exact sources of fecal bacteria.
M-8-I (205, 206)	**Kanes Creek**	**Forest, agriculture, suburban**	**Centralized (Reedville/Masontown sewer system), septic systems, straight pipes, package plants**	**Yes. Known failing septic systems in the headwaters region.**
M-8 (103, 209, 210)	**Deckers Creek RM 18.2 to 23.7**	**Forest, agriculture suburban**	**Centralized (Reedsville/Masontown sewer system), home aeration units, septic systems, straight pipes, package plant**	**Yes. Limited data in the headwaters region. Known problem areas.**

Table 12: Overview of wastewater assessment (Christ and Pavlick, 2006).

Sediment

No Deckers Creek or subwatershed segments have TMDLs developed for sediment loads. However, sediment is identified by the WV TMDL's as a potential stressor in Deckers Creek, Aaron Creek, and UNT/Deckers Creek RM 5.70 (Figure 10).

Aaron Creek has embedded rocks, suggesting possible sediment input, possibly from inadequately controlled construction practices and unstable stream banks, as well as uncontrolled agricultural practices regarding livestock. The location of the stream bank destabilization was likely once bottomland hardwood forest, but is now agricultural livestock grazing land. The alteration to native vegetation and landscape has affected local hydrology causing increased run-off and higher velocity flows in the stream channel. FODC has observed relatively high turbidity, grassy chunks of streambank in the stream and moving sand in the streambed even at average flows along much of the channelized stretch.

In addition, six miles of stream channels were dredged and straightened as part of the flood protection project in the upper part of the watershed. These channels are prone to streambank erosion. Evidence of sediment contamination consists of embedded substrate, channel incision, and destruction of aquatic habitat due to reduced interstitial pore space in the steam substrate. Further studies are anticipated in the upper watershed to thoroughly evaluate the severity of sediment degradation as well as initiate sediment remediation planning.

In 2014, FODC developed a stream bank stabilization plan to remediate sediment inputs into Aaron Creek. The project was funded by EPA 319(h) funding and calls for grading out incised channels, re-vegetating, and installing fencing, cattle crossings, and solar powered livestock watering systems to reduce livestock impacts on the stream bank.

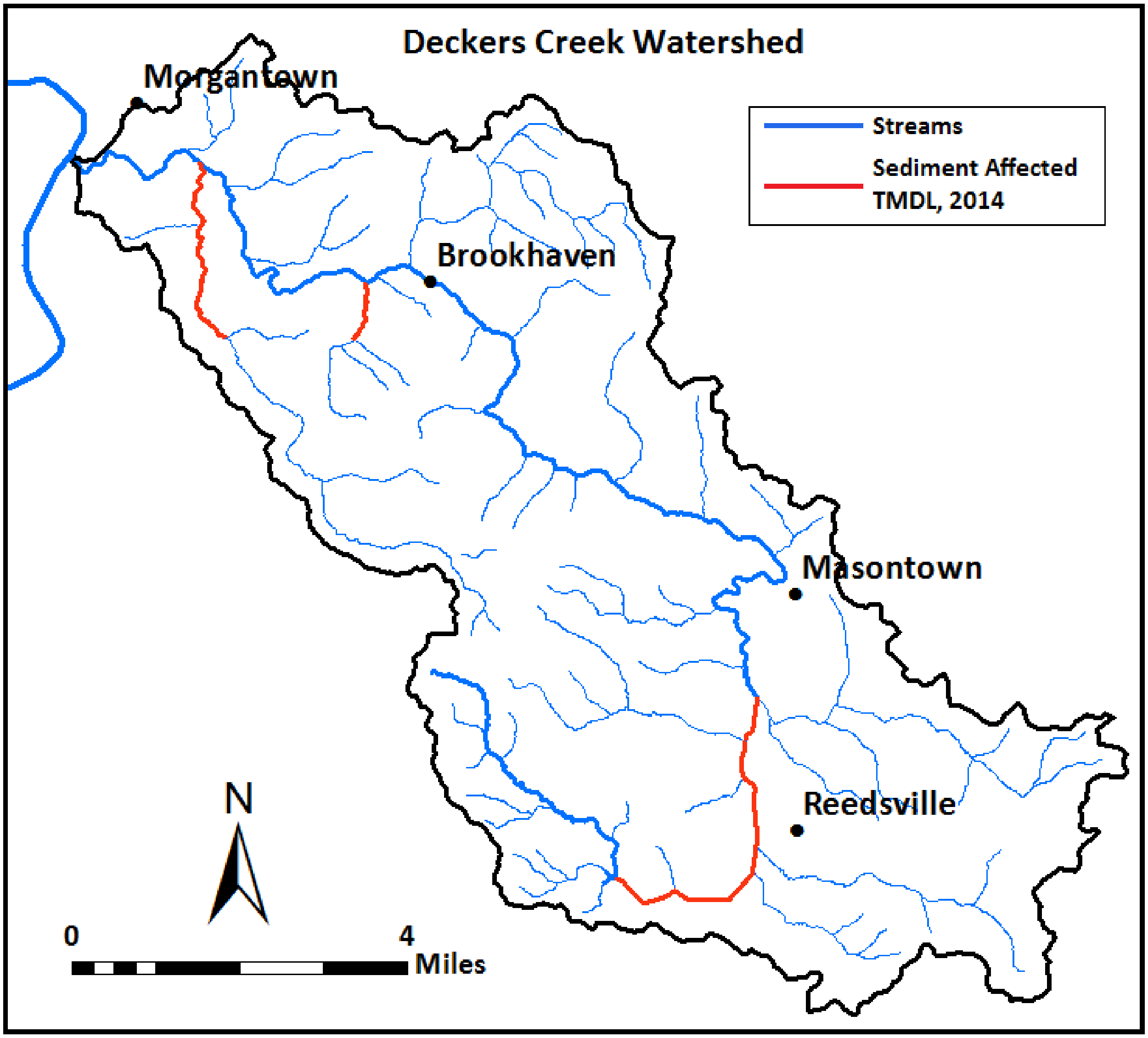


Figure 10: Location of streams segments that may be impaired by sediment.

Lead

From Christ and Pavlick, 2006:

One tributary (UNT/Deckers Creek RM 18.48; WV-M-14-W) is impaired by lead. A foundry for plumbing fixtures in the upper part of the watershed used sand in their processes. The sand became infused with lead and other metals, and was landfilled in three areas of the watershed (Figure 11).

Concentrations of lead violating the aquatic life designated use have been found in the stream water. According to area residents, there are approximately 45 acres where the fill material may have been used in the watershed of this tributary, and an additional 10 acres of fill material that may contribute lead to other segments of the Deckers Creek stream system. WVDEP is currently monitoring the watershed to see if lead impairments will be detected again, and if they are, will prepare a TMDL by the end of 2017.

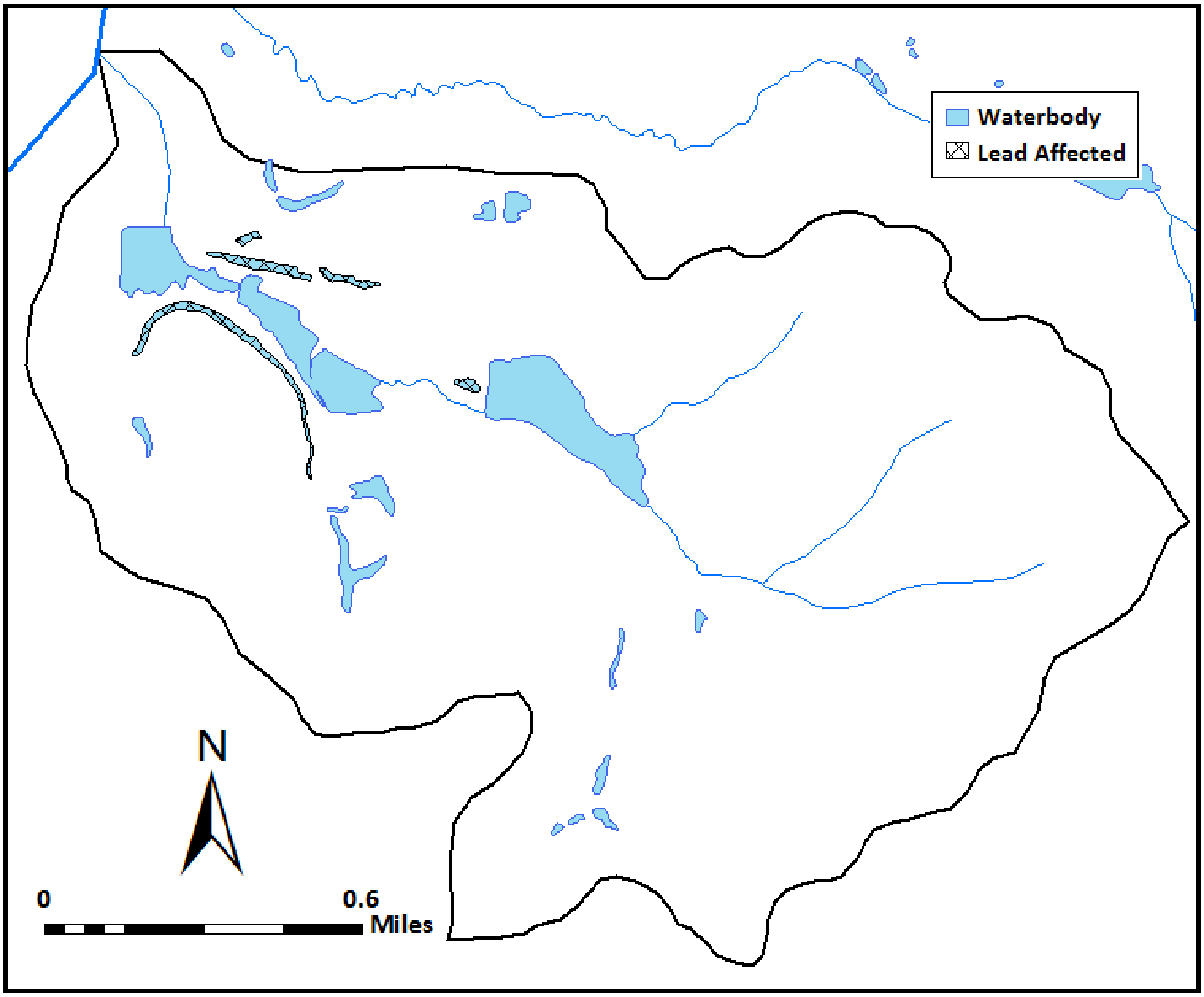


Figure 11: Source of possible lead contamination in UNT/Deckers Creek RM 18.48.

ELEMENT B: ESTIMATED LOAD REDUCTIONS

Since implementation of an U.S. EPA accepted WBP plan in the Deckers Creek watershed, load reductions have been observed at seven completed FODC AMD project sites (Tables 13-15).

Former Projects

Load reductions

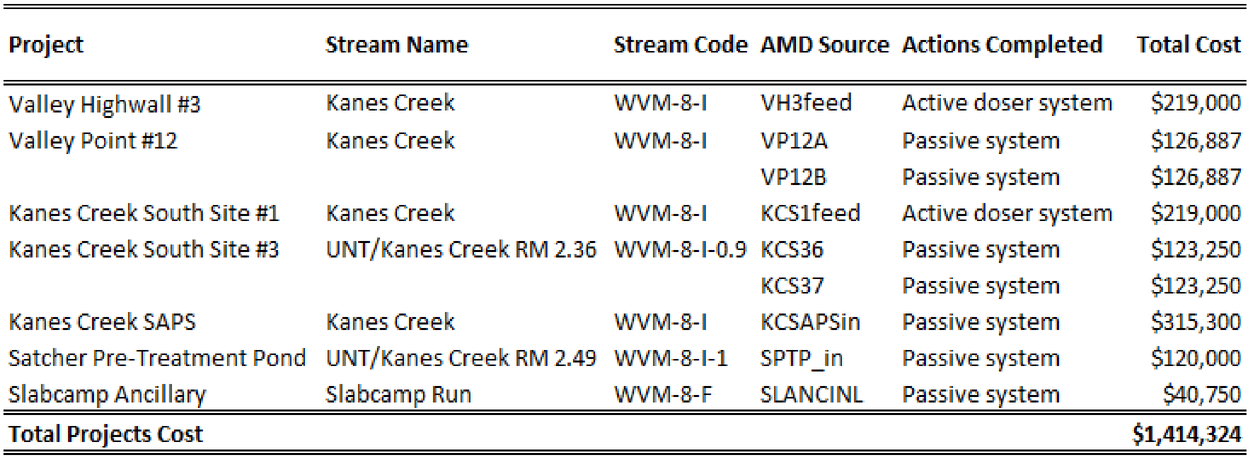
FODC Project Site ID	Short ID	Acid L	Al L	Fe L	Mn L
		lbs/year			
Valley Highwall #3	VH3feed	21,955	758	1,492	16
	VH3weir	13,887	646	1,400	21
Valley Point #12	VP12A	41,858	2,171	5,967	57
	VP12B	10,948	621	1,211	28
	VP12Road	22,109	1,299	462	170
Kanes Creek South Site #1	KCS1feed	10,271	370	988	13
	KCS1byp	959	47	20	2
	KCS1weir	1,312	112	137	10
Kanes Creek South Site #3	KCS36cmp	27,026	1,666	1,188	104
	KSC37cmp	5,113	410	462	30
	KCS3out	3,060	229	54	132
Kanes Creek SAPS	KCSAPSin	19,205	946	2,633	96
	KCSAPSout	8,163	440	162	123
Satcher Pre-Treatment Pond	SPTPin	70,967	1,598	7,346	79
	SPTPout	22,227	865	3,275	81
Slabcamp Ancillary	SLANCINL	7,925	294	117	53
	SLSLGout	2,610	129	227	29
	SLALSout	1,111	42	53	31

Table 13: Averaged loads calculated at sources/effluent for each FODC operated AMD treatment system.

FODC Project Site ID	Short ID	Acid L	Al L	Fe L	Mn L
		lbs/year and percentage			
Valley Highwall #3	VH3	8,067	112	92	-5
	VH3	37%	15%	6%	-31%
Valley Point #12	VP12	30,697	1,493	6,716	-85
	VP12	58%	53%	94%	-100%
Kanes Creek South Site #1	KCS1	9,918	305	871	5
	KCS1	88%	73%	86%	33%
Kanes Creek South Site #3	KCS3	29,079	1,847	1,596	2
	KCS3	90%	89%	97%	1%
Kanes Creek SAPS	KCSAPS	82,009	2,103	9,817	52
	KCSAPS	91%	83%	98%	30%
Satcher Pre-Treatment Pond	SPTP	48,740	733	4,072	-2
	SPTP	69%	46%	55%	-2%
Slabcamp Ancillary	SlabAnc	6,814	252	64	22
	SlabAnc	86%	86%	55%	42%

Table 14: Load reductions for FODC operated AMD treatment listed as lbs/year and percent reduction.

Costs



Project	Stream Name	Stream Code	AMD Source	Actions Completed	Total Cost
Valley Highwall #3	Kanes Creek	WVM-8-I	VH3feed	Active doser system	$219,000
Valley Point #12	Kanes Creek	WVM-8-I	VP12A	Passive system	$126,887
			VP12B	Passive system	$126,887
Kanes Creek South Site #1	Kanes Creek	WVM-8-I	KCS1feed	Active doser system	$219,000
Kanes Creek South Site #3	UNT/Kanes Creek RM 2.36	WVM-8-I-0.9	KCS36	Passive system	$123,250
			KCS37	Passive system	$123,250
Kanes Creek SAPS	Kanes Creek	WVM-8-I	KCSAPSin	Passive system	$315,300
Satcher Pre-Treatment Pond	UNT/Kanes Creek RM 2.49	WVM-8-I-1	SPTP_in	Passive system	$120,000
Slabcamp Ancillary	Slabcamp Run	WVM-8-F	SLANCINL	Passive system	$40,750
Total Projects Cost					**$1,414,324**

Table 15: Construction costs associated with former FODC AMD Remediation projects.

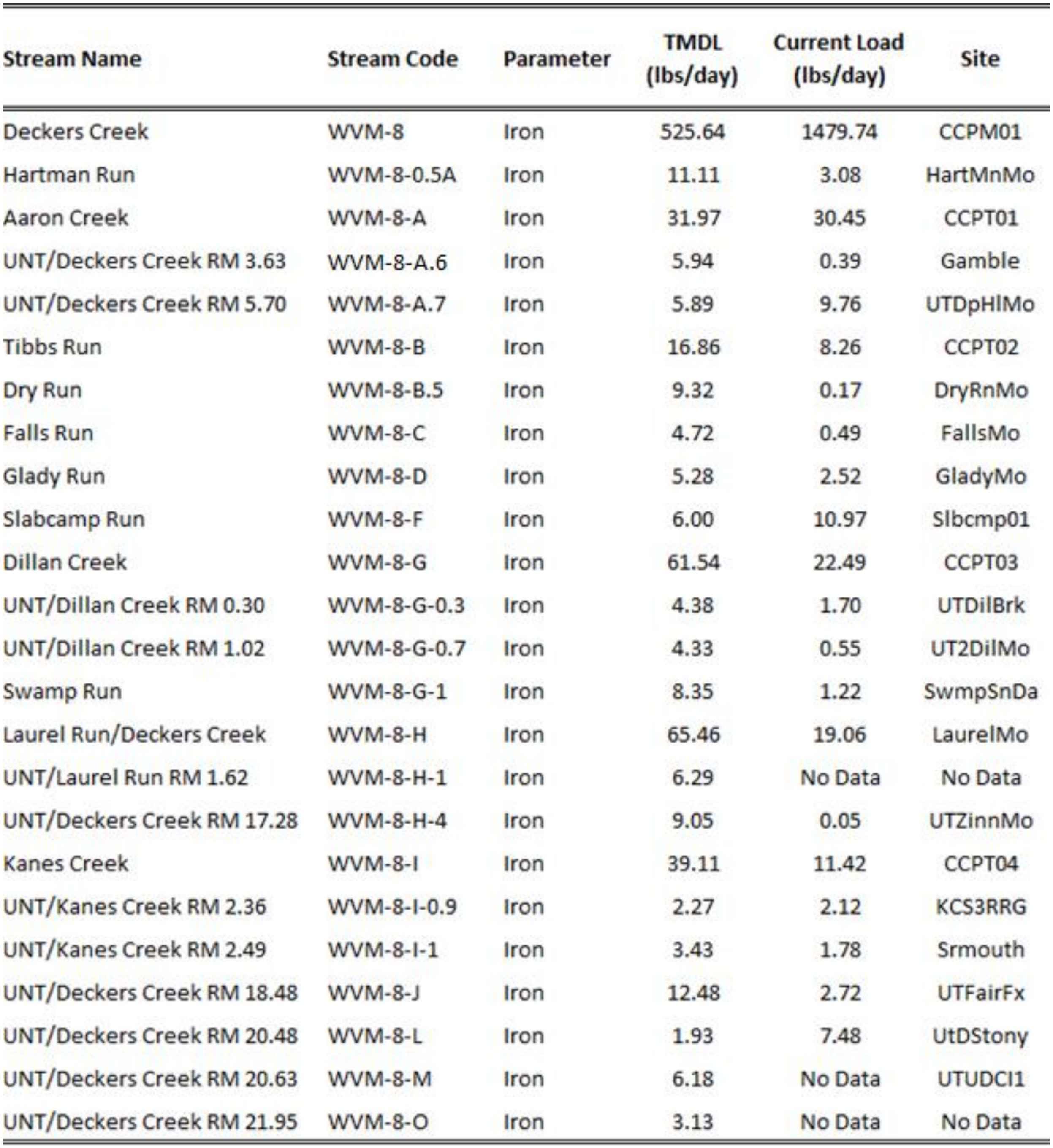
Future Projects

This section discusses AMD related contaminant sources and TMDL (Tables 16-20) within subwatersheds of the larger Deckers Creek watershed (Tables 21-45; Figures 12-36), and costs associated with remediation at each AMD source (Table 46). Each subwatershed will be reviewed in an upstream trend from the mouth of Deckers Creek where Deckers Creek discharges into the Monongahela River, Morgantown, WV, to the headwaters of Deckers Creek west of Arthurdale, WV. Field observations of changes in water quality above and below pollutant sources provide evidence that remediation of those sources will benefit the streams. Measurements needed to compare source loads with in-stream loads are available in only a few cases. Twenty-four subwatersheds/segments within the greater Deckers Creek watershed indicate contamination issues based on the WVDEP TMDLs (WVDEP, 2014).

Load Reductions

Stream Name	Stream Code	Actions Planned	Length of Improved Segment (meters)
Deckers Creek	WVM-8	Construct BMPs	20,251.0
Hartman Run	WVM-8-0.5A	Construct BMPs	2,513.0
Aaron Creek	WVM-8-A	No action planned	0.0
Knocking Run	WVM-8-A.5	No action planned	0.0
UNT/Deckers Creek RM 3.63	WVM-8-A.6	No action planned	0.0
UNT/Deckers Creek RM 5.70	WVM-8-A.7	Construct BMPs	3,448.0
Tibbs Run	WVM-8-B	No action planned	0.0
Dry Run	WVM-8-B.5	No action planned	0.0
Falls Run	WVM-8-C	No action planned	0.0
Glady Run	WVM-8-D	Construct BMPs	1,959.0
Slabcamp Run	WVM-8-F	Construct BMPs	2,324.0
Dillan Creek	WVM-8-G	Construct BMPs	8,681.0
UNT/Dillan Creek RM 0.30	WVM-8-G-0.3	No action planned	0.0
UNT/Dillan Creek RM 1.02	WVM-8-G-0.7	No action planned	0.0
Swamp Run	WVM-8-G-1	Mitigation	2,255.0
Laurel Run/Deckers Creek	WVM-8-H	Construct BMPs	1,260.0
UNT/Laurel Run RM 1.62	WVM-8-H-1	No action planned	0.0
UNT/Deckers Creek RM 17.28	WVM-8-H-4	No action planned	0.0
Kanes Creek	WVM-8-I	Construct BMPs	6,564.0
UNT/Kanes Creek RM 2.36	WVM-8-I-0.9	Construct BMPs	890.0
UNT/Kanes Creek RM 2.49	WVM-8-I-1	Construct BMPs	726.0
UNT/Deckers Creek RM 18.48	WVM-8-J	No action planned	0.0
UNT/Deckers Creek RM 20.48	WVM-8-L	No action planned	0.0
UNT/Deckers Creek RM 20.63	WVM-8-M	No action planned	0.0
UNT/Deckers Creek RM 21.95	WVM-8-O	No action planned	0.0
Total Improved Length			**50,871.0**

Table 16: Actions planned in each subwatershed described by the TMDL.



Stream Name	Stream Code	Parameter	TMDL (lbs/day)	Current Load (lbs/day)	Site
Deckers Creek	WVM-8	Iron	525.64	1479.74	CCPM01
Hartman Run	WVM-8-0.5A	Iron	11.11	3.08	HartMnMo
Aaron Creek	WVM-8-A	Iron	31.97	30.45	CCPT01
UNT/Deckers Creek RM 3.63	WVM-8-A.6	Iron	5.94	0.39	Gamble
UNT/Deckers Creek RM 5.70	WVM-8-A.7	Iron	5.89	9.76	UTDpHlMo
Tibbs Run	WVM-8-B	Iron	16.86	8.26	CCPT02
Dry Run	WVM-8-B.5	Iron	9.32	0.17	DryRnMo
Falls Run	WVM-8-C	Iron	4.72	0.49	FallsMo
Glady Run	WVM-8-D	Iron	5.28	2.52	GladyMo
Slabcamp Run	WVM-8-F	Iron	6.00	10.97	Slbcmp01
Dillan Creek	WVM-8-G	Iron	61.54	22.49	CCPT03
UNT/Dillan Creek RM 0.30	WVM-8-G-0.3	Iron	4.38	1.70	UTDilBrk
UNT/Dillan Creek RM 1.02	WVM-8-G-0.7	Iron	4.33	0.55	UT2DilMo
Swamp Run	WVM-8-G-1	Iron	8.35	1.22	SwmpSnDa
Laurel Run/Deckers Creek	WVM-8-H	Iron	65.46	19.06	LaurelMo
UNT/Laurel Run RM 1.62	WVM-8-H-1	Iron	6.29	No Data	No Data
UNT/Deckers Creek RM 17.28	WVM-8-H-4	Iron	9.05	0.05	UTZinnMo
Kanes Creek	WVM-8-I	Iron	39.11	11.42	CCPT04
UNT/Kanes Creek RM 2.36	WVM-8-I-0.9	Iron	2.27	2.12	KCS3RRG
UNT/Kanes Creek RM 2.49	WVM-8-I-1	Iron	3.43	1.78	Srmouth
UNT/Deckers Creek RM 18.48	WVM-8-J	Iron	12.48	2.72	UTFairFx
UNT/Deckers Creek RM 20.48	WVM-8-L	Iron	1.93	7.48	UtDStony
UNT/Deckers Creek RM 20.63	WVM-8-M	Iron	6.18	No Data	UTUDCI1
UNT/Deckers Creek RM 21.95	WVM-8-O	Iron	3.13	No Data	No Data

Table 17: TMDL for iron.

Stream Name	Stream Code	Parameter	TMDL (lbs/day)	Current (lbs/day)	Site
Glady Run	WVM-8-D	Aluminum	0.54	0.44	GladyMo
Slabcamp Run	WVM-8-F	Aluminum	1.16	33.86	Slbcmp01
Dillan Creek	WVM-8-G	Aluminum	6.96	5.97	CCPT03
Laurel Run/Deckers Creek	WVM-8-H	Aluminum	24.04	21.90	LaurelMo
Kanes Creek	WVM-8-I	Aluminum	5.31	1.81	CCPT04
UNT/Kanes Creek RM 2.36	WVM-8-I-0.9	Aluminum	0.22	11.08	KCS3RRG
UNT/Kanes Creek RM 2.49	WVM-8-I-1	Aluminum	0.87	7.97	SRmouth

Table 18: TMDL for aluminum.

Stream Name	Stream Code	Parameter	Net Acidity TMDL (lbs CaCO3/day)	Current TMDL (lbs CaCO3/day)	Site
Glady Run	WVM-8-D	Acidity	-2.45	6.36	GladyMo
Slabcamp Run	WVM-8-F	Acidity	-3.65	448.69	Slbcmp01
Dillan Creek	WVM-8-G	Acidity	-954.06	-1571.66	CCPT03
Laurel Run/Deckers Creek	WVM-8-H	Acidity	-3709.99	281.52	LaurelMo
Kanes Creek	WVM-8-I	Acidity	-43.59	-265.69	CCPT04
UNT/Kanes Creek RM 2.36	WVM-8-I-0.9	Acidity	-4.39	304.67	KCS3RRG
UNT/Kanes Creek RM 2.49	WVM-8-I-1	Acidity	-5.22	165.97	SRmouth

Table 19: TMDL for acidity.

Stream Name	Stream Code	Parameter	TMDL counts/day	Current Load counts/day	Site
Deckers Creek	WVM-8	Fecal	4.16E+11	4.06E+12	CCPM01
Hartman Run	WVM-8-0.5A	Fecal	6.74E+09	1.52E+09	HartMnMo
Aaron Creek	WVM-8-A	Fecal	4.40E+10	5.33E+10	CCPT01
Knocking Run	WVM-8-A.5	Fecal	1.09E+10	8.52E+09	KnockingSab
UNT/Deckers Creek RM 5.70	WVM-8-A.7	Fecal	1.20E+10	5.24E+10	UTDpHlMo
Tibbs Run	WVM-8-B	Fecal	3.42E+10	1.04E+11	CCPT02
Dillan Creek	WVM-8-G	Fecal	4.67E+10	7.87E+10	CCPT03

Table 20: TMDL for fecal coliform.

Deckers Creek (WVM-8)

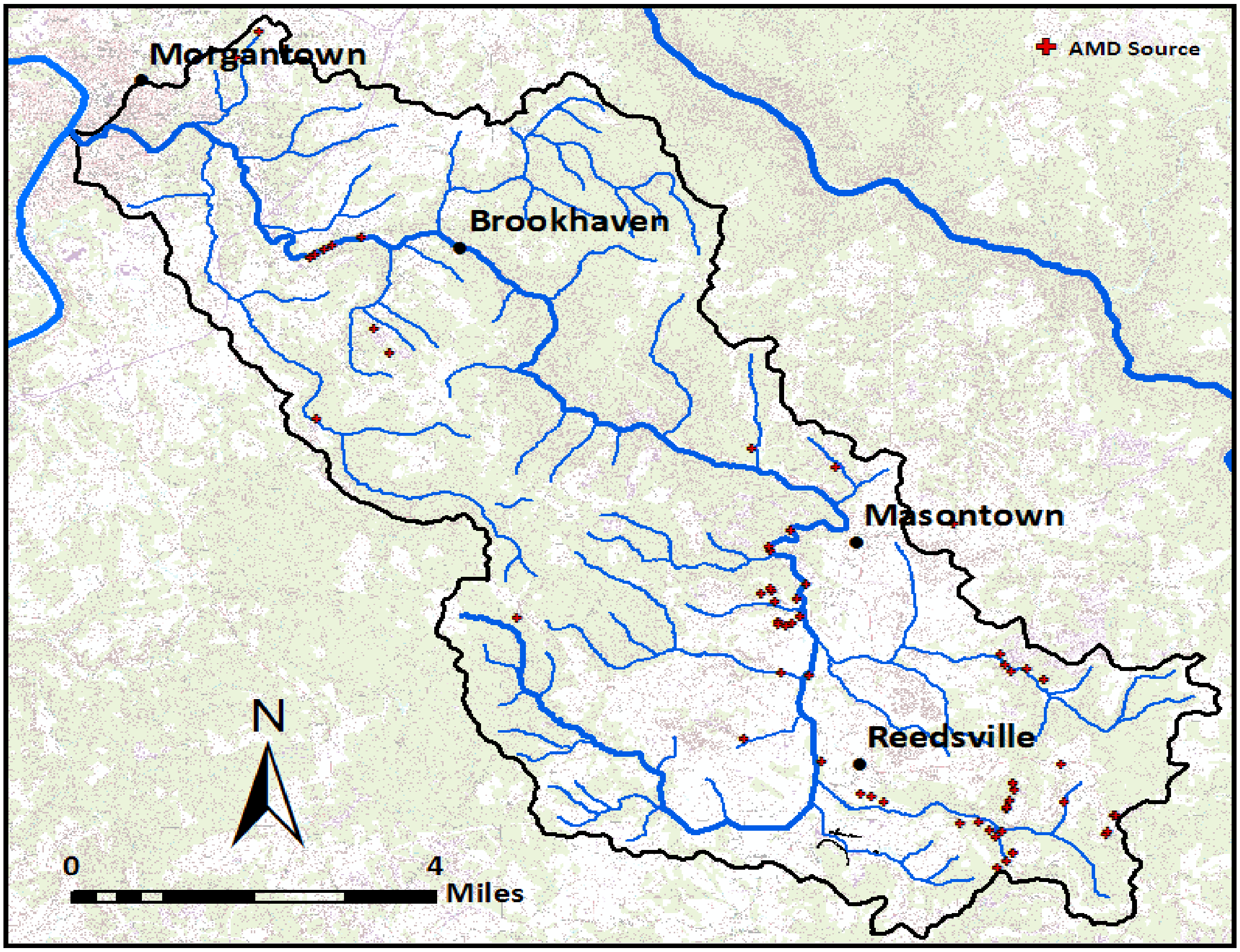


Figure 12: Deckers Creek (WVM-8; SWS ID: 2131, 2156, 2133, 2148, 2150, 2144, 2135, 2127, 2125, 2123, 2121, 2118, 2113, 2101, 2111, 2103, 2129, 2164, 2161, 2162, 2158, 2115, and 2116).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day)	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
Richard	1988.01	196.43	508.89	-	Active	$5,000,000	90%	198.80	19.64	50.89	-
Dalton	-	-	-	-	Passive	$160,000	90%	-	-	-	-
RckFrgHT	-1.97	0.00	0.12	-	Passive	$160,000	90%	-0.20	0.00	0.01	-
RckFrgPVC	2.44	0.01	0.54	-	Passive	$160,000	90%	0.24	0.00	0.05	-
RckFrgRD	12.69	0.35	1.20	-	Passive	$160,000	90%	1.27	0.04	0.12	-
Bridge5AMD	79.62	4.88	19.85	-	Passive	$160,000	90%	7.96	0.49	1.99	-
Goat1A	1.02	0.09	0.00	-	Passive	$50,000	90%	0.10	0.01	0.00	-
Goat1B	1.30	0.14	0.01	-	Passive	$50,000	90%	0.13	0.01	0.00	-
Goat2	-	-	-	-	Passive	$50,000	90%	-	-	-	-
Bretz Matheny	-	-	-	-	Passive	OAMLR	90%	-	-	-	-
CCPM01	-	-	-	4.06E+12	TBD	TBD	90%	-	-	-	4.06E+11
Total	2083.11	201.90	530.61	4.06E+12		$5,950,000		208.31	20.19	53.06	4.06E+11
TMDL	-	-	525.64	4.16E+11				-	-	525.64	4.16E+11

Table 21: TMDL and source loads for Deckers Creek (WVM-8; SWS ID: 2131, 2156, 2133, 2148, 2150, 2144, 2135, 2127, 2125, 2123, 2121, 2118, 2113, 2101, 2111, 2103, 2129, 2164, 2161, 2162, 2158, 2115 and 2116).

Hartman Run (WVM-8-0.5A)

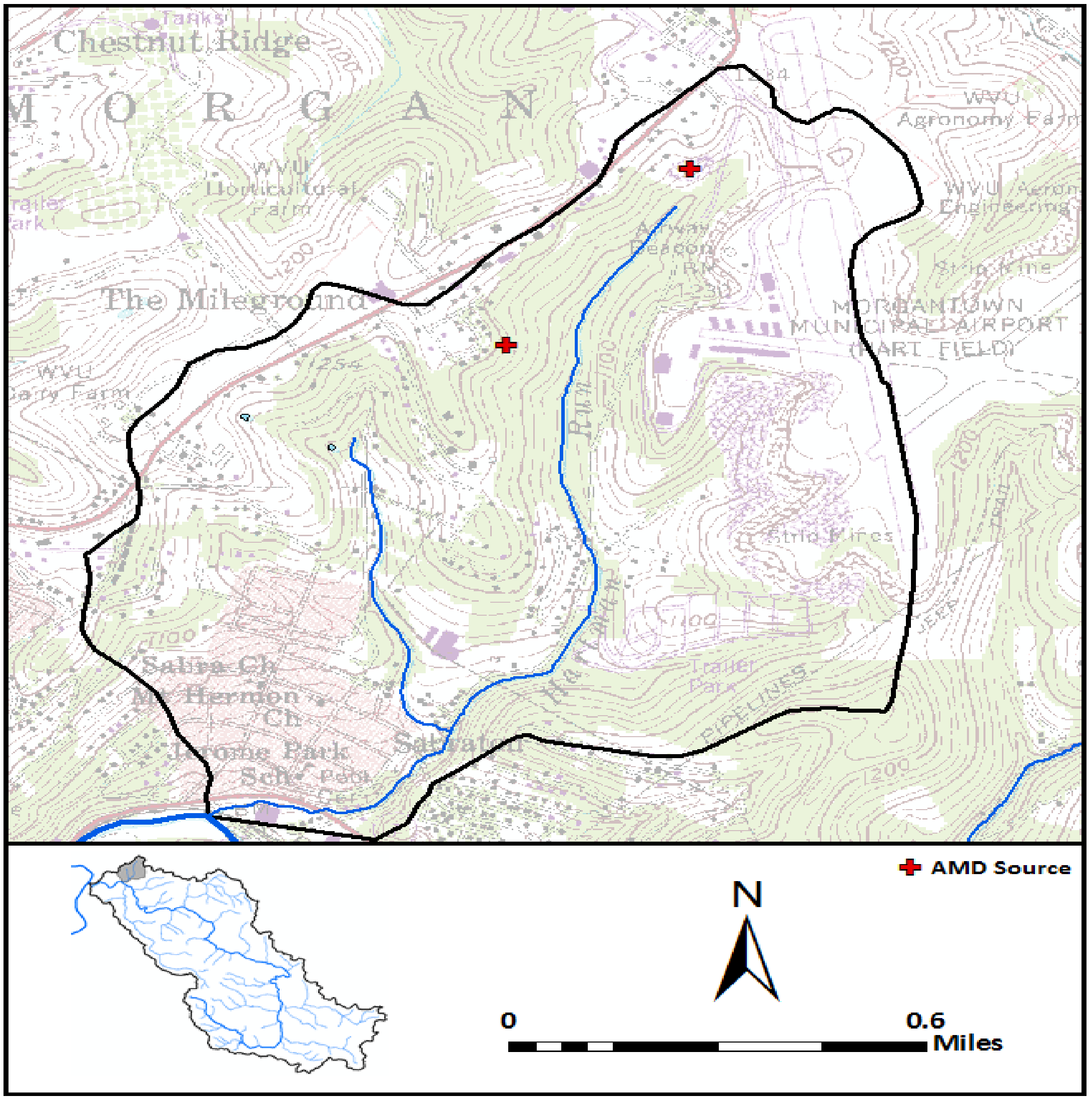


Figure 13: Hartman Run (WVM-8-0.5A; SWS ID: 2102).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
HrtMonGen	-0.12	0.01	0.05	-	Passive	$160,000	90%	-0.01	0.00	0.00	-
Mlgrweir	62.18	2.38	10.31	-	Passive	$160,000	90%	6.22	0.24	0.00	-
HartMnMo	-	-	-	1.52E+09	TBD	TBD	90%	-	-	-	1.52E+08
Total	62.06	2.39	10.36	1.52E+09		$320,000		6.21	0.24	0.00	1.52E+08
TMDL	-	-	11.11	6.74E+09				-	-	11.11	6.74E+09

Table 22: TMDL and source loads for Hartman Run (WVM-18-0.5A; SWS ID: 2102).

Aaron Creek (WVM-8-A)

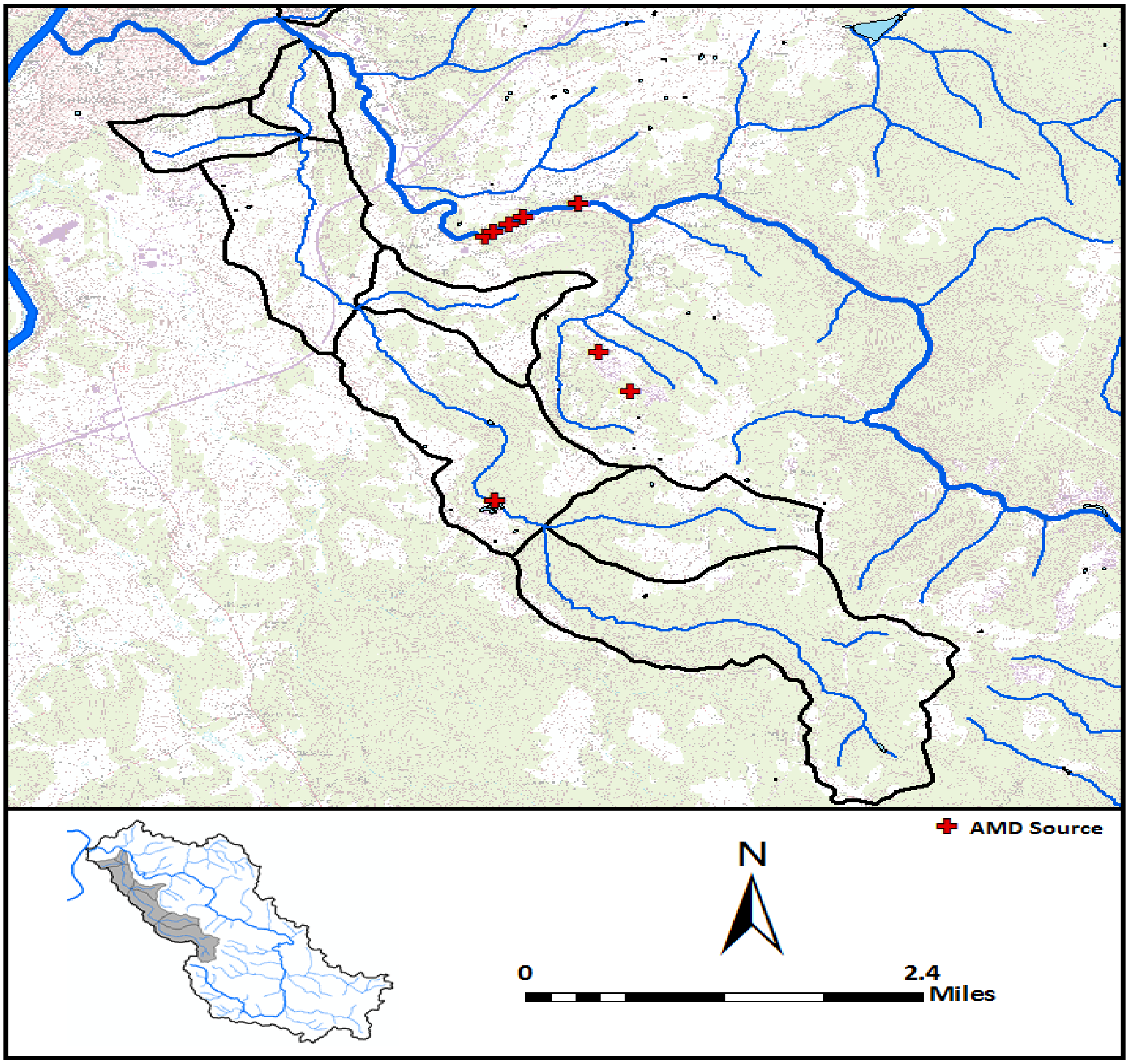


Figure 14: Aaron Creek (WVM-8-A; SWS ID: 2106, 2104, 2110 and 2108).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
AaronAMD	901.83	0.68	0.68	-	Passive	$160,000	90%	90.18	0.07	0.07	-
CCPT01	-	-	-	5.33E+10	TBD	TBD	90%	-	-	-	5.33E+09
Total	901.83	0.68	0.68	5.33E+10		$160,000		90.18	0.07	0.07	5.33E+09
TMDL	-	-	31.97	4.40E+10				-	-	31.97	4.40E+10

Table 23: TMDL and source loads for Aaron Creek (WVM-8-A; SWS ID: 2106, 2104, 2110, and 2108).

Knocking Run (WVM-8-A.5)

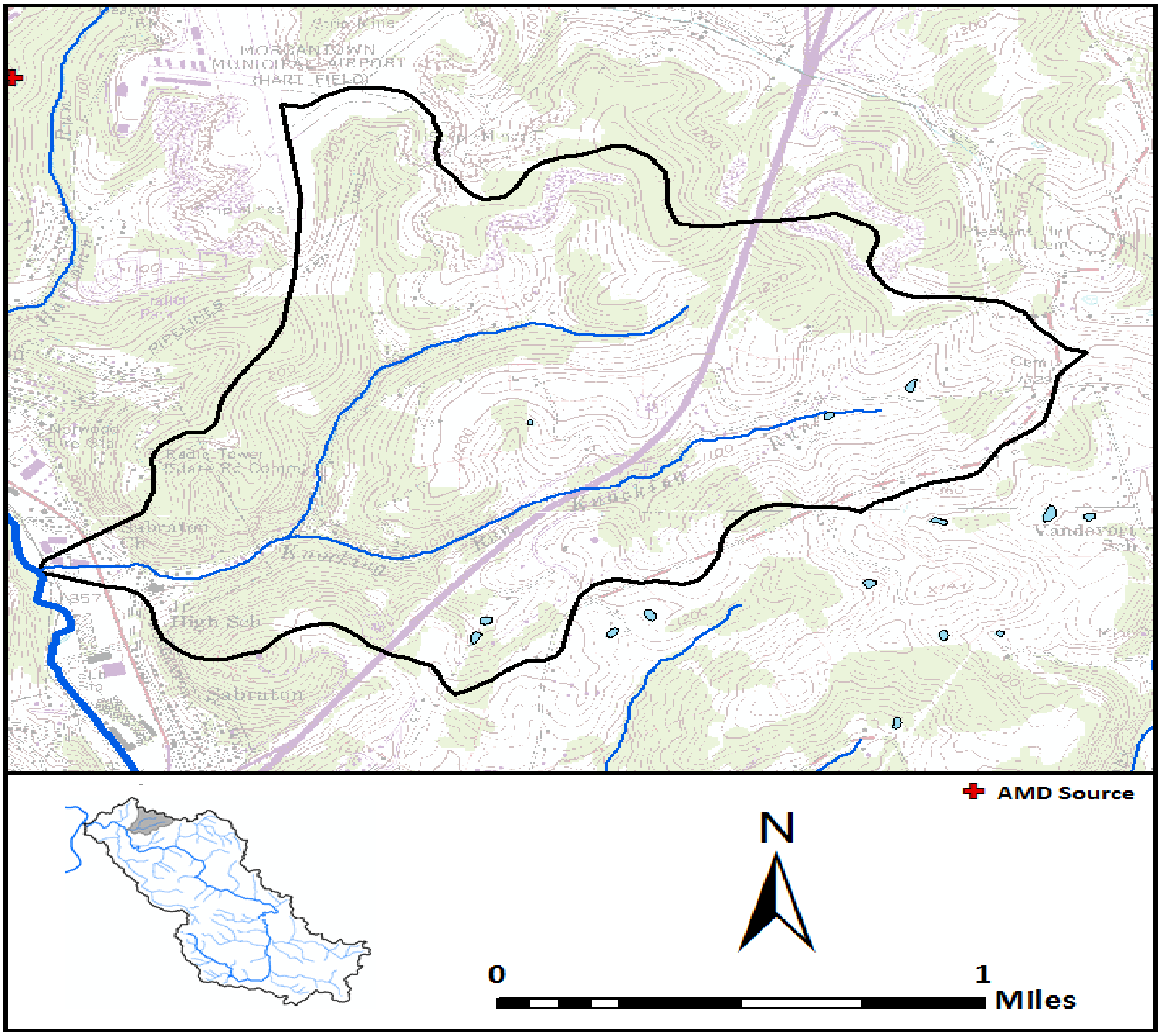


Figure 15: Knocking Run (WVM-8-A.5; SWS ID: 2112).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
KnockingSab	-	-	-	8.52E+09	TBD	TBD	90%	-	-	-	8.52E+08
Total	-	-	-	8.52E+09		TBD		-	-	-	8.52E+08
TMDL	-	-	-	1.09E+10				-	-	-	1.09E+10

Table 24: TMDL and source loads for Knocking Run (WVM-8-A.5; SWS ID: 2112).

UNT/Deckers Creek RM 3.63 (WVM-A.6)

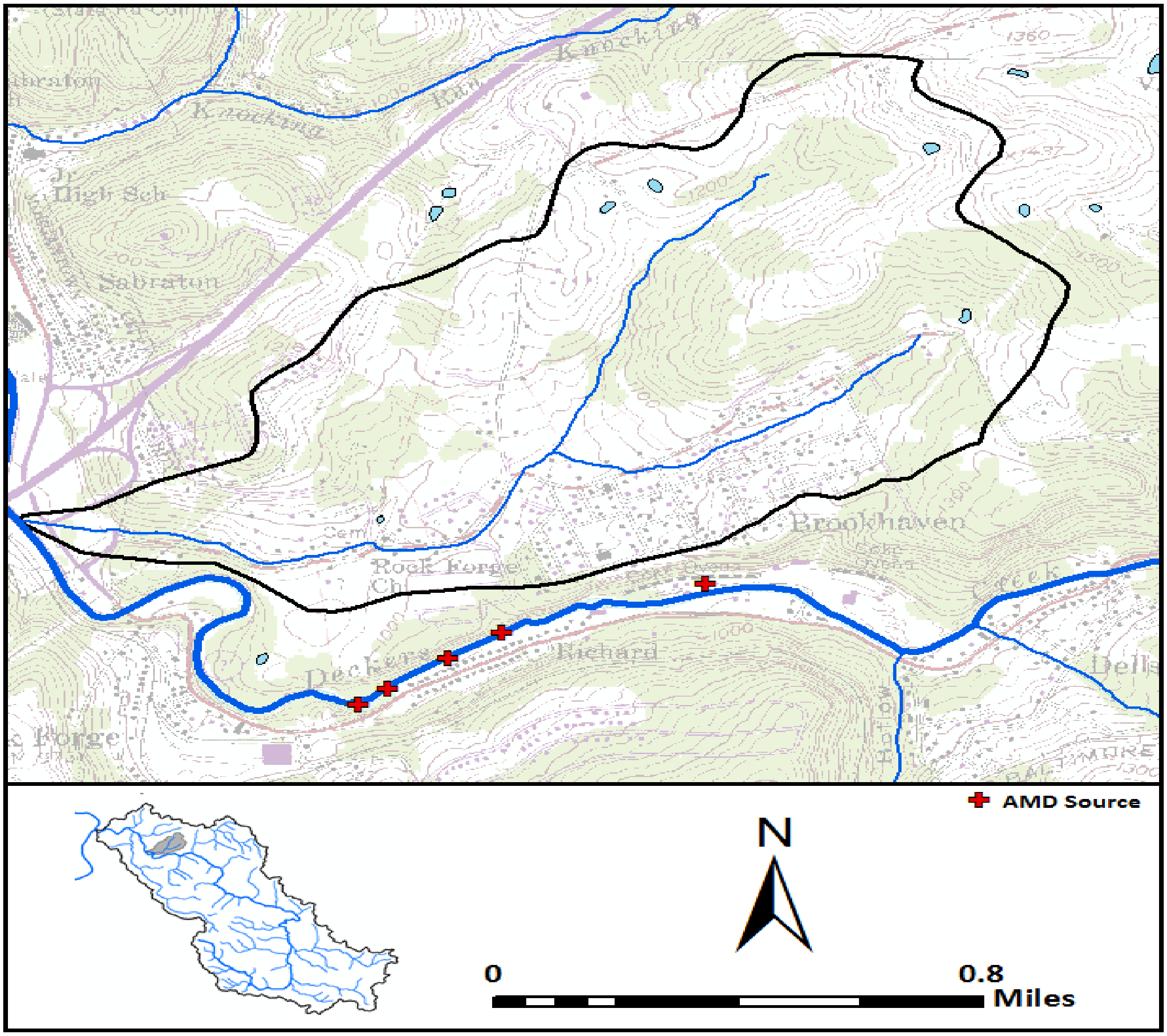


Figure 16: UNT/Deckers Creek RM 3.63 (WVM-8-A.6; SWS ID: 2114).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
Gamble	-	-	0.39	-	No Action	NA	0%	-	-	0.39	-
Total	-	-	0.39	-		NA		-	-	0.39	-
TMDL	-	-	5.89	-				-	-	5.89	-

Table 25: TMDL and source loads for UNT/Deckers Creek RM 3.63 (WVM-8-A.6; SWS ID: 2114).

UNT/Deckers Creek RM 5.70 (WVM-8-A.7)

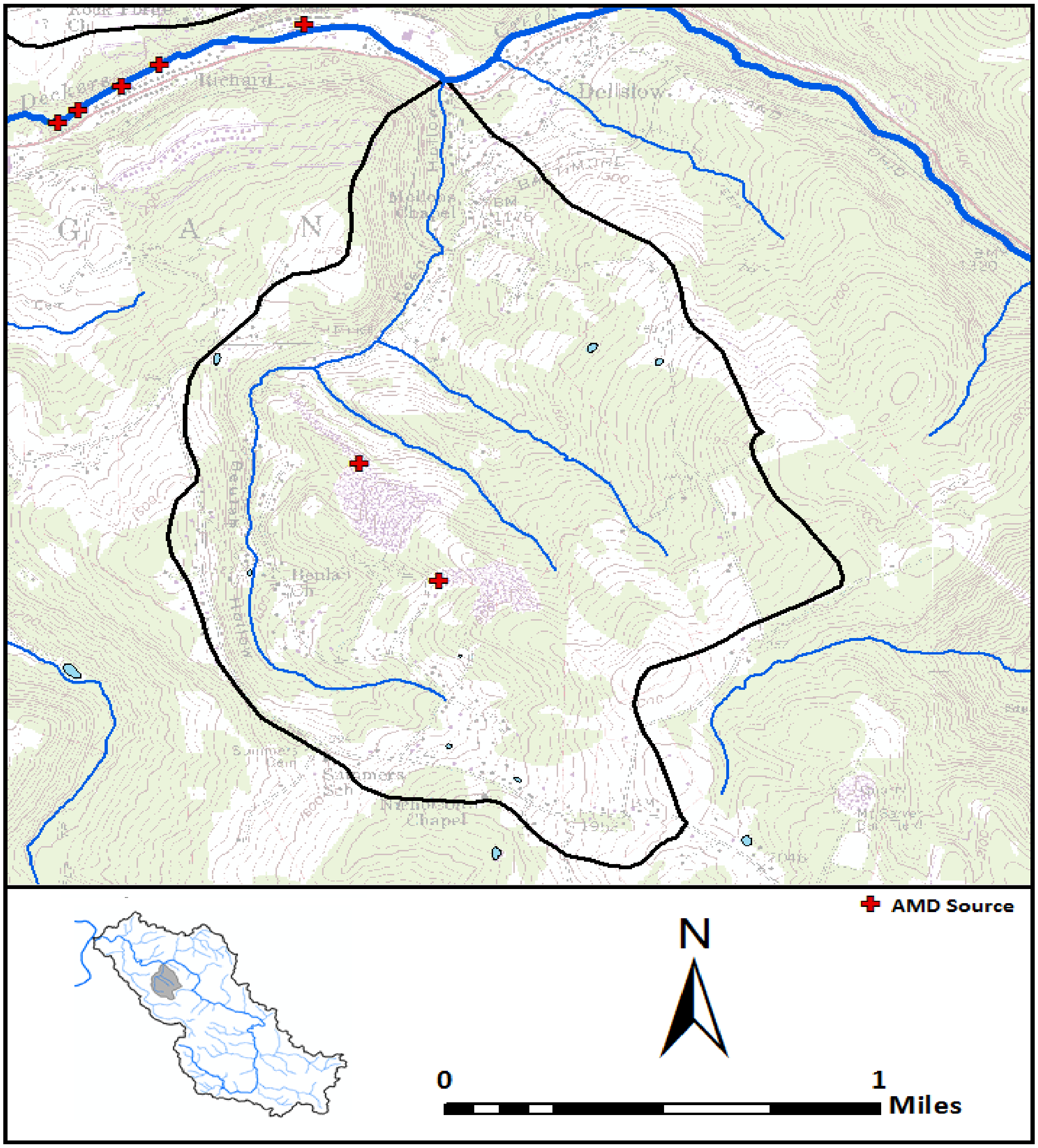


Figure 16: UNT/Deckers Creek RM 5.70 (WVM-8-A.7; SWS ID 2117).

Current Load					BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
Valley Mining	22.19	0.95	0.05	-	Passive	$100,000	90%	2.22	0.10	0.01	
Beulah Chapel	16.53	0.75	0.07	-	Passive	$100,000	90%	1.65	0.08	0.01	
UTDpHlMo	-	-	-	5.24E+10	TBD	TBD	90%	-	-	-	5.24E+09
Total	38.72	1.70	0.12	5.24E+10		$200,000		3.87	0.17	0.01	5.24E+09
TMDL	-	-	5.89	1.20E+10				-	-	5.89	1.20E+10

Table 25: TMDL and source loads for UNT/Deckers Creek RM 5.70 (WVM-8-A.7; SWS ID 2117).

Tibbs Run (WVM-8-B)

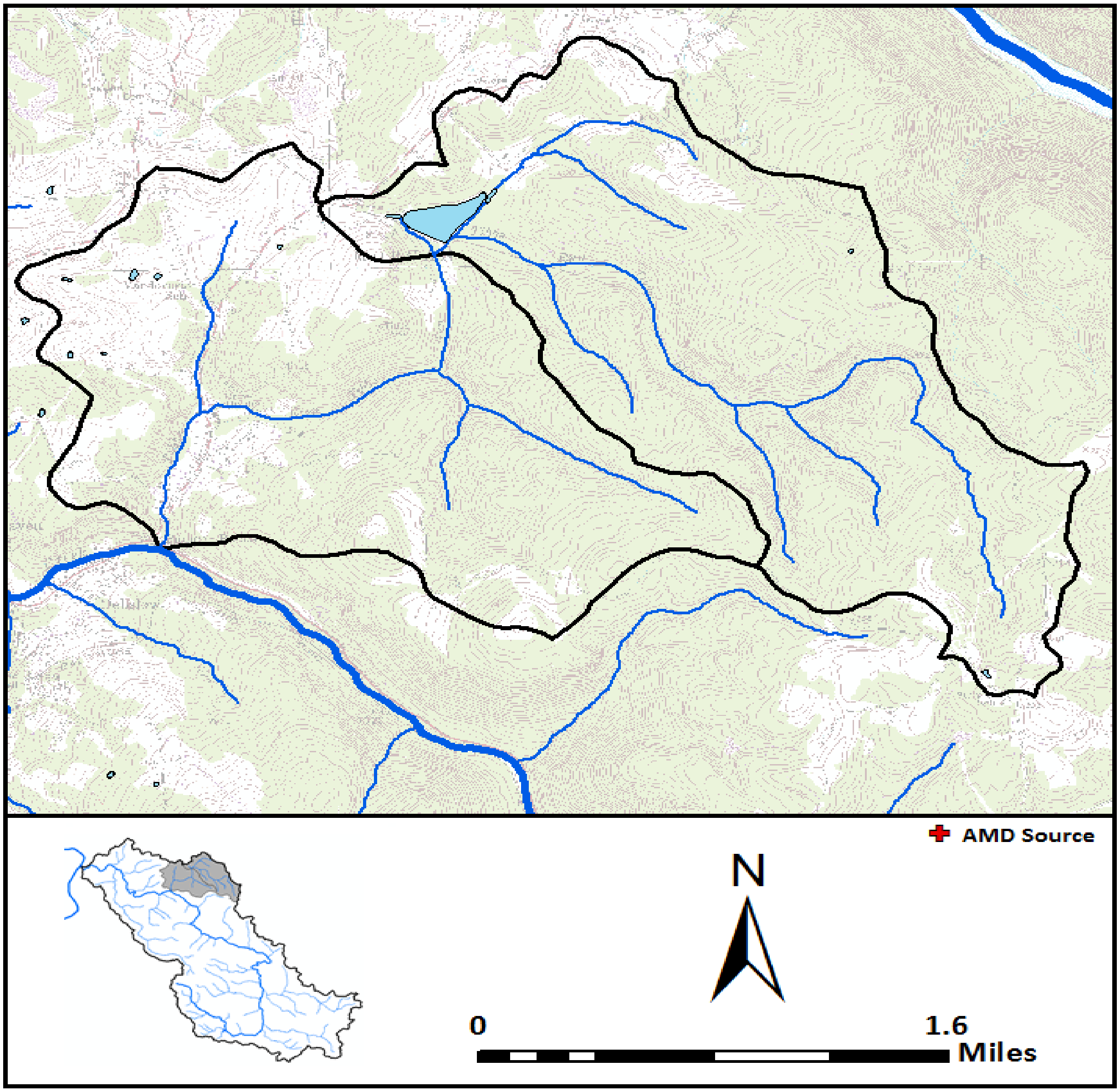


Figure 17: Tibbs Run (WVM-8-B; SWS ID: 2119 and 2120).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
CCPT02	-	-	8.26	1.04E+11	TBD	TBD	90%	-	-	0.83	1.04E+10
Total	-	-	8.26	-		TBD		-	-	0.83	1.04E+10
TMDL	-	-	16.86	3.42E+10				-	-	16.86	3.42E+10

Table 26: TMDL and source loads for Tibbs Run (WVM-8-B; SWS ID: 2119 and 2120).

Dry Run (WVM-8-B.5)

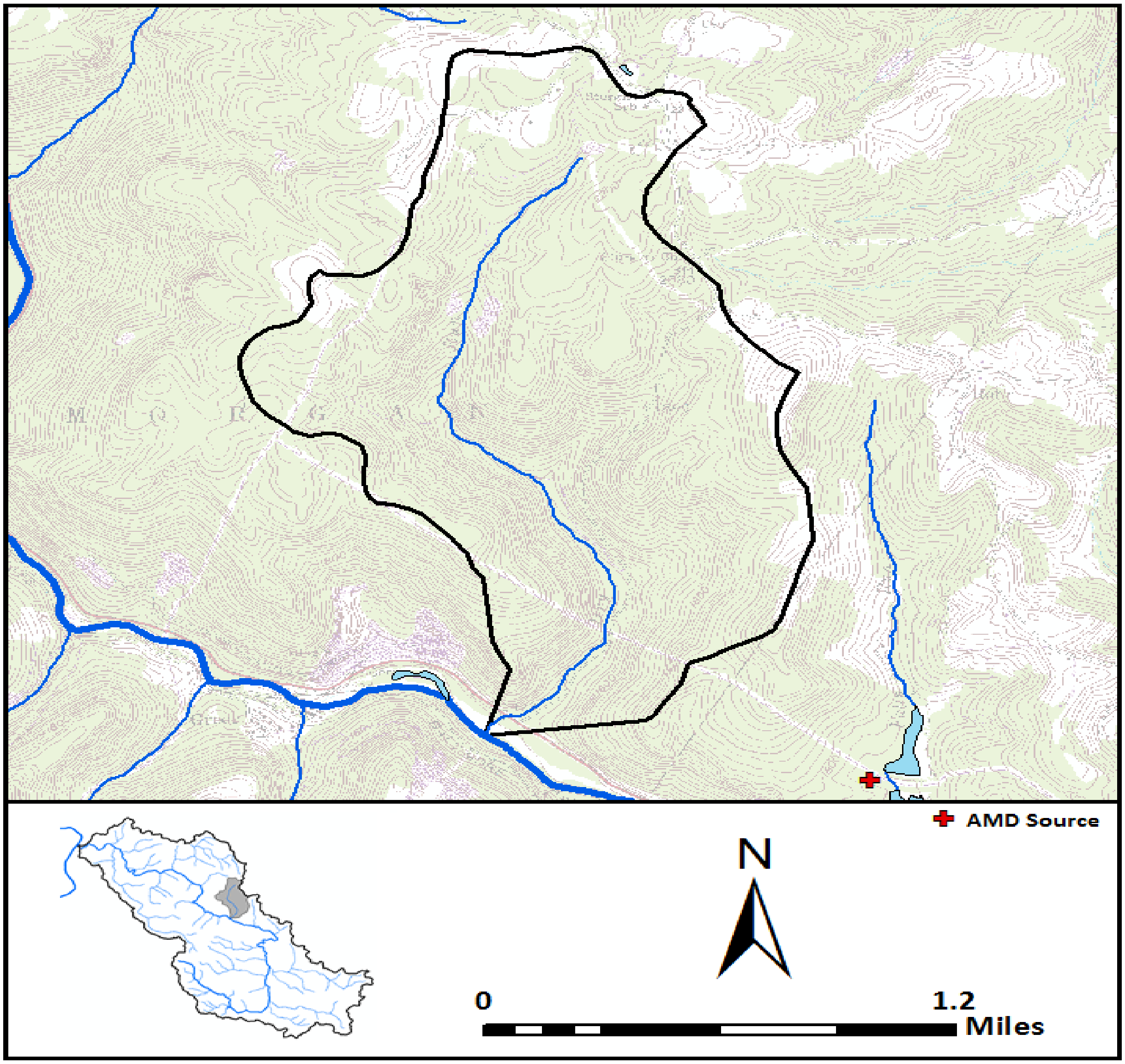


Figure 18: Dry Run (WVM-8-B.5; SWS ID: 2126).

Current Load					BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
DryRunMo	-	-	0.17	-	No Action	NA	0%	-	-	0.17	-
Total	-	-	0.17	-		NA		-	-	0.17	-
TMDL	-	-	9.32	-				-	-	9.32	-

Table 27: TMDL and source loads for Dry Run (WVM-8-B.5; SWS ID: 2126).

Falls Run (WVM-8-C)

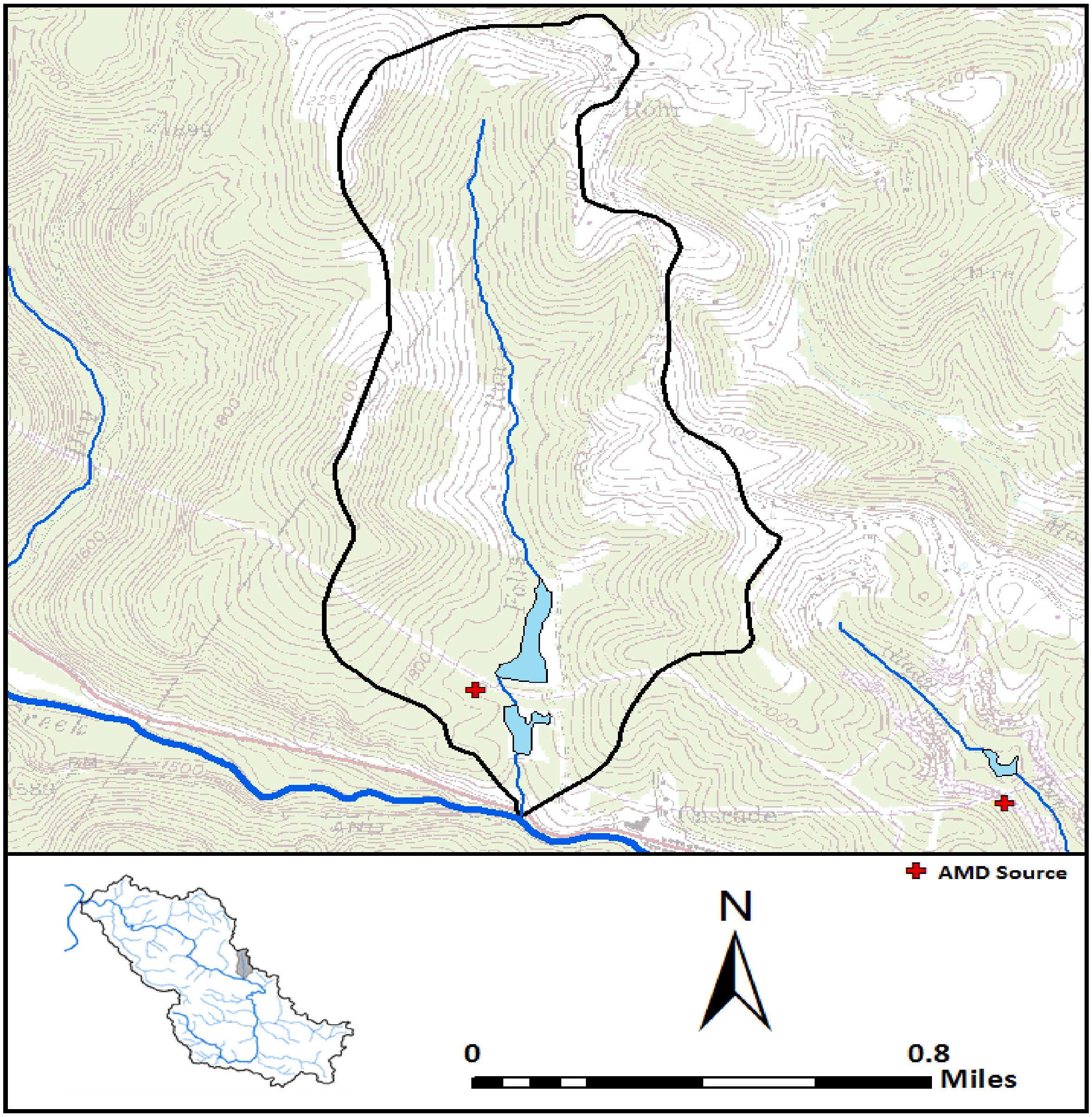


Figure 19: Falls Run (WVM-8-C; SWS ID: 2128).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
FallsAMD	-	-	-	-	Passive	$160,000	90%	-	-	-	-
Total	-	-	-	-		$160,000		-	-	-	-
TMDL	-	-	4.72	-				-	-	4.72	-

Table 28: TMDL and source loads for Falls Run (WVM-8-C; SWS ID: 2128).

Glady Run (WVM-8-D)

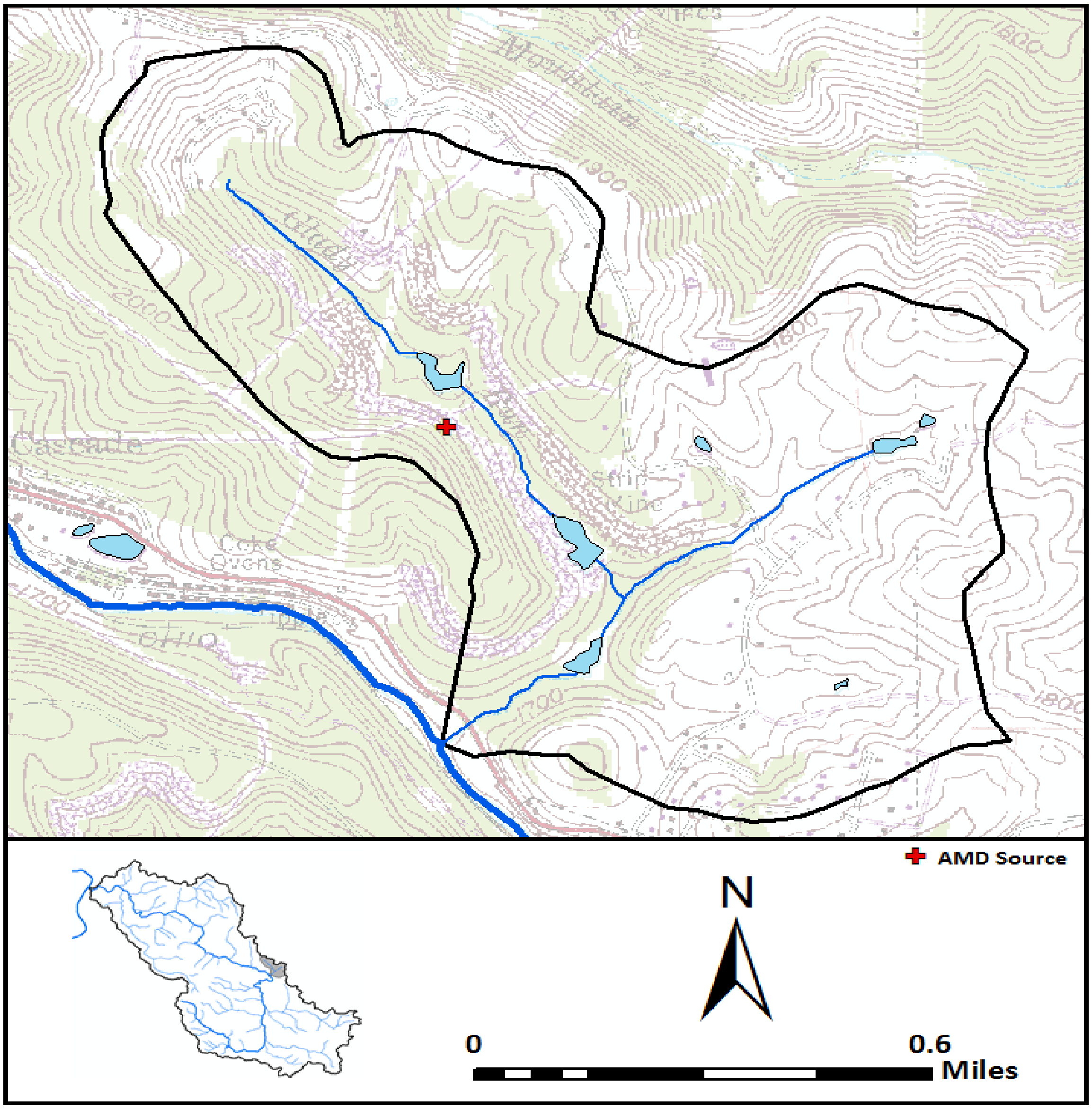


Figure 20: Glady Run (WVM-8-D; SWS ID: 2130).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
GladyMo	6.36	0.44	2.52	-	Passive	$160,000	90%	0.64	0.04	0.25	-
Total	6.36	0.44	2.52	-		$160,000		0.64	0.04	0.25	-
TMDL	-2.45	0.54	5.28	-				-2.45	0.54	5.28	-

Table 29: TMDL and source loads for Glady Run (WVM-8-D; SWS ID: 2130).

Slabcamp Run (WVM-8-F)

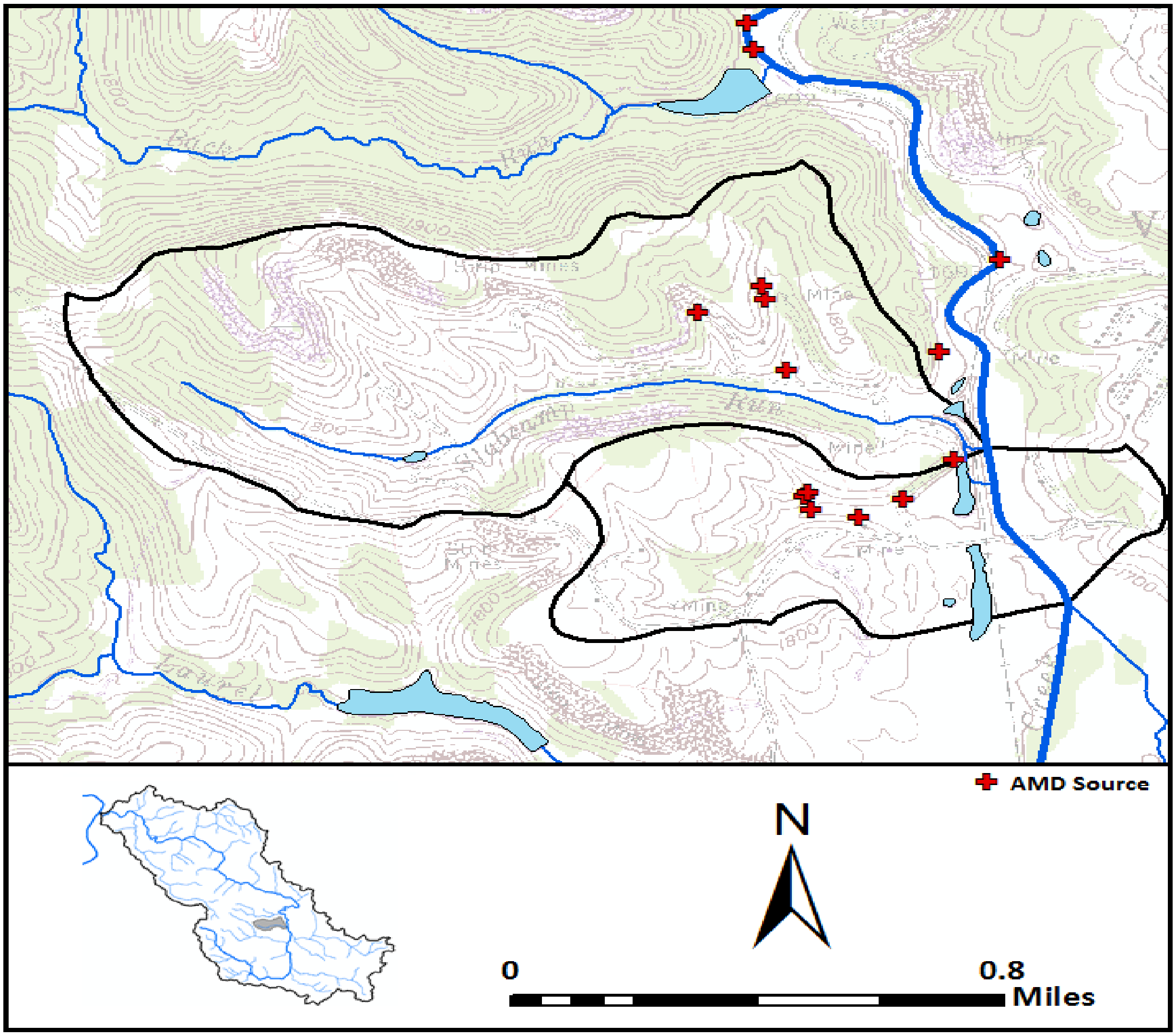


Figure 21: Slabcamp Run (WVM-8-F; SWS ID: 2134).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
SLANCINL	11.85	0.81	0.38	-	Passive	$107,300	90%	1.19	0.08	0.04	-
OLC 250	130.23	10.19	0.85	-	Passive	$107,300	90%	13.02	1.02	0.09	-
OLC 300	71.32	4.99	1.91	-	Passive	$107,300	90%	7.13	0.50	0.19	-
OLC 400	0.86	0.05	0.14	-	Passive	$107,300	90%	0.09	0.01	0.01	-
OLC 650	79.44	5.57	5.02	-	Passive	$160,000	90%	7.94	0.56	0.50	-
OLC 750	115.12	9.04	5.74	-	Passive	$160,000	90%	11.51	0.90	0.57	-
Total	408.82	30.65	14.04	-		$749,200		40.88	3.07	1.40	-
TMDL	-3.65	1.16	6.00	-				-3.65	1.16	6.00	-

Table 30: TMDL and source loads for Slabcamp Run (WVM-8-F; SWS ID: 2134).

Dillan Creek (WVM-8-G)

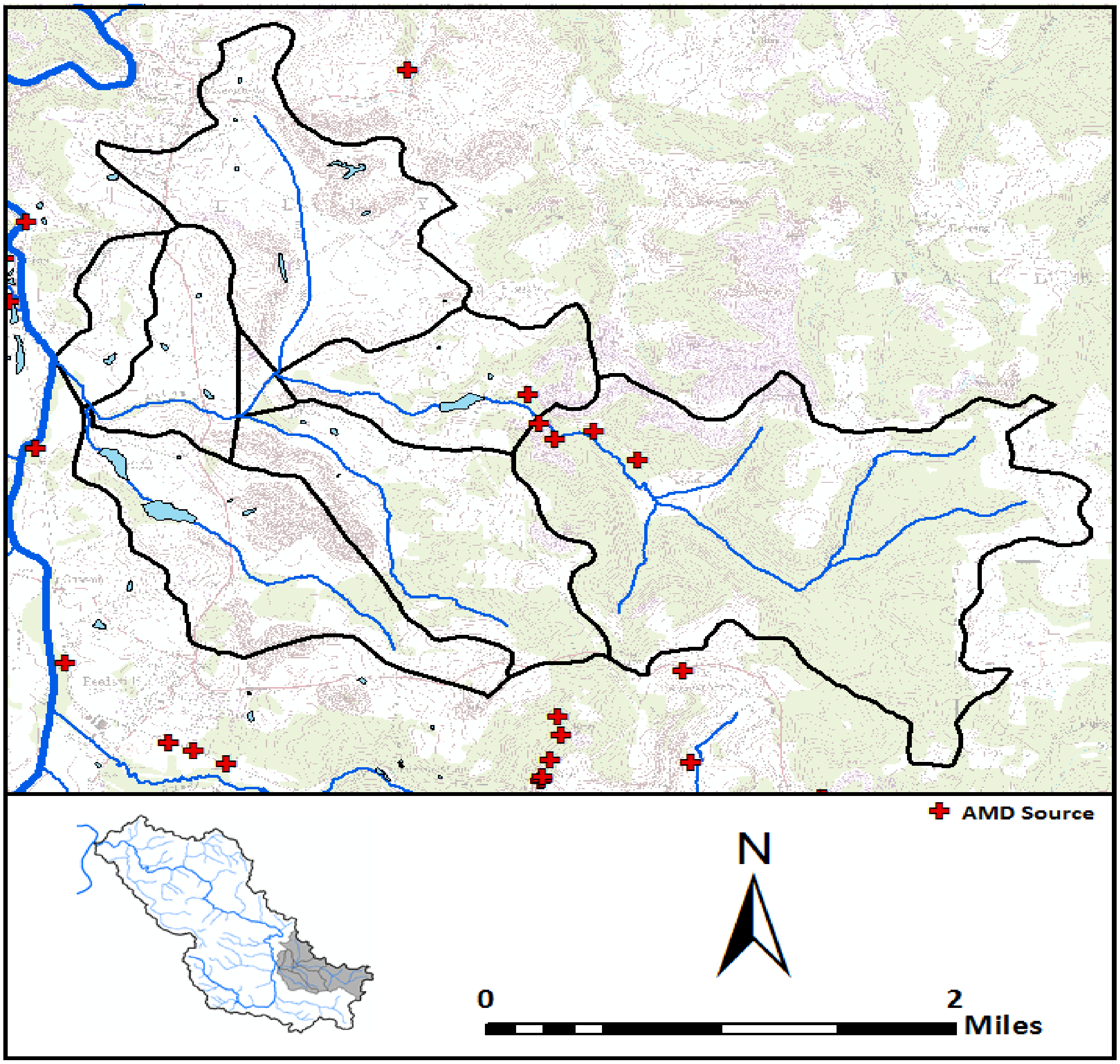


Figure 22: Dillan Creek (WVM-8-G; SWS ID: 2143, 2142, 2138, 2140 and 2136).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
DILJLCLV	19.73	1.09	0.03	-	Passive	$160,000	90%	1.97	0.11	0.00	-
DILCLV01	10.04	0.52	0.20	-	Passive	$160,000	90%	1.00	0.05	0.02	-
DILCLV02	744.31	52.98	31.96	-	Passive	$160,000	90%	74.43	5.30	3.20	-
DILDVRSN	550.39	54.88	7.01	-	Passive	$160,000	90%	55.04	5.49	0.70	-
DilCR253	792.78	54.21	27.48	-	Passive	$160,000	90%	79.28	5.42	2.75	-
CCPT03	-	-	-	7.87E+10	TBD	TBD	90%	-	-	-	7.87E+09
Total	2117.25	163.68	66.68	7.87E+10		$800,000		211.73	16.37	6.67	7.87E+09
TMDL	-954.06	6.96	61.54	4.67E+10				-954.06	6.96	61.54	4.67E+10

Table 31: TMDL and source loads for Dillan Creek (WVM-8-G; SWS ID: 2143, 2142, 2138, 2140 and 2136).

UNT/Dillan Creek RM 0.30 (WVM-8-G-0.3)

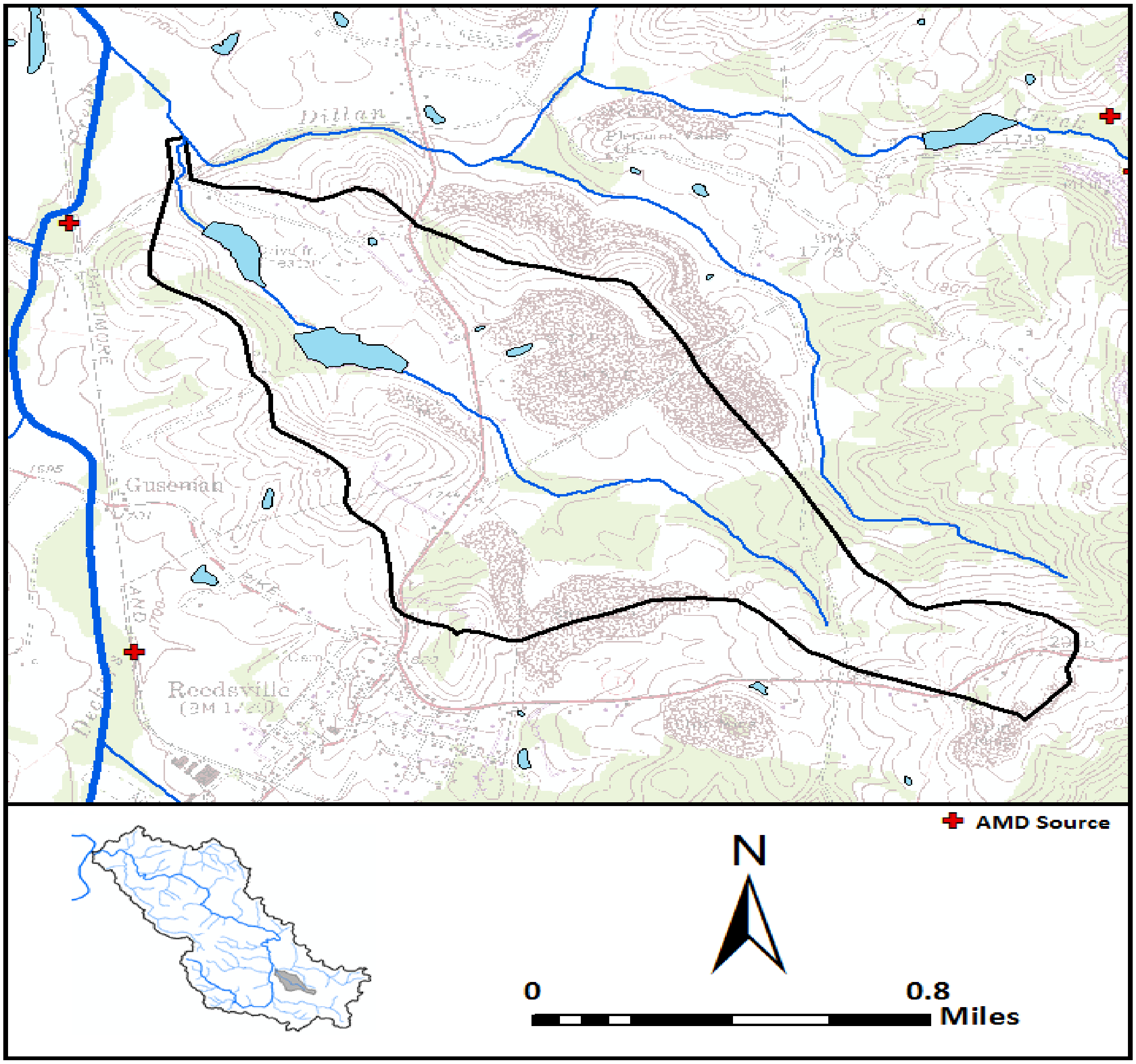


Figure 23: UNT/Dillan Creek RM 0.30 (WVM-8-G-0.3; SWS ID: 2137).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
UTDilBrk	-	-	1.70	-	No Action	NA	0%	-	-	1.70	-
Total	-	-	1.70	-		NA		-	-	1.70	-
TMDL	-	-	4.38	-				-	-	4.38	-

Table 32: TMDL and source loads for UNT/Dillan Creek RM 0.30 (WVM-8-G-0.3; SWS ID: 2137).

UNT/Dillan Creek RM 1.02 (WVM-8-G.7)

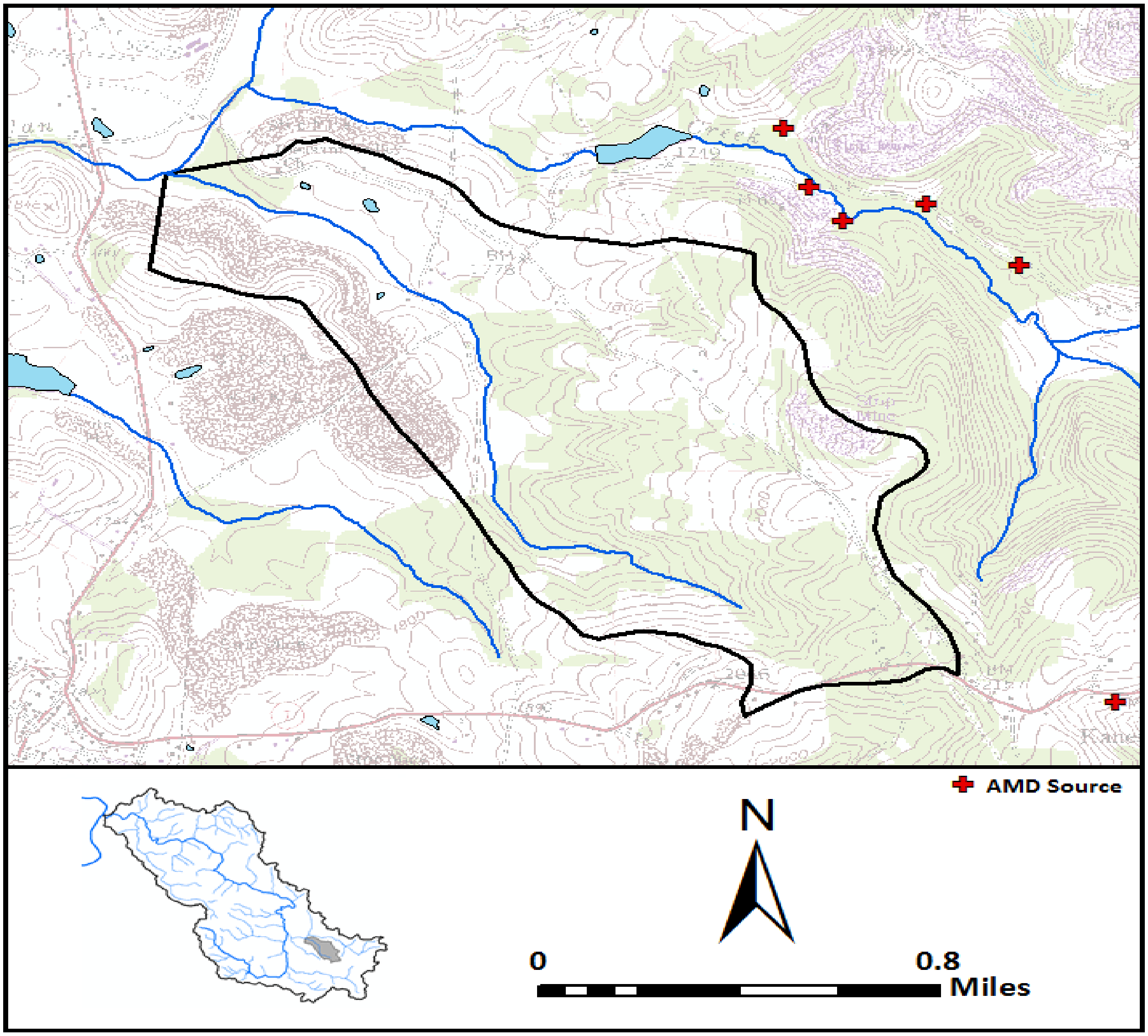


Figure 24: UNT/Dillan Creek RM 1.02 (WVM-8-G.7; SWS ID: 2139).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
UT2DilMo	-	-	0.55	-	No Action	NA	0%	-	-	0.55	-
Total	-	-	0.55	-		NA		-	-	0.55	-
TMDL	-	-	4.33	-				-	-	4.33	-

Table 33: TMDL and source loads for UNT/Dillan Creek RM 1.02 (WVM-8-G.7; SWS ID: 2139).

Swamp Run (WVM-8-G-1)

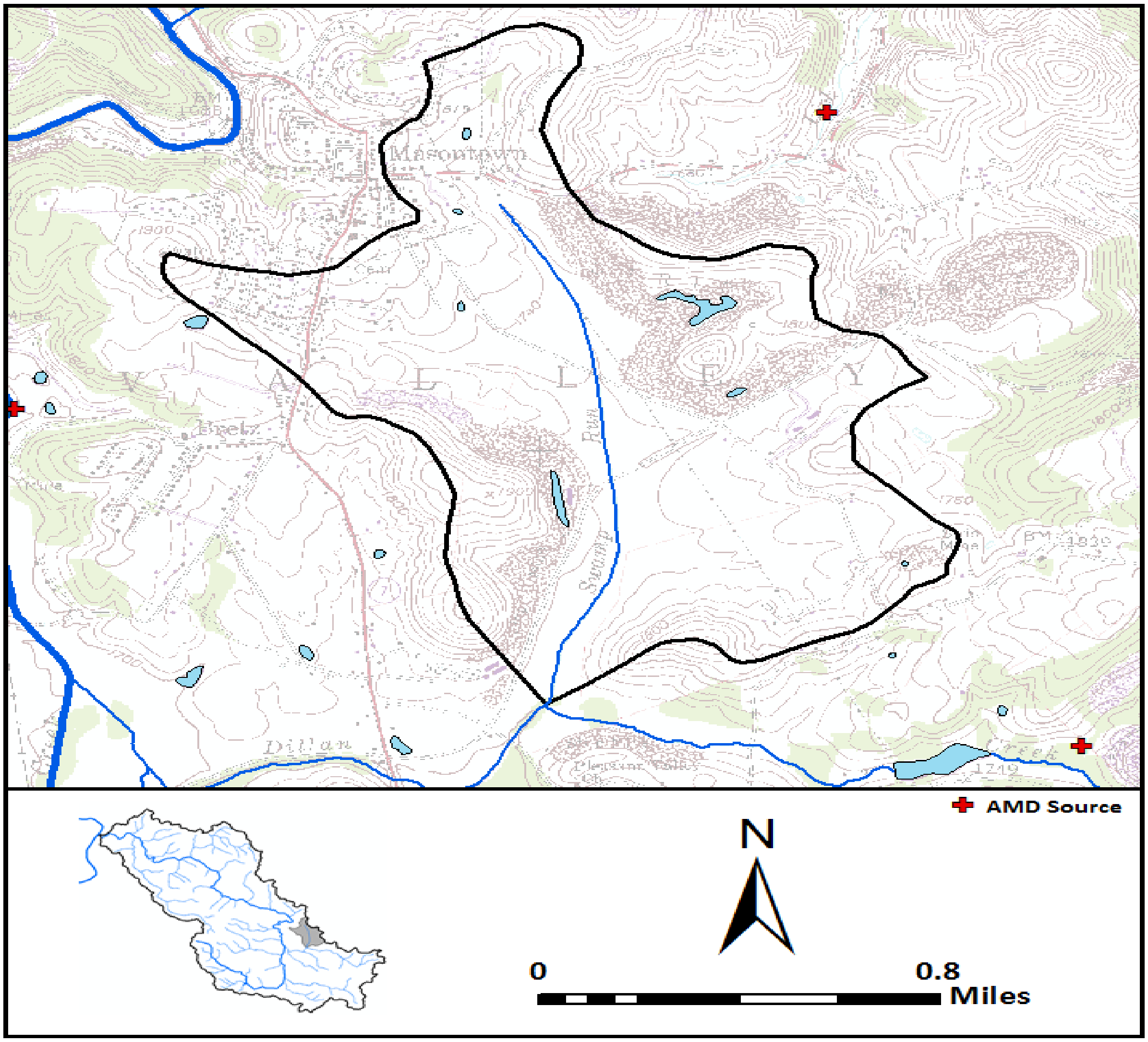


Figure 25: Swamp Run (WVM-8-G-1; SWS ID: 2141).

Current Load					BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
SwmpSnDa	-	-	1.22	-	Mitigation	NA	0%	-	-	1.22	-
Total	-	-	1.22	-		NA		-	-	1.22	-
TMDL	-	-	8.35	-				-	-	8.35	-

Table 34: TMDL and source loads for Swamp Run (WVM-8-G-1; SWS ID: 2141).

Laurel Run (WVM-8-H)

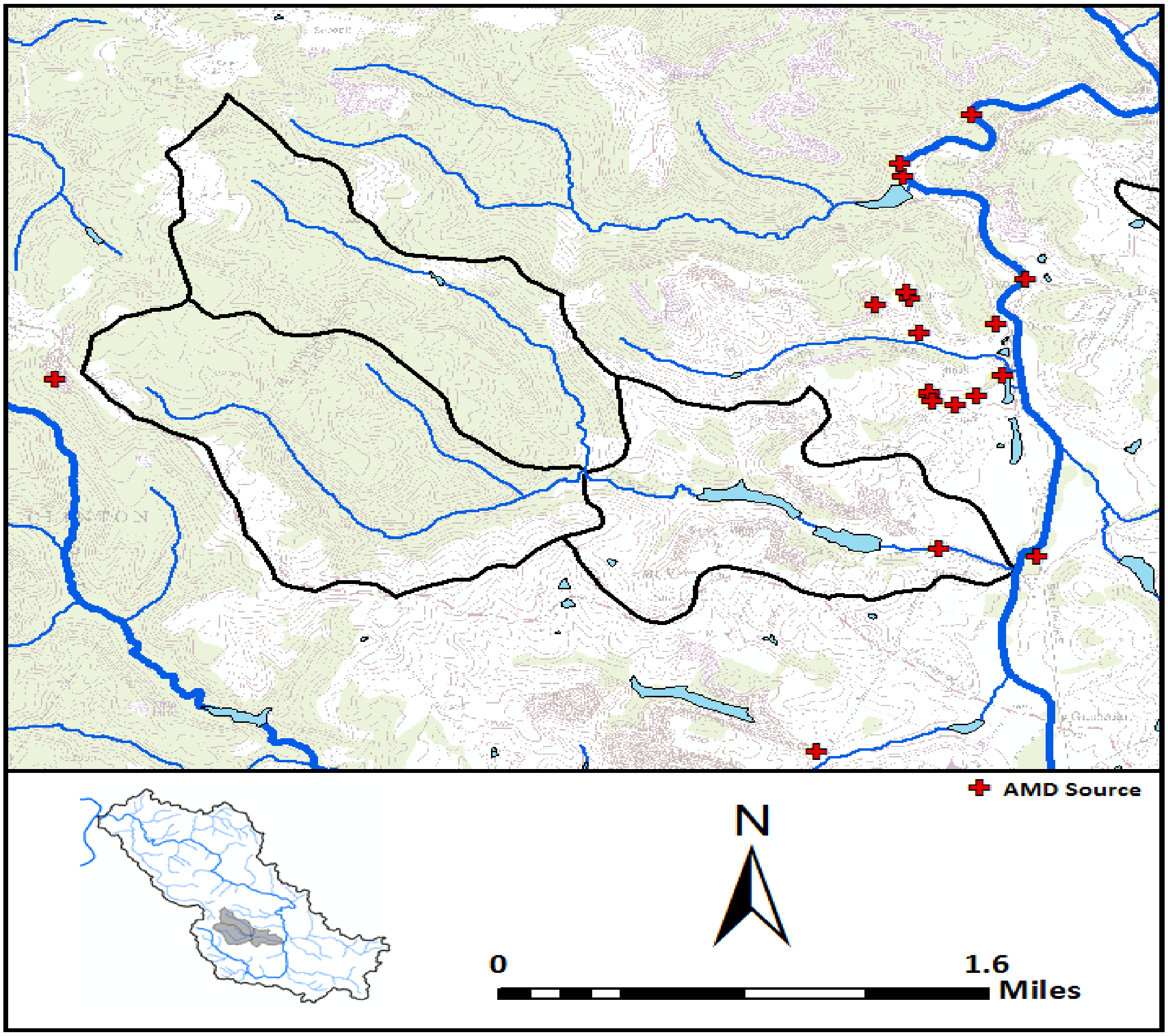


Figure 26: Laurel Run (WVM-8-H; SWS ID: 2109, 2147 and 2145).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
BurkeRdAMD	3249.66	117.45	35.91	-	Passive	$160,000	90%	324.97	11.75	3.59	-
Sharon5	-	-	-	-	Passive	$160,000	90%	-	-	-	-
Total	3249.66	117.45	35.91	-		$320,000		324.97	11.75	3.59	-
TMDL	-3709.99	24.04	65.46	-				-3709.99	24.04	65.46	-

Table 35: TMDL and source loads for Laurel Run (WVM-8-H; SWS ID: 2109, 2147 and 2145).

UNT/Laurel Run RM 1.62 (WVM-8-H-1)

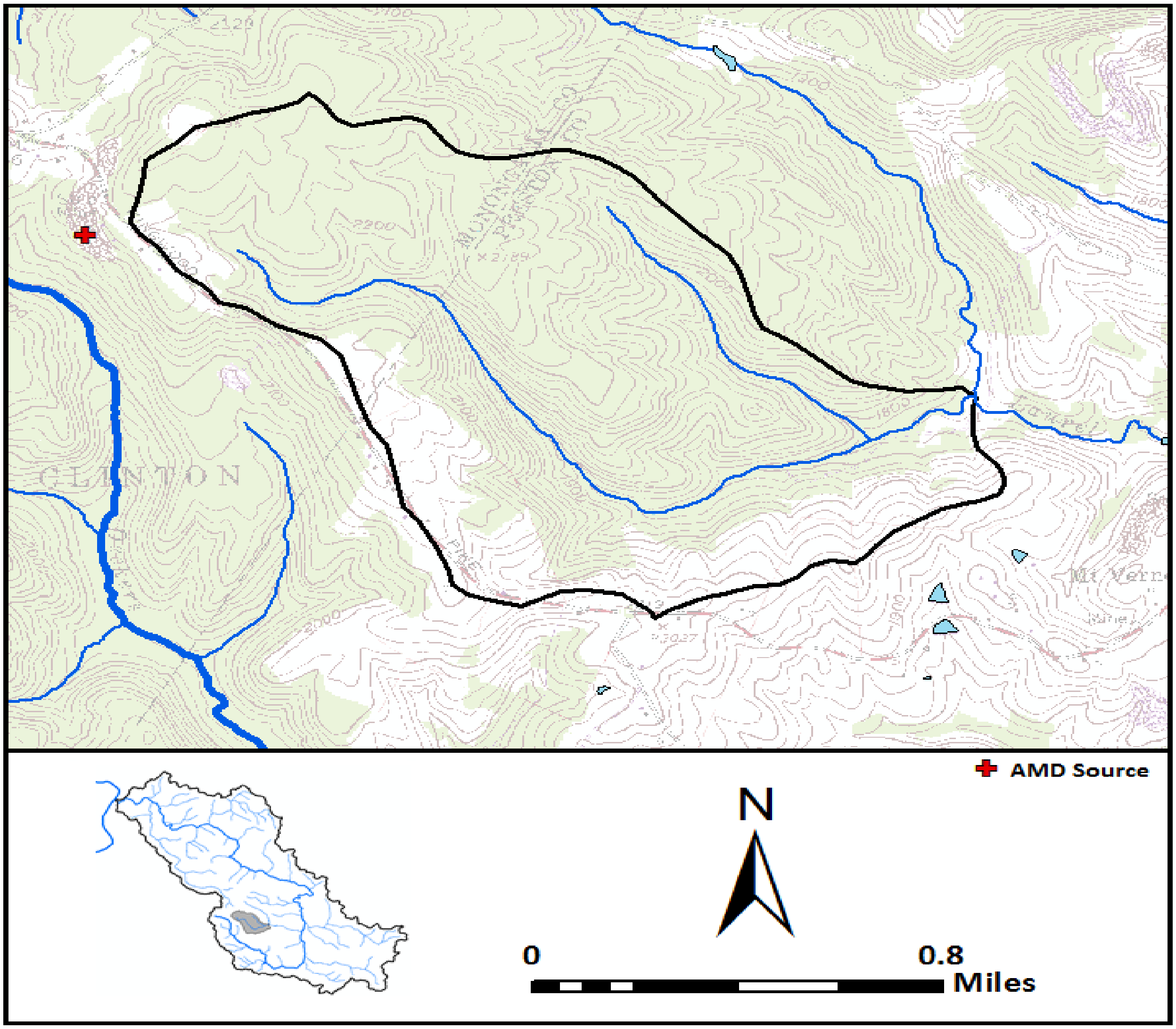


Figure 27: UNT/Laurel Run RM 1.62 (WVM-8-H-1; SWS ID: 2146).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
NA	-	-	-	-	No Action	NA	0%	-	-	-	-
Total	-	-	-	-		NA		-	-	-	-
TMDL	-	-	6.29	-				-	-	6.29	-

Table 38: TMDL and source loads for UNT/Laurel Run RM 1.62 (WVM-8-H-1; SWS ID: 2146).

UNT/Deckers Creek RM 17.28 (WVM-8-H-4)

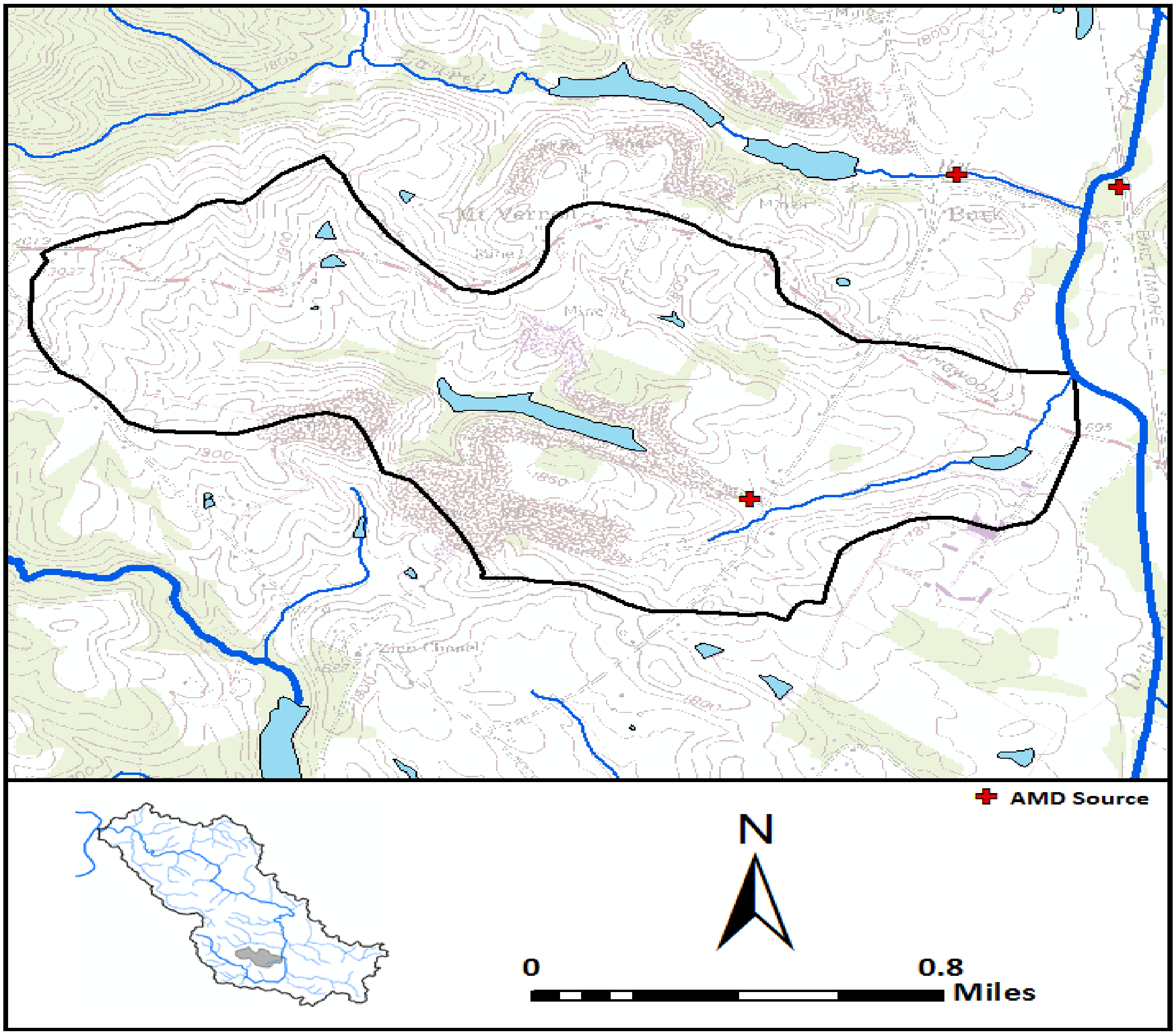


Figure 28: UNT/Deckers Creek RM 17.28 (WVM-8-H-4; SWS ID: 2149).

Current Load					BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
ZinnAMD	-45.62	0.29	1.33	-	No Action	NA	0%	-45.62	0.29	1.33	-
Total	-45.62	0.29	1.33	-		NA		-45.62	0.29	1.33	-
TMDL	-	-	9.05	-				-	-	9.05	-

Table 37: TMDL and source loads for UNT/Deckers Creek RM 17.28 (WVM-8-H-4; SWS ID: 2149).

Kanes Creek (WVM-8-I)

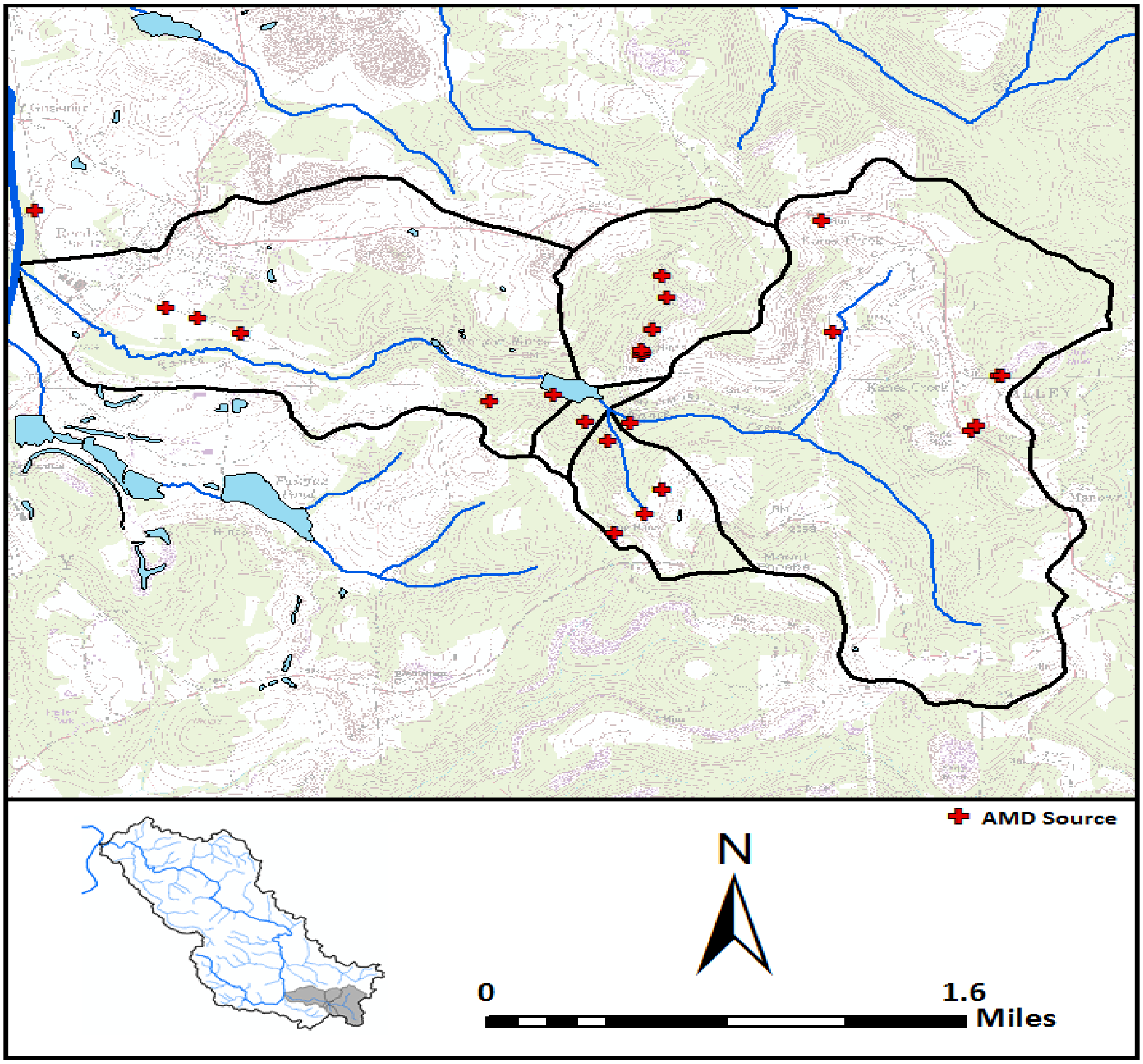


Figure 29: Kanes Creek (WVM-8-I; SWS ID: 2155, 2153 and 2151).

Current Load					BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
MMRAMD	112.81	5.04	10.51	-	Passive	$160,000	90%	11.28	0.50	1.05	-
BlnktDrn#2	83.11	1.92	14.69	-	Passive	$160,000	90%	8.31	0.19	1.47	-
VP12A	114.57	5.94	16.33	-	Passive	$127,500	90%	11.46	0.59	1.63	-
VP12B	29.95	1.70	3.31	-	Passive	$127,500	90%	3.00	0.17	0.33	-
VH3	59.95	2.07	4.34	-	Active	$284,000	90%	6.00	0.21	0.43	-
KCS1Feed	28.12	1.01	2.70	-	Active	$213,350	90%	2.81	0.10	0.27	-
KCS2Culv	-7.24	0.01	0.06	-	Passive	$50,000	90%	-0.72	0.00	0.01	-
Total	421.27	17.69	51.94	-		$1,122,350		42.13	1.77	5.19	-
TMDL	-43.59	5.31	39.11	-				-43.59	5.31	39.11	-

Table 38: TMDL and source loads for Kanes Creek (WVM-8-I; SWS ID: 2155, 2153 and 2151).

UNT/Kanes Creek RM 2.36 (WVM-8-I-0.9)

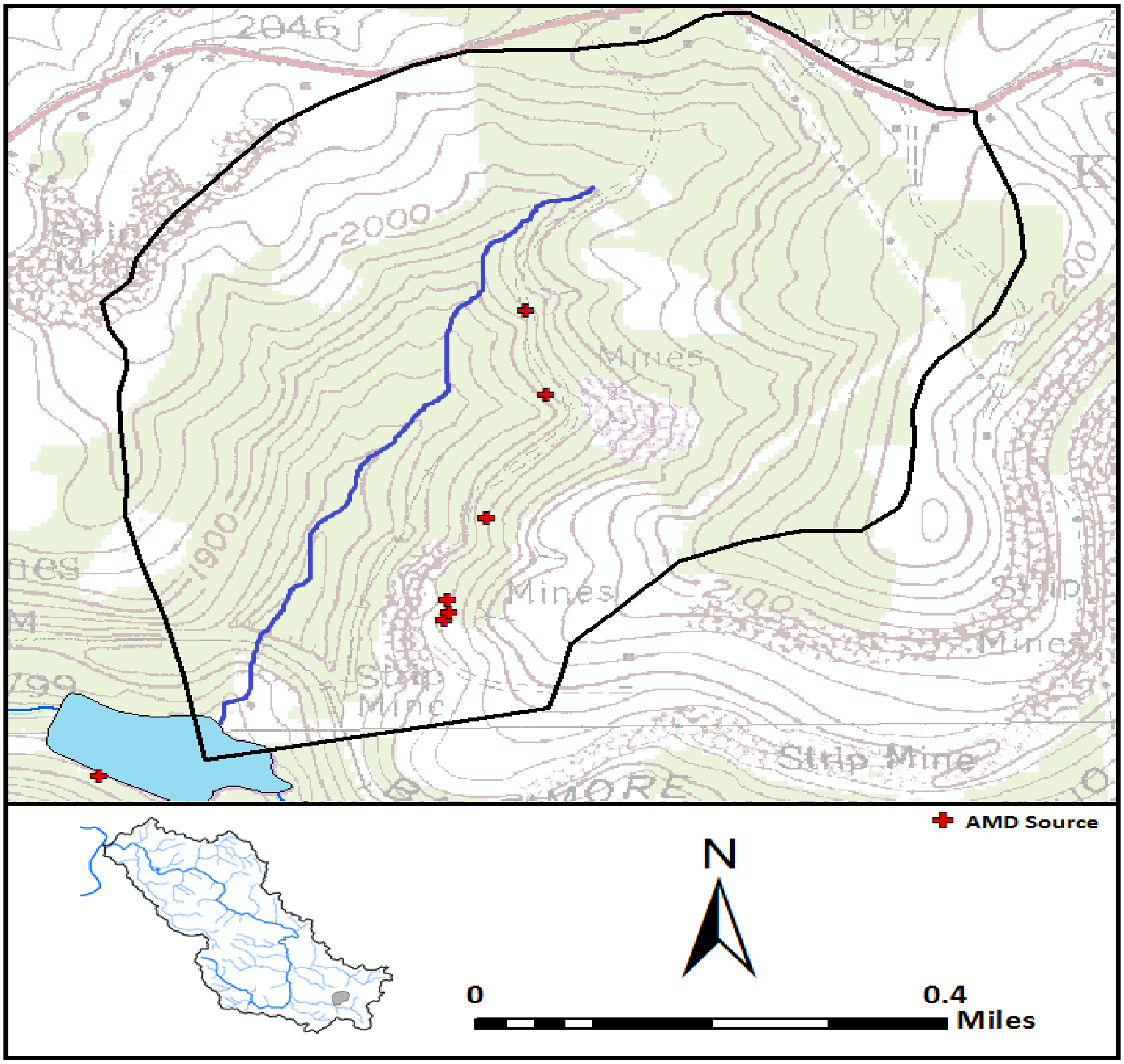


Figure 30: UNT/Kanes Creek RM 2.36 (WVM-8-I-0.9; SWS ID: 2152).

Current Load					BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
KCS3123	56.68	4.29	3.57	-	Passive	$200,500	90%	5.67	0.43	0.36	-
KCS34Dis	54.15	4.11	6.09	-	Passive	$200,500	90%	5.42	0.41	0.61	-
Total	110.83	8.40	9.66	-		$401,000		11.08	0.84	0.97	-
TMDL	-4.39	0.22	2.27	-				-4.39	0.22	2.27	-

Table 39: TMDL and source loads for UNT/Kanes Creek RM 2.36 (WVM-8-I-0.9; SWS ID: 2152).

UNT/Kanes Creek RM 2.49 (WVM-8-I-1)

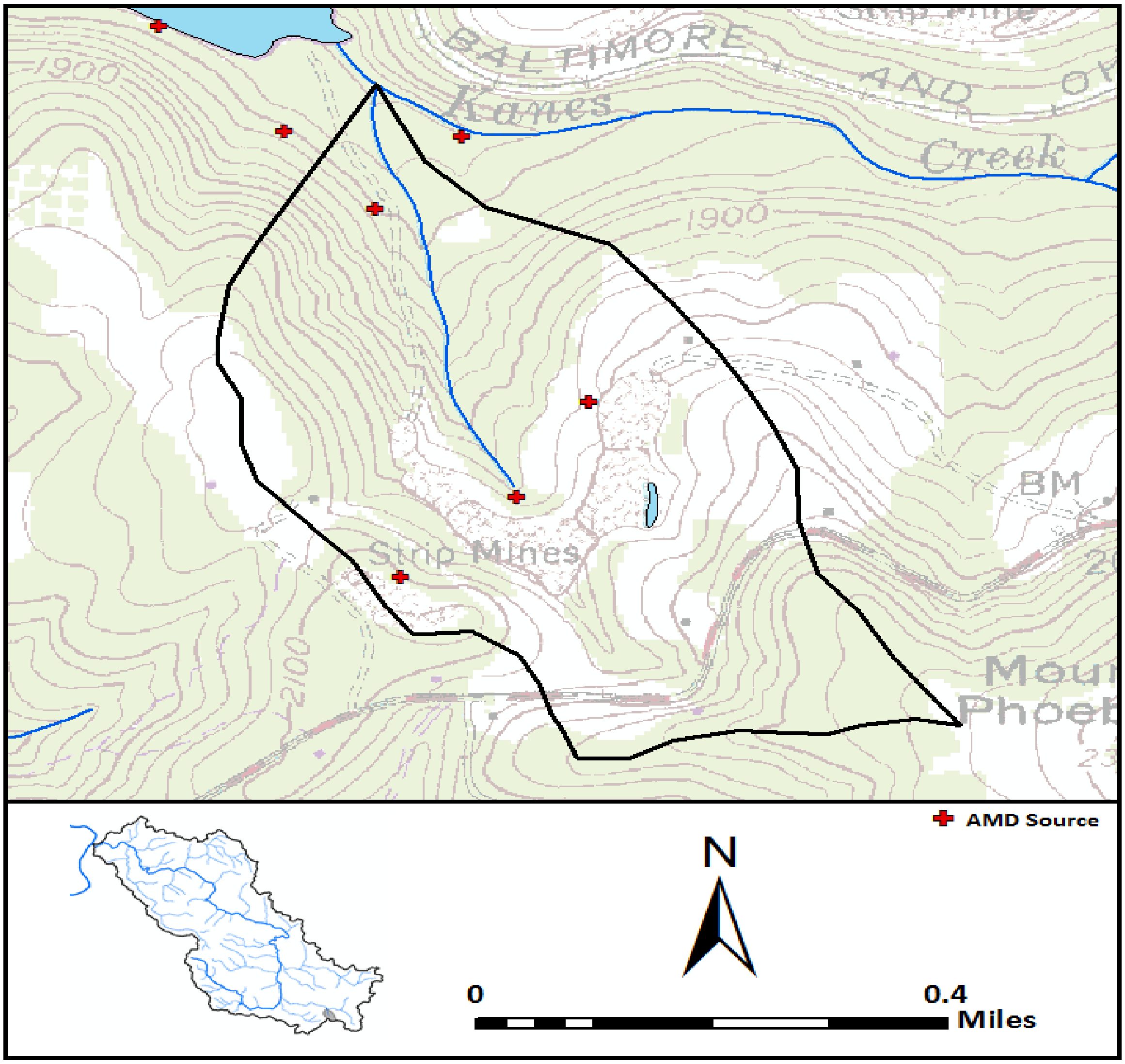


Figure 31: UNT/Kanes Creek RM 2.49 (WVM-8-I-1; SWS ID: 2154).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
SPTP	194.32	4.37	11.50	-	Active	$160,000	90%	19.43	0.44	1.15	-
SandySeep	78.65	3.93	3.02	-	Passive	$160,000	90%	7.87	0.39	0.30	-
Nbraham	5.72	0.43	0.09	-	Passive	$50,000	90%	0.57	0.04	0.01	-
Total	278.69	8.73	14.61	-		$370,000		27.87	0.87	1.46	-
TMDL	-5.22	0.87	3.43	-				-5.22	0.87	3.43	-

Table 40: TMDL and source loads for UNT/Kanes Creek RM 2.49 (WVM-8-I-1; SWS ID: 2154).

UNT/Deckers Creek RM 18.48 (WV-M-8-J)

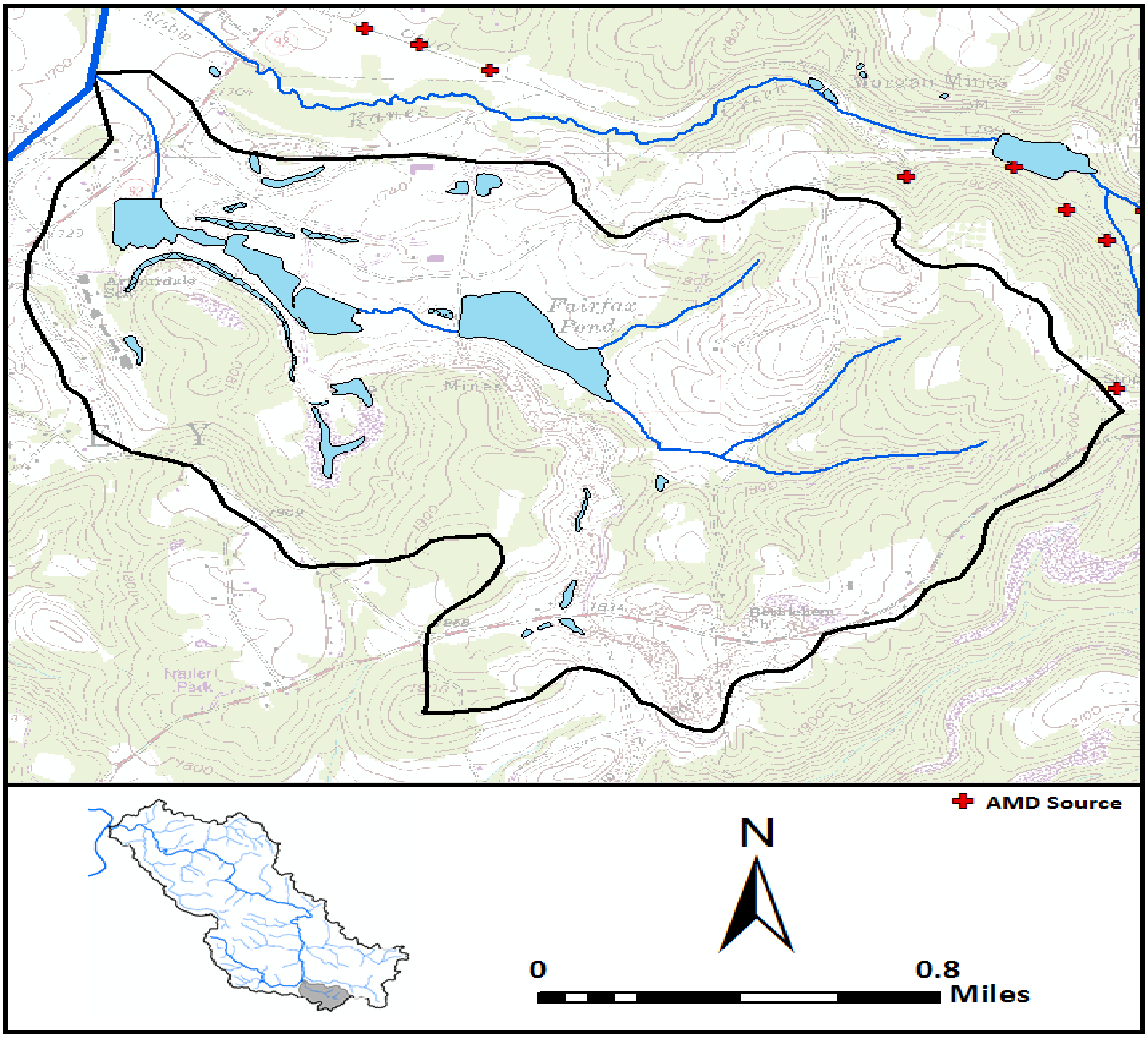


Figure 32: UNT/Deckers Creek RM 18.48 (WVM-8-J; SWS ID: 2157).

Current Load					BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
UTFairFx	-	-	2.72	-	No Action	NA	0%	-	-	2.72	-
Total	-	-	2.72	-		NA		-	-	2.72	-
TMDL	-	-	12.48	-				-	-	12.48	-

Table 41: TMDL and source loads for UNT/Deckers Creek RM 18.48 (WVM-8-J; SWS ID: 2157).

UNT/Deckers Creek RM 20.48 (WVM-8-L)

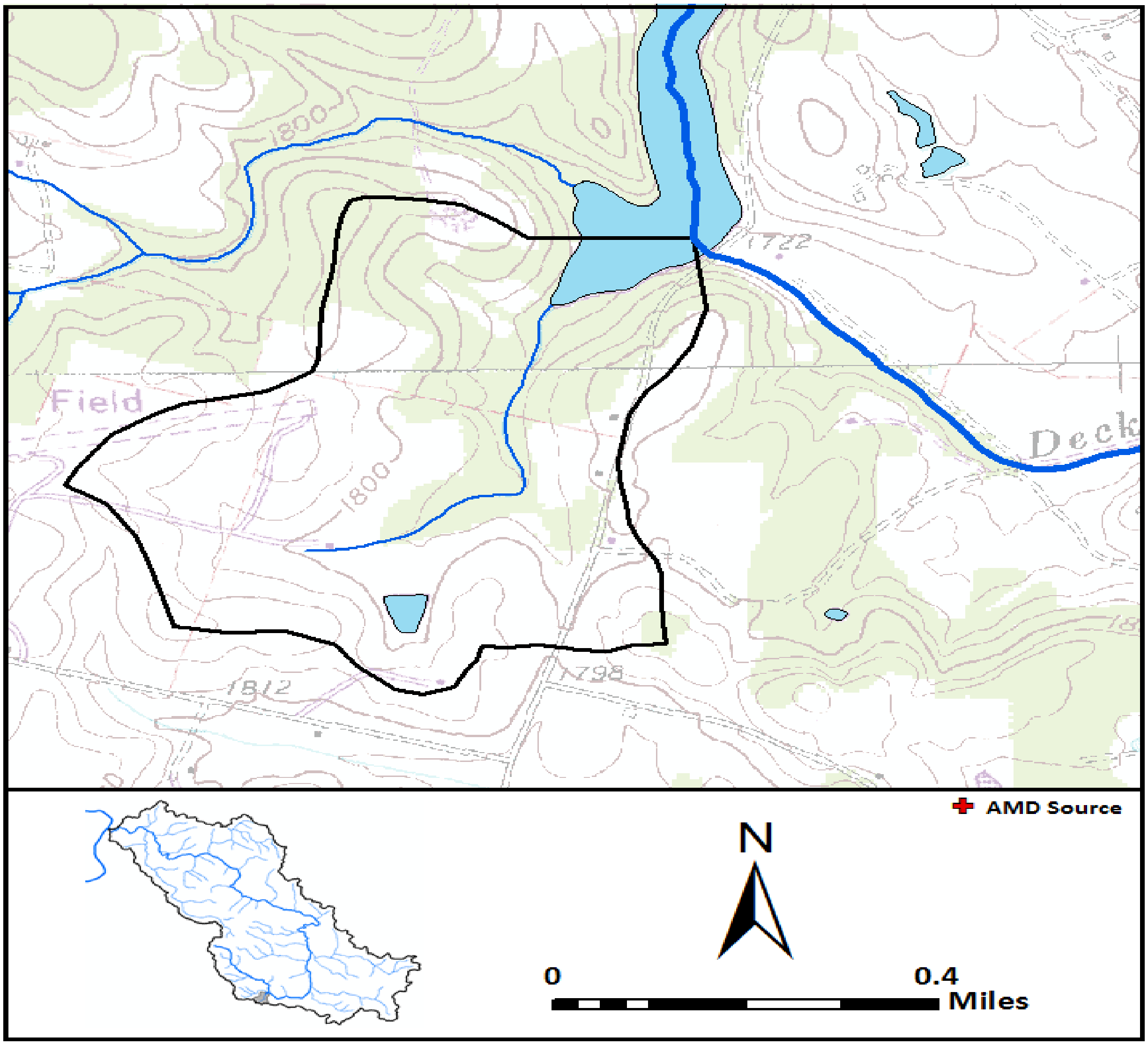


Figure 33: UNT/Deckers Creek RM 20.48 (WVM-8-L; SWS ID: 2159).

	Current Load				BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
UtDStony	-	-	7.48	-	Passive	$160,000	90%	-	-	0.75	-
Total	-	-	7.48	-		$160,000		-	-	0.75	-
TMDL	-	-	1.93	-				-	-	1.93	-

Table 42: TMDL and source loads for UNT/Deckers Creek RM 20.48 (WVM-8-L; SWS ID: 2159).

UNT/Deckers Creek RM 20.63 (WVM-8-M)

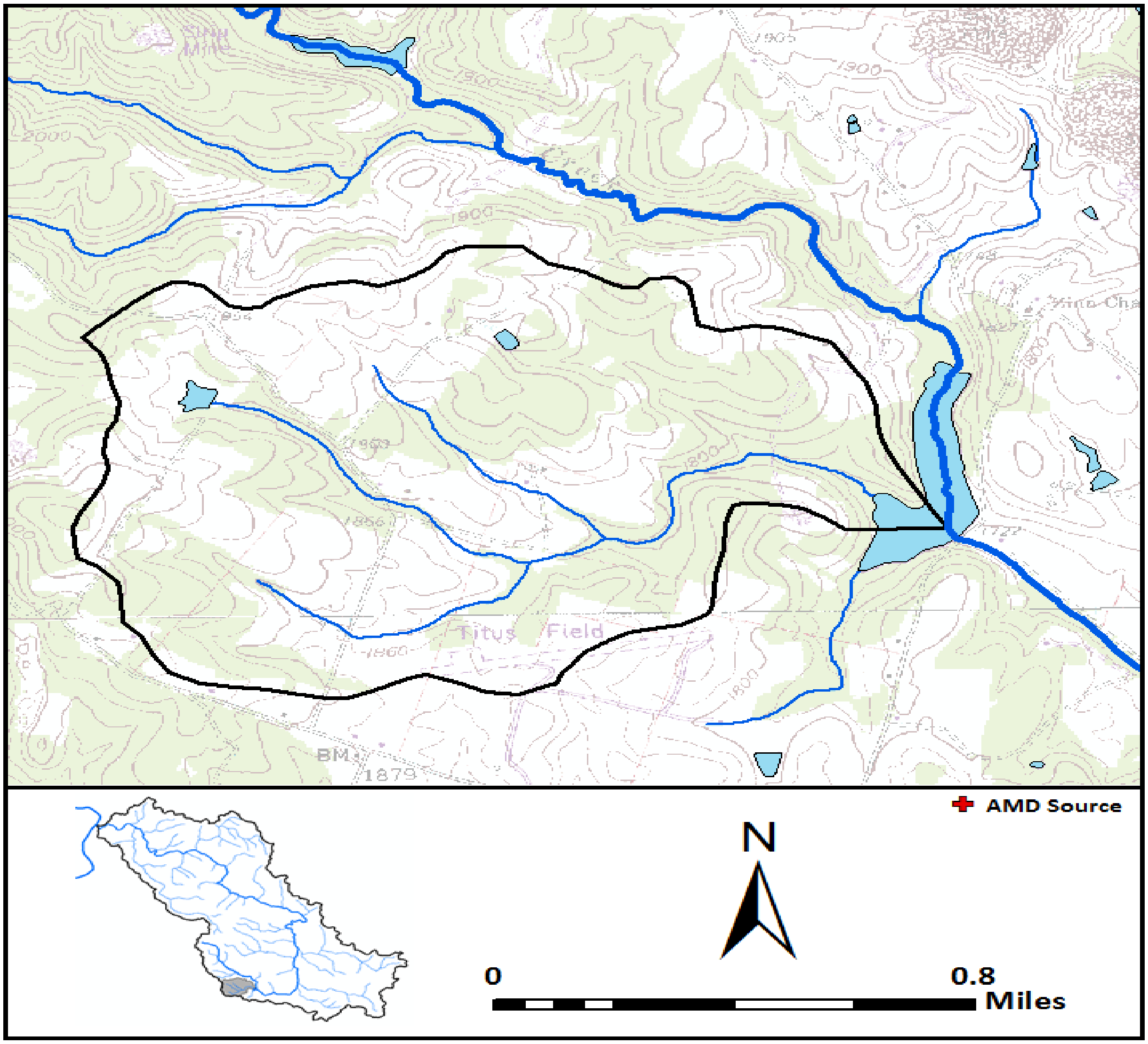


Figure 34: UNT/Deckers Creek RM 20.63 (WVM-8-M; SWS ID: 2160).

Current Load					BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs $CaCO_3$/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
UTUDCI1	-	-	-	-	No Action	NA	0%	-	-	-	-
Total	-	-	-	-		NA		-	-	-	-
TMDL	-	-	6.18	-				-	-	6.18	-

Table 43: TMDL and source loads for UNT/Deckers Creek RM 20.63 (WVM-8-M; SWS ID: 2160).

UNT/Deckers Creek RM 21.95 (WVM-8-O)

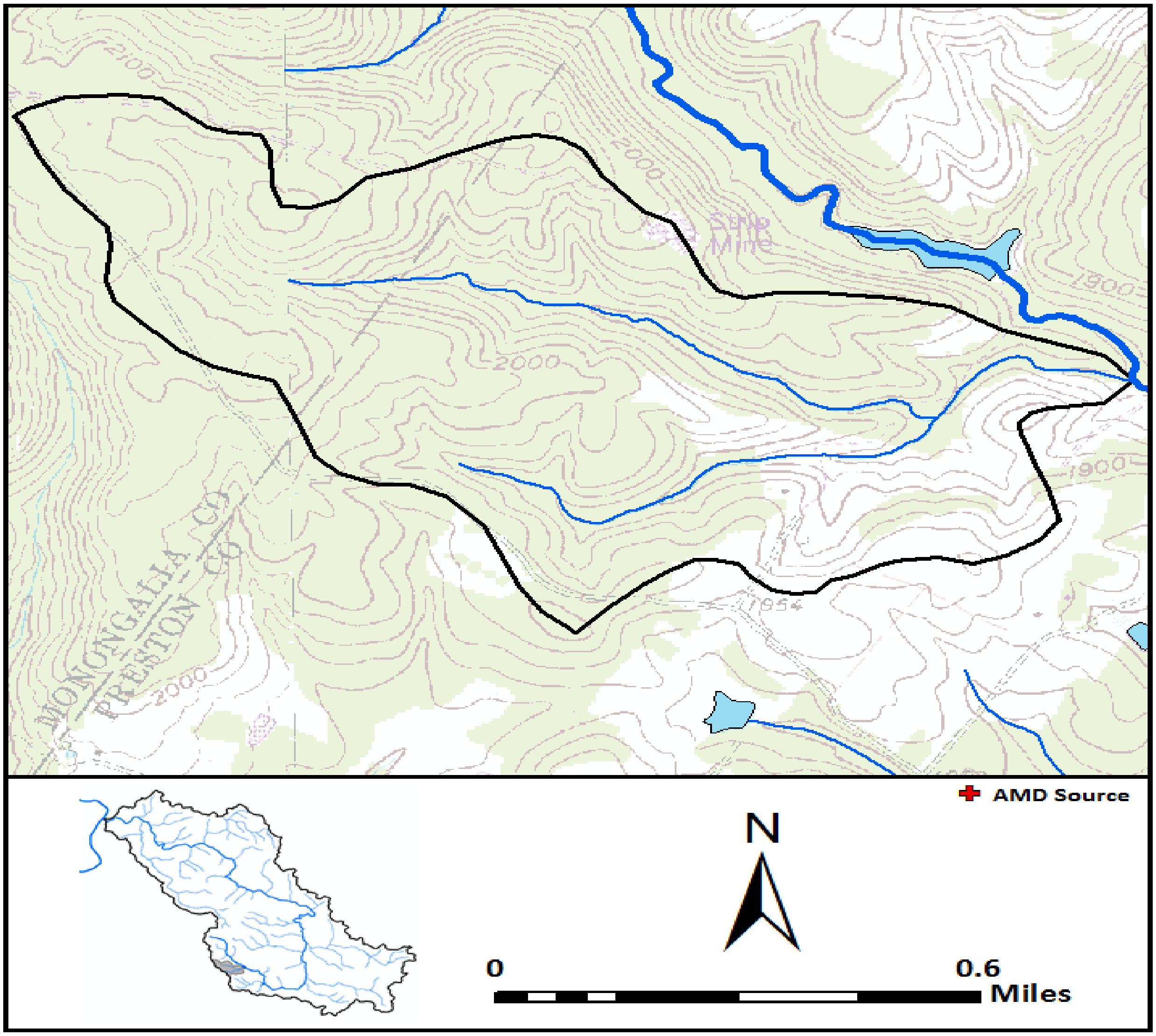


Figure 35: UNT/Deckers Creek RM 21.95 (WVM-8-O; SWS ID: 2163).

Current Load					BMP Information			Estimated Final Load			
Source	Net Acidity Load (lbs CaCO3/day	Aluminum Load (lbs/day)	Iron Load (lbs/day)	Fecal Coliform (counts/day)	BMP	Cost	Expected Reduction (%)	Final Net Acidity Load	Final Aluminum Load	Final Iron Load	Final Fecal Coliform
NA	-	-	-	-	No Action	NA	0%	-	-	-	-
Total	-	-	-	-		NA					
TMDL	-	-	3.13	-				-	-	3.13	-

Table 44: TMDL and source loads for UNT/Deckers Creek RM 21.95 (WVM-8-O; SWS ID: 2163).

Costs

Stream name	AnCode	AMD source	Priority	Cost
Deckers Creek	WVM-8	Bretz	High	OAMLR
Slabcamp Run	WVM-8-F	OLC 250	High	$107,300
Slabcamp Run	WVM-8-F	OLC 300	High	$107,300
UNT/Kanes Creek RM 2.36	WVM-8-I.9	KC3123	High	$200,500
UNT/Kanes Creek RM 2.36	WVM-8-I.9	KC334Dis	High	$200,500
Kanes Creek	WVM-8-I	Vp12A	High	$127,500
Kanes Creek	WVM-8-I	Vp12B	High	$127,500
Kanes Creek	WVM-8-I	KCS1Feed	High	$213,350
Kanes Creek	WVM-8-I	VH3 upgrades	High	$284,000
Kanes Creek	WVM-8-I	Blanket Drain	High	$160,000
Kanes Creek	WVM-8-I	MMRamd	High	$160,000
Dillan Creek	WVM-8-I	DILCLV02	High	$160,000
Dillan Creek	WVM-8-I	DILDVRSN	High	$160,000
Dillan Creek	WVM-8-I	DILCR253	High	$160,000
Deckers Creek	WVM-8	Brdg5AMD	High	$160,000
Deckers Creek	WVM-8	Richard	High	$5,000,000
Slabcamp Run	WVM-8-F	OLC 650	High	$160,000
Slabcamp Run	WVM-8-F	OLC 750	High	$160,000
Laurel Run/Deckers Creek	WVM-8-H	Burke Rd	High	$160,000
Slabcamp Run	WVM-8-F	SLANCINL	Moderate	$107,300
Slabcamp Run	WVM-8-F	OLC 400	Moderate	$107,300
Dillan Creek	WVM-8-G	DILILCLV	Moderate	$160,000
Dillan Creek	WVM-8-G	DILCLV01	Moderate	$160,000
Hartman Run	WVM-8-.5A	Mlgrweir	Moderate	$160,000
Aaron Creek	WVM-8-A	AaronAMD	Moderate	$160,000
Glady Run	WVM-8-D	Glady strip	Moderate	$160,000
Deckers Creek	WVM-8	Dalton	Moderate	$160,000
UNT/Kanes Creek RM 2.49	WVM-8-I-1	SPTP	Moderate	$160,000
UNT/Kanes Creek RM 2.49	WVM-8-I-1	Sandy Seep	Moderate	$160,000
Falls Run	WVM-8-C	FallsAMD	Low	$160,000
Deckers Creek	WVM-8	RckFrgPVC	Low	$160,000
Deckers Creek	WVM-8	RckFrgHT	Low	$160,000
Deckers Creek	WVM-8	RckFrgRD	Low	$160,000
Laurel Run/Deckers Creek	WVM-8-H	Sharon5	Low	$160,000
UNT/Deckers Creek RM 5.70	WVM-8-A.7	Valley Mine	Low	$100,000
UNT/Deckers Creek RM 5.70	WVM-8-A.7	Beulah Chapel	Low	$100,000
Back Run	WVM-8-E	BckRnDiv	Low	$50,000
UNT/Kanes Creek RM 2.49	WVM-8-I-1	Nbraham	Low	$50,000
UNT/Deckers Creek RM 17.28	WVM-8-H-4	ZinnAMD	Low	$120,000
Hartman Run	WVM-8-.5A	HrtMonGen	Low	$120,000
Deckers Creek	WVM-8	Goat1A	Low	$50,000
Deckers Creek	WVM-8	Goat1B	Low	$50,000
Deckers Creek	WVM-8	Goat2	Low	$50,000
Kanes Creek	WVM-8-I	KCS2Culv	Low	$50,000
Total Cost				**$10,842,550**

Table 45: Estimated costs of construction for future BMPs.

Utilizing chemical and flow data to determine magnitude of BMPs required per project, the Richard Mine (Superior Hydraulics PA 3738) represents the largest cost. The Richard Mine will require construction of a large-scale active treatment plant with extraction pumps, lime dosing, aeration units, clarifiers, and sludge injection. The facility will require a part-time staff to manage operations and a twenty year commitment for operations and maintenance will be required from a local partner. Engineering and construction are conservatively estimated at $3,000,000 and twenty years of operations and maintenance is estimated at $2,000,000. Total investment for long-term treatment of the Richard Mine discharge is estimated at $5,000,000.

The remaining sites can be treated by passive AMD remediation techniques. Actions are currently planned in subwatersheds containing high, moderate, and low priority AMD sources. Based on cost averages from completed and currently funded projects, remediation systems typically average $50,000 - $200,000 per treated AMD source, depending on severity of the AMD and available land. Not counting the Richard Mine treatment system, the cost of watershed wide AMD sources planned for remediation is $5,842,550.

Addition of the $5,000,000 for the Richard Mine system to the planned passive systems costs of $5,842,550 gives a grand total of $10,842,550 for remediation of all high and moderate priority AMD sources in the Deckers Creek watershed, plus several low priority AMD sources.

ELEMENT C: NONPOINT MANAGEMENT MEASURES

Eliminating nonpoint source (NPS) pollution in the Deckers Creek watershed will require a team of cooperating entities to implement a wide range of pollution control measures. The Deckers Creek Restoration Team (DCRT) or a similar entity will lead the efforts to address the pollution sources addressed by this plan.

Acid mine drainage

AMD in the Deckers Creek watershed has typically been treated by one of two methods; active treatment or passive treatment.

Remediation

Active AMD Treatment:

Active treatment of mine water means controlling and adjusting treatment processes. Mine water is mechanically dosed with a pre-measured amount of alkaline chemical under controlled conditions. Chemical doses can be adjusted real-time to events such as heavy rain or drought, but the dynamic nature of environmental conditions requires weekly, monthly, and annual attentiveness. Also, mechanical components wear and alkaline chemicals require regular replenishment. Though active treatment requires constant maintenance, it allows for a high level of control over polluted mine water treatment, typically within a small geographic footprint. The most common active water treatment is one of a number of devices that add an alkaline material to the AMD, such as hydrated lime or pebble quicklime, followed by a settling pond where metals precipitate out of solution and form sludge.

Passive AMD treatment:

Passive treatment of mine water means low-maintenance self-sustaining treatment systems requiring little maintenance. The systems are engineered to contain enough alkaline chemical and collection pond area to handle years of mine water under varying environmental conditions. The treatment systems are often designed to handle average flows, with additional features to handle heavy rain or drought events. Passive systems contain hundreds of tons limestone and large settling ponds spaced over a relatively large geographic footprint. Despite the large footprint and extensive pre-construction engineering, once constructed passive systems successfully treat polluted mine water up to a decade with limited maintenance.

Passive AMD treatment systems are designed for twenty years of functionality at the 90% load reduction level. During the first several post-construction years the 90% load reduction is typically maintained, however, many passive systems have proven to require maintenance after 5-8 years. Maintenance tasks typically include dredging sludge from collection ponds and replacing/rejuvenating limestone to counteract metal-hydroxide armoring and remove accumulated metal precipitates from interstitial spaces. The need for maintenance tasks at passive AMD sites positively correlates to AMD severity, and AMD produced in the Upper Freeport coal bed is relatively severe to other West Virginia coal beds.

Passive treatment methods include land reclamation, in which a surface mines, a refuse pile, or spoil is landscaped to prevent contact between pyrite and water. Passive treatment also includes a number of water treatment measures (Table 47) in which AMD is neutralized by contact with limestone or other alkaline materials. Net acidic water with Al, ferric iron or dissolved oxygen concentrations greater than 1 mg/L require a reducing and alkalinity producing system (RAPS). In such systems, also known as successive alkalinity producing systems (SAPS) or vertical flow ponds (VFPs), water is allowed to seep through a compost layer which strips it of oxygen, and reduces ferric iron to the ferrous state. In a second reactor, the anoxic water reacts with limestone to neutralize any acidity present, and to add alkalinity to offset the acidity generated as iron oxidizes and precipitates from solution. In the last reactor, water is allowed to take on oxygen, allowing iron to oxidize and precipitate out of solution (Christ and Pavlick, 2006).

Prevention

In recent years, OSM and WVDEP have observed a policy of refusing permits to mines that are likely to create perpetual AMD problems. Selective permitting based on chemical and hydrological evaluation is the most important safeguard preventing additional AMD pollution.

Method	Function	Notes	Size guideline
Aerobic Wetland	Allows water to aerate, causing metals to precipitate from solution	Used for net alkaline discharges	Removes 5 g iron m^{-2} day^{-1}
Anoxic Limestone Drain (ALD)	Water that has little oxygen is allowed to flow through limestone	Suitable water is rare in the Deckers Creek watershed	According to retention time or total amount of acidity to neutralize
Compost Wetland	Contains anaerobic zone that generates alkalinity through sulfate reduction	Alkaline material is required in compost to maintain environment suitable for sulfate reduction	RAPS or SRS are usually preferred
Grouting	Material is pumped into a mine and allowed to harden, creating a barrier to water flow	Most examples show high costs and low to moderate success	According to mine geometry
Manganese Removal Bed (MRB)	Removes Mn from water	Used when Al and Fe have already been removed	Size for 24-hour hydraulic retention time
Open Limestone Channel (OLC)	Controls water path, prevents seepage back into spoil, neutralizes some acidity	Cheap to construct, acidity neutralization not completely understood. Wide construction rights of way distasteful to some landowners	Length set by distance water must be conveyed. Width set according to volume of water to transport.
Reducing and Alkalinity Producing System (RAPS)	In sequential reactors, water is stripped of oxygen, ferric ion is reduced to ferrous, acidity is neutralized with limestone, and reoxidation allows precipitation of iron	Also known as sequential alkalinity producing system (SAPS) or vertical flow pond (VFP)	Size to neutralize 25 g acidity m^{-2} day.
Sulfate Reducing Bioreactor	Compost and alkaline material are combined in a single bed. pH is kept neutral in anaerobic zone, promoting alkalinity generation by sulfate reduction	Relatively new, a limited number have been built for water typical of AMD in Deckers Creek watershed	Sized to remove 0.3 moles of metals or of sulfate per cubic meter of substrate per day
Wet seal	Path from underground to above ground is constrained, usually to a pair of PVC pipes	Controls where water flows, also prevents access to mine	According to flow

Table 46: Methods of passive and active AMD treatment (Christ and Pavlick, 2006).

Fecal Coliform Bacteria

From Christ and Pavlick, 2006:

Given the available data this section focuses on reducing fecal coliform bacteria by addressing wastewater. Before other sources of fecal coliform bacteria can be addressed, more data will have to be collected to determine the location of other pollution sources contributing to fecal coliform bacteria impairment. However, some suggestions for addressing fecal coliform bacteria from non-wastewater sources are presented at the end of this section.

The Deckers Creek wastewater assessment has determined that at least 6 tributaries and 19.1 miles of the mainstem are likely violating water quality criteria for fecal coliform bacteria due to wastewater. While some of this pollution can be attributed to point sources such as CSOs and poorly maintained package plants, nonpoint sources of pollution also contribute to the wastewater pollution in Deckers Creek.

Nonpoint source wastewater pollution can be attributed to inadequate wastewater treatment caused by a number of different factors including poor soils, insufficient drain field size, leaking or broken septic tanks or drain fields, and proximity of drain fields to waterways. In turn, these physical problems may be traced to various predisposing factors in the watershed, such as, low income levels, low population densities, and distance of housing clusters from centralized systems.

Remediation

Many different decentralized and onsite wastewater treatment systems can be utilized to address the wastewater needs of the targeted watersheds, as well as any other wastewater pollution sources identified in the future.

Individual Onsite

“Where space and soil conditions allow, traditional onsite treatment systems serving a single home or business are the simplest and most cost-effective option. Space constraints often preclude the use of individual onsite systems in communities located in narrow valleys. Nevertheless, onsite systems are the preferred wastewater treatment method for many communities, particularly those in more isolated areas and those located along ridge tops” (UGWA, 2006, p.30).

“Onsite systems commonly consist of a septic tank and a subsurface wastewater infiltration system (or treatment field). The septic tank allows solids to settle out and grease and “scum” to float to the top. The effluent from the tank is then transported, typically by gravity, to the treatment field. The treatment field disperses the effluent and allows it to be absorbed and purified by the soil. Conventional treatment fields consist of perforated pipes lain in gravel-filled trenches. Additional treatment technologies (as detailed below) may be necessary on some lots in order to ensure effective treatment” (UGWA, 2006, p.30).

Cluster Systems

“Cluster systems utilize the same treatment technologies as do individual onsite systems…. [But, unlike individual onsite, cluster systems are shared by two or more homes and may use small (4 inch) diameter pipes to transport, typically by gravity, septic tank effluent to a common treatment field. (Shallow-burial collection systems may use even smaller-diameter, light-weight pipe in longer lengths in order to minimize joints.) Additional treatment technologies (as detailed below) are necessary in some communities in order to ensure effective treatment. When space and soil conditions allow, multiple cluster systems can be installed in order to serve as many homes as possible in the community" (UGWA, p.30, 2006).

Low Pressure Pipe (LPP)

"Low pressure pipe systems use a pump or siphon to pressure dose effluent to a treatment field. Pressure dosing forces the effluent completely through the pipe system and creates a more equal distribution of effluent through the field. (A pump typically achieves a more uniform distribution than does a siphon). Also, dosing the field a few times a day allows for resting, more time for the effluent to percolate through the soil, and more chance for oxygen in the soil to rejuvenate the treatment field" (UGWA, 2006 p.30).

"LPP systems are typically slightly more expensive than conventional fields because of the pump or siphon and the extra tank each device uses. However, these systems have many advantages. They can be installed on upslope sites, on sites with high groundwater tables or bedrock, and in soils with slow percolation rates. When used on sites with high groundwater, some additional treatment of the effluent may be required" (UGWA, 2006, pp.30-31).

Drip Dispersal

"Drip dispersal systems, or drip irrigation, also use pumps to pressure dose effluent to a subsurface absorption field. However, in this case, small flexible tubes with emitters are used to force the effluent into the soil. Because the tubes and emitters are so small, a filter is typically installed after the pump to remove most of the solids" (UGWA, 2006, p.31).

"Installing drip tubes is relatively easy; they can be placed at a depth of 12-18 inches below the soil using a small plow. This ease of installation allows for the utilization of unconventional treatment fields such as forested or rocky sites, sites with high bedrock or groundwater tables, or sloping sites. They do require a sophisticated pumping and control system, which adds to the cost.

Most designers also recommend additional treatment beyond a septic tank before using drip dispersal. However, for cluster systems, the cost per house drops rapidly because of the low cost of installation" (UGWA, 2006, p.31).

Pretreatment

"At some sites, septic tank effluent requires additional treatment before entering the treatment field. One of the most reliable and effective pretreatment systems is the recirculating media filter. In a recirculating media filter, microorganisms are attached to a fixed media and the effluent passes over the media. A variety of materials can be utilized for the media including sand, peat, or textiles. Effluent percolates through the media, is collected by an underdrain, and recirculates for additional treatment. A once-through variation of this approach is the intermittent sand filter. In an intermittent sand filter, the septic tank effluent is similarly spread evenly over the surface of the sand, ground glass, or peat at a lower loading rate, is collected by an underdrain and discharged to the treatment field" (UGWA, 2006, p.31).

Decentralized - Collection Systems

Septic Tank Effluent

“When decentralized community systems are employed, a septic tank effluent system is the preferred collection system for many communities. These systems are economical solutions for small, dense communities, where lot size, soil conditions, depth to bedrock, groundwater, or other constraints prevent a straightforward onsite approach” (UGWA, 2006, p.31).

“In this type of collection system, properly sized septic systems are installed at each home and/or business. The septic tank collects the solids and the effluent from the tank then enters the collection system. The collection system consists of shallowly buried, small diameter pipe. The effluent is transported through the system by gravity or, when necessary, small pumps. When gravity flow and 4-inch pipes are utilized the system is referred to as Septic Tank Effluent Gravity or STEG; when pumps and 2- or 3-inch pipes are used the system is called Septic Tank Effluent Pumped or STEP” (UGWA, 2006, p.31).

“These small diameter sewers are advantageous and cost-effective because the need for constant slope, manholes, lifts stations and their inherent capital and operation and maintenance costs are minimized. In addition, because the collection and on-lot piping system is sealed, inflow and infiltration is rare. Drawbacks include a more expensive on-lot component and the periodic need to access private property in order to pump and haul solids from the tank” (UGWA, 2006, p.32).

Vacuum

“Vacuum sewers also use small diameter pipes (typically 4-inch), but, unlike STEP or STEG, they use centrally-located pumps to generate a vacuum to pull sewage along rather than using pressure to force it through the mains. The onsite component for the system is a vacuum valve pit, which can serve 1 to 4 homes. The valve is actuated when enough sewage collects in the pit to allow the vacuum in the line to “suck” the collected sewage to the vacuum collection station. The collection station houses the vacuum pumps and storage tanks and pumps the sewage to the treatment plant” (UGWA, 2006, p.32).

“Vacuum sewers are capable of lifting sewage over high points and are advantageous for densely populated areas of 75 or more homes, in rolling terrain, and for areas with high bedrock or water tables. They are also capable of transporting solids, so there are no residuals left on site for periodic pump and haul operations. The valve pit is cheaper than a STEP connection, especially where multiple houses share a pit, but the vacuum collection station can be quite expensive” (UGWA, 2006, p.32).

Gravity

“Traditional gravity collection systems transport all the wastewater from a home or business to a treatment plant using a large diameter (8 inch and greater) pipe. In order for these systems to transport solids in addition to fluids, pipes must be installed at a certain slope to ensure scouring and movement of solids. Maintaining this slope moves the pipe deeper, which requires either deep excavations or lift stations to pump the waste back up toward the ground surface. Manholes are also required at set intervals and pipe junctions for maintenance purposes” (UGWA, 2006, p.32).

“Gravity collection systems are well understood, reliable and frequently chosen because engineers and designers have little experience with alternative sewers. However, a high capital cost often makes them cost prohibitive in rural areas of low population density and they have been selected as the preferred treatment type in only a limited number of communities. Because of their depth, high number of pipe joints, leaking manholes, poor on-lot lateral construction and insufficient inspection (which often results in illegal “clear water” entry), they are also subject to extensive infiltration and inflow.” (UGWA, 2006, p.32).

Decentralized - Treatment Systems

Community Treatment Field

"When space and soil conditions allow, a single treatment field can be used to serve an entire community. If state codified site criteria can be met, treatment fields offer very high treatment efficiency in removing total suspended solids (TSS), biological oxygen demand (BOD), phosphorus, and microbiological contaminants. These subsurface wastewater infiltration systems typically demonstrate 99% efficiency in removing pollutants from wastewater (USEPA, 2002) and the design is based on the same principles as in onsite systems…. Additional treatment technologies… may be necessary in some communities in order to meet code requirements and ensure effective treatment. In order to protect water quality, treatment technologies utilizing subsurface dispersal are preferred" (UGWA, 2006, pp.32-33).

Package Plant

"Package plants utilize the same treatment technology as do large, centralized wastewater treatment facilities…, but on a smaller scale. Unfortunately, the same level of skilled operation is required for both" (UGWA, 2006, p.33).

"Package plants can treat wastewater to secondary levels (30 mg/L of BOD and TSS) and typically demonstrate 90% efficiency in removing pollutants from wastewater. They must be followed by disinfection to meet surface discharge requirements for pathogens, and must be augmented in order to perform significant nutrient (nitrogen and phosphorus) removal" (UGWA, 2006, p.33).

"They are the preferred treatment system only for communities where a subsurface discharge is not feasible. Because package plants result in a surface discharge which requires a NPDES permit, Section 319 funding will not be sought to implement these projects" (UGWA, 2006, p.33).

Centralized Systems

"Traditional, centralized wastewater collection and treatment systems pipe wastewater from a large number of homes and businesses to a central place for treatment. …Treatment plants are sized according to the volume of wastewater they handle. During primary treatment, solids and fluids are separated and aerobic bacteria treat the waste. Most facilities also use chlorine, UV light, or ozone to further disinfect treated effluent. Disinfected effluent is then discharged to a surface water body. Ultimately, the solids generated by the treatment facility must be removed from the system, treated if necessary, and disposed of by hauling to a sewage treatment facility or landfill or, more typically, via land application" (UGWA, 2006, p.33).

<u>Prevention</u>

As this watershed based plan is implemented, it is strongly suggested that proper operation and maintenance measures be put in place for new systems. "Adequate and capable management of wastewater treatment systems is critical to ensuring system performance and the protection of water quality and public health. If the options presented in this WBP are to be long-term, sustainable solutions, then proper maintenance of treatment systems is essential" (UGWA, 2006, p.33). Existing entities that could assist in the proper operation and maintenance of systems include:

- Deckers Creek Public Service District
- Morgantown Utility Board

- Home Owner Associations
- County Health Departments
- Local Utility Companies

Sediment

Further monitoring to identify sediment sources as well as research on sediment control methods are required to determine appropriate control measures for this NPS pollutant. Streambank stabilization, instream structures, natural stream design and streamside buffer strips are likely to be a part of the solution. An option for sediment remediation was developed in 2014 by FODC for a sediment impaired segment of Aaron Creek. A reach of 2,000 ft. was selected for evaluation due to its location within disturbed agricultural pastureland. Approximately 1,040 ft. of stream bank was compromised within the 2,000ft. study area (Figure 37). The full stream bank stabilization plan can be read in the NPS 1367 Final Report submitted to WVDEP (FODC, 2014). The following BMPs constitute the general conceptual design:

Grading and revegetating stream banks:

As discussed in the USDA NRCS Engineering Field Handbook, steep streambanks must be graded to a maximum slope of 3:1. Aaron Creek has six major failing/exposed streambank areas, four of which have a rise (vertical face) of approximately three feet with no run, and two that have a rise of four feet with no run.

Re-grading will be followed by re-vegetating with appropriate plant species. Currently, the vegetation present along the Aaron Creek study area streambanks is cool season grasses that have shallow root systems. This existing vegetation is not suitable for holding sediment in place and stabilizing streambanks. FODC proposes planting native riparian species (e.g., willows (*Salix* spp.)) that are adapted to growing on streambanks and can develop deep root systems that can better retain sediment and maintain stabilized streambanks. This will be done by installation bioengineering materials in the six major problem areas within our project site: willow brush mattresses, live stakes, and fascine bundles. Installation guidelines can be found on page 30 of Chapter 16, “Streambank and Shoreline Protection” of the United States Department of Agriculture Natural Resources Conservation Service’s (USDA NRCS) Engineering Field Handbook (1996).

A 30 foot vegetated buffer on each side of the stream will be fenced off along the entire 2000 foot section of compromised stream in our project area. The vegetation in this area will be allowed to regenerate to a riparian forest without impacts of grazing cattle. Over time, management measures (e.g., herbicide application; cutting; mowing) may need to be taken to establish a suitable vegetative community; however, this is not addressed in the design.

Figure 36: Location of six major streambank failures along Aaron Creek .

Installing fencing

Cattle and other livestock are often allowed to freely move into and around streams, rivers, and other surface water. This is a practice that requires no costs for livestock owners that need to provide drinking water and a place for their livestock to cool themselves during warm periods. This is often to the detriment of the water body, and can lead to issues with livestock.

While cattle are most likely not the chief driver in the failure of streambanks along Aaron Creek, their presence may exacerbate problems. Livestock can degrade a stream in several ways. The hooves of cattle can exert great pressure on the soil. This loosens soil which can then erode into streams where it can settle into the interstitial spaces of the stream bed that would normally be occupied by benthic macroinvertebrates and used by fish for cover and nesting habitat. In more extreme cases, entire sides of the bank will begin to slough off and settle into the stream.

Cattle also consume and trample riparian vegetation that would normally function to help stabilize stream banks and hold soil in place with their roots. Vegetation provides shade, which helps to regulate water temperature. This is especially important because some aquatic life is intolerant to warmer conditions. Vegetation also helps dissipate the energy from water moving through the stream, intercepts and slows water from runoff during precipitation events, and assimilates and removes nutrients that would otherwise end up in a stream.

Another concern is that cattle excrement directly goes into the stream, or can enter the stream via runoff. This can lead to an excess in nitrogen and phosphorus, both nutrients critical to plant growth, but when present in excessive amounts can lead to eutrophication. Eutrophication can allow certain plants to grow so quickly, they overwhelm a body of water. This is commonly seen in certain types of algae. These algae, in some instances, can produce toxins that impair the aquatic environment (Higgins et al. 2011).

Installing cattle crossing

The property has pasture on both sides of the stream, so a cattle crossing is required in order for cattle to be moved between each side. To ensure that the cattle do not cause damage to the stream bed, or themselves, a cattle crossing will be installed. The design of the cattle crossing will adhere to the recommendations described in Higgins et al. (2011).

The width of the cattle crossing will be 12 feet wide and have 30 foot approaches on each side. This will allow cattle to move through and is large enough to allow a truck to drive across, if need be. The crossing will consist of excavating the area described above and then placing geotextile fabric (weight >6 ounces per square yard) in the excavated area. A 3” diameter rock aggregate (AASHTO #2) layer will be placed on top of the geotextile fabric to aid in stabilizing the crossing. The crossing will sit flush with the streambed to minimize the possibility of the rock aggregate from washing out.

Installing solar powered watering system

A solar-powered water pump may be the most viable option as an alternative water source. While initial costs may be high compared to other alternative water source options (e.g., gravity-powered systems; animal activated systems), a direct-coupled solar pumping system can be a reliable option with relatively low operating costs. This system will require no monthly utility payments. Solar pumps will allow for a continuous water supply during all months—as long as heavy snow doesn’t cover the photovoltaic panels—with limited maintenance. The maintenance issues that may arise will be related to the pump, which can develop problems when sand and silt clogs the pump. A fine mesh filter will help to reduce this risk. These systems can operate with 12- or 24-volt systems. The University of Tennessee agricultural engineering specialists suggest that operating with a 24-volt battery that will charge over time is the most dependable route (Buschermohle and Burns 2009). These systems are able to accommodate up to 50 head of cattle. Also, the system will be created so that it can be moved from one pasture to another; however, two water tanks and concrete pads will be needed—one of each on each side.

Water storage tanks will be freeze proof and insulated by material in order to avoid frost. Insulation can be from partial burial of the tank, mounding dirt around the tank, or by packing sawdust or other materials around the tank. Also, all piping will be buried below the frost line. Another potential way of reducing the risk of freezing the water stored in tanks, a continuous flow from the storage tank to the trough, out a pipe can be developed. Valves will allow this technique to be used during winter months and then turned off during months without a risk of freezing temperatures. A concrete pad and geotextile fabric will be placed around the tanks in order to minimize erosion.

Engineers’ certification of conceptual design

The stream bank stabilization design for the study area within Aaron Creek subwatershed was designed internally by FODC employees. Federal and state funded project typically require certified engineers’ approval to receive funding. FODC will have the internally developed conceptual design reviewed by a state certified engineering firm and will be provided signed/stamped final design drawings, bid documents, and contract documents. Procurement of an engineering firm will follow West Virginia Procurement of Architectural/Engineering firms for projects <$250,000, which will select at least three engineering firms based upon submitted qualifications.

Construction/Labor

FODC will publish a Class II Legal Advertisement in the local periodical as well as contact qualified contractors by email, phone, and fax to invite them to a construction pre-bid meeting. The estimated duration of the project is three months with a four man crew.

FODC Labor/Permitting

To facilitate the stream bank stabilization project will require FODC staff complete several activities such as submitting the appropriate permit applications, procuring an engineering firm for approval of conceptual design, procuring a contractor for construction phase, and overseeing construction and ensuring contractors are meeting design specifications, processing engineering and construction invoices and paperwork.

Permitting will consists of:

1. WVDNR – Stream Activity Permit
2. WVDNR – National Environmental Policy Act
3. WVDEP – Construction Stormwater Permit
4. U.S. Army Corps of Engineers – Nationwide 27 or 404 Permit and 401 Certification
5. NFIP / FEMA / Local 911 – Floodplain permit

One potential route to expedite the process would be to work through the West Virginia Conservation Agency's (WVCA) Landowner Stream Access Permit Program. This program serves as a one-stop shop in that the WVCA notifies all other government agency permit programs that may need to be involved in the permit process. The activities eligible for such a permit include excavation, stream bank stabilization, channel restoration, and maintenance, all of which may be necessary to implement a successful project on Aaron Creek. Communications between FODC and employees of the WVCA suggest that the WVCA would be willing to offer technical support and help with permits if this project were to be implemented.

Total design budget

The total material costs associated with the implementation of the Aaron Creek streambank stabilization project will be approximately $43,652. In addition, engineering and labor fees will increase the overall cost. FODC will procure an engineering firm to revise and approve the existing conceptual design. The cost of the consultation with a qualified engineering firm is estimated at $10,000. Regarding construction phase, assuming a timeline of three months, with a four man crew, and a rate of $50/hr., labor costs could be approximately $96,000. Also, FODC personnel will expend time and funds while conducting inspections, permitting, and post-construction monitoring. Personnel time and fees are estimated at $10,000. Total costs are calculated in Table 48.

Item	Cost per Unit
Bioengineering Products	$33,870
Fencing	$4,917
Cattle Crossing	$700
Solar Powered Watering System	$4,165
Engineering	$10,000
Construction Labor	$96,000
FODC Labor / Permitting	$10,000
Total Costs	**$159,652**

Table 47. Total costs for stream bank stabilization project.

Lead

From Christ and Pavlick, 2006:

Although the source of lead pollution in the Deckers Creek watershed, and particularly in the watershed of the UNT/Deckers Creek RM 18.6, is probably foundry waste used as fill, there is not enough information available to determine the best measures for eliminating inputs to the streams. The largest source could be the waste materials themselves, organic matter or sediments stored in the impoundments of the subwatershed which have absorbed the lead over the years, or other materials. The most important immediate measure will be additional research to determine sources of lead. Once that effort is complete, measures may include removal of the foundry waste, eliminating water flow through the material, or other measures.

Further problems with heavy metals are unlikely because foundries no longer operate in the watershed, because foundries generally use processes that generate less waste, and because of much stricter regulation than in the time when the foundry operated.

ELEMENT D: TECHNICAL AND FINANCIAL ASSISTANCE

Acid Mine Drainage

Passive and active mine drainage remediation entails a number of tasks and roles, including planning, site evaluation, funding, conceptual design, engineering design, project management, maintenance and monitoring. A number of organizations and state and federal agencies are committed to filling these roles.

Friends of Deckers Creek is actively engaged in the Deckers Creek Restoration Team (DCRT). DCRT is responsible for progress in extensive AMD remediation within the Deckers Creek watershed. The majority of action in DCRT consists of FODC, WVDEP-DWWM, WVDEP-OAMLR, WVDEP-OSR, USDA-NRCS, and U.S.-OSM.

WVDEP through distribution of EPA Clean Water Funds typically fund the pre-construction monitoring phase, engineering phase, and a portion of the construction phase of AMD remediation projects. The

Office of Surface Mining typically makes a contribution to the construction phase. Both WVDEP and OSM typically provided some funding for the post-construction monitoring and reporting phase.

Fecal Coliform

To implement this Watershed Based Plan, strong partnerships with local agencies and adequate funding will be needed. DCRT will seek advice and technical and financial assistance from several quarters to address wastewater sources. DCRT will approach home and business owners, West Virginia Department of Health and Human Resources, WVDEP, extension agents, county sanitarians, local public service districts, Morgantown Utility Board, and the National Small Flows Clearinghouse to form partnerships and to find funding for failed septic systems and straight pipes.

DCRT will approach landowners, the Natural Resources Conservation Service (NRCS), the West Virginia Conservation Agency (WVCA), the Monongahela Resource Conservation District (MRCD), and extension agents for solutions to fecal coliform pollution by livestock. Point source dischargers are also expected to decrease unpermitted discharges. Prevention of additional fecal coliform pollution will depend on the vigilance of citizens, citizens' groups, and WVDEP.

Other likely nonpoint sources of fecal coliform bacteria pollution include livestock and wildlife. While wildlife sources of fecal coliform bacteria are difficult to control, livestock sources of fecal coliform bacteria pollution can be addressed though a number of methods including, but not limited to:

- fencing livestock out of streams,
- creating permanent riparian zones, making them inaccessible to livestock,
- construction of ponds to collect pasture runoff, and
- construction of sheds to hold animal waste.

Sediment

In 2014 the West Virginia Conservation Agency began construction of a stream bank stabilization plan within the Aaron Creek subwatershed of Deckers Creek. The WVCA site is located upstream from the site for which FODC developed a stream bank stabilization plan. Future activities regarding sediment studies and stream bank stabilization plans will likely involve extensive communication with WVCA and WV Conservation Committee.

Lead

Concentrations of lead violating the aquatic life designated use have been found in the stream water. According to area residents, there are approximately 45 acres where the fill material may have been used in the watershed of this tributary, and an additional 10 acres of fill material that may contribute lead to other segments of the Deckers Creek stream system. WVDEP is currently monitoring the watershed to see if lead impairments will be detected again, and if they are, will prepare a TMDL by the end of 2017.

Stakeholders

Stakeholders in the Deckers Creek watershed are those entities that will play a role in assisting, developing, maintaining, or utilizing improvements within the watershed (Table 49). Stakeholders have been contacted and invited to participate in Deckers Creek Restoration Team meetings to make contributions to the updated WBP.

Since implementation of the 2005 Deckers Creek WBP several projects have been completed with land contributions from cooperative landowners. Funding contributions consist mainly of grants and awards from federal and state environmental agencies. Many more local businesses have contributed to education and outreach activities and general administrative duties of FODC. In addition, several local businesses have donated supplies or free publicity to disseminate the mission of FODC to the greater regional community. The timeline for AMD remediation is included as Table 50.

Deckers Creek Watershed Stakeholders	
ArchCoal/Patriot Mining Company	Monongalia County Commission
City of Masontown	Morgantown Printing and Binding
City of Morgatown	Morgantown Utility Board
City of Reedsville	Natural Resources Conservation Service
Community Members	Preston County Commission
Dominion Post	The Upper Monongahela River Association
Environmental Banc and Exchange	Trout Unlimited
Environmental Engineering Firms	U.S. Army Corps of Engineers
FODC Board of Directors	U.S. Environmental Protection Agency
Friends of Deckers Creek	U.S. Office of Surface Mining
Greater Morgantown Area Chamber of Commerce	West Virginia University
Greer Limestone	WV Conservation Agency
Isaac Walton League	WV Conservation Committee
Landowners	WV Deparment of Natural Resources
Local Businesses	WV Regional Planning and Development Council
Local Contractors	WVDEP Division of Water and Waste Management
Mon County Development Authority	WVDEP Office Abandoned Mine Lands and Reclamation
Mon Trails Conservancy	WVDEP Office of Special Reclamation

Table 48: Stakeholders in the Deckers Creek watershed.

ELEMENT E: EDUCATIONAL COMPONENT

An important component in watershed remediation is dependent on community outreach. Friends of Deckers Creek's outreach programs target federal and state agencies, fellow watershed organizations, local businesses, and community members.

Friends of Deckers Creek host multiple activities and events each year to educate watershed residents and users about the problems and potential issues within the Deckers Creek watershed. The following education components will be used to communicate the goals and progress of the Watershed Based Plan:

Internet components

1. www.DeckersCreek.org - FODC maintains a website with information about current water remediation projects, volunteer opportunities, the history of Deckers Creek, and existing

educational components. Information regarding staff, board members, and the Youth Action Board can also be found on the website.

2. www.CreekDog.org - CreekDog is an easy-to-use tool for watershed watchdogs. Report watershed pollutants such as trash, untreated sewage, suspicious drilling activity, or stream dredge and fill. Locate and report on pollution in the Deckers Creek watershed using Creek Dog and FODC will contact the appropriate agencies in Monongalia and Preston counties.
3. Youth Watershed Connections
4. The Youth Watershed Connections (YWC) is a project led by Friends of Deckers Creek's Youth Action Board. YWC developed the Youth Guide to Deckers Creek as the first youth-led, online, watershed guide connected to an interactive map. YWC seeks to support the creation of other youth developed watershed guides.
5. Social media presence
6. FODC has social media presence on Facebook, Twitter, Instagram, and Pinterest. These social media outlets are used to advertise upcoming events and volunteer opportunities as well as organization successes.

<u>Printed Components</u>

1. Deckers Creek Currents - FODC publishes a newsletter three times each year to inform the organization's members about the progress of remediation projects in the watershed and other Deckers Creek-related successes or information. Each due-paying member of the organization receives a newsletter as one of many benefits of donating to FODC. Newsletters are also available free for the public to acquire from the FODC office at any time during the year.
2. Publications - FODC has published two natural history brochures, Ferns of the Deckers Creek Rail Trail and Wildflowers of the Deckers Creek Rail Trail, as well as a birding checklist for the Deckers Creek watershed. Aquatic Communities of the Deckers Creek Watershed, a brochure detailing the Clean Creek Program, was also produced. Current publications also include the Richard Mine Community Report and the Aaron Creek Streambank Stabilization Report.
3. Educational Kiosks - FODC partnered with the Morgantown Utility Board and the Monongahela River Trails Conservancy to install 3 permanent kiosks along the Deckers Creek Rail Trail. The kiosks currently display information about our Clean Creek Program.

<u>Community Components</u>

1. Outdoor Learning Park - In 2009, FODC developed the Sabraton Outdoor Learning Park (OLP). The OLP is an inclusive green space that engages users in meaningful educational opportunities and unique, passive recreational experiences. The OLP includes an outdoor classroom pavilion, a picnic pavilion, community mosaic mural, walking trails, seating, native gardens and plants, public art created by local youth, interpretive signs, and is located on a local rail-trail. Areas of green space can be instrumental in passively communicating with the public about certain topics and issues, such as environmental impairments, that may be of interest.
2. Youth Action Board - The FODC Youth Action Board (YAB) is a group of dedicated youth, ages 12-18, interested in clean water and helping the community. Their mission is to clean up the Deckers Creek watershed for conservation, preservation, and recreation through youth-led projects and research. YAB members do hands-on activities benefiting local streams, watersheds, and community members.
3. Public Meetings - FODC hosts community meetings on regular basis. The following are addressed during the meetings: updates on restoration projects, upcoming events and volunteer opportunities, and issues within the watershed to be addressed.

Fundraising Components

1. The Holiday Social - The Holiday Social serves as the FODC's annual gathering of staff, board members, and supporters. Held in December, the event celebrates the year's accomplishments and honors FODC's major donors and hardworking volunteers. A presentation is given by FODC staff regarding the year's progress and setbacks.
2. The Spring Meltdown - The Spring Meltdown is FODC's annual spring fundraiser. The event includes silent and live auctions and live music. This is the largest fundraising event for the organization.
3. Deckers Dash 10K - The Deckers Dash 10k serves as FODC's fall fundraiser. The race starts at Hazel Ruby McQuain Riverfront Park and follows the Deckers Creek Rail Trail where it maneuvers through the Outdoor Learning Park before turning back to the Riverfront Park.

Water Quality Components

1. Watershed Bill of Rights - The purpose of the Watershed Bill of Rights is to help protect the Deckers Creek watershed and surrounding watersheds through the prevention, reduction, and elimination of water pollution by educating local citizens on water polluting activities, their rights as citizens and landowners to report these activities, and directions on doing so. The program also trains and empowers citizens to monitor specific pollutants. The program activities are promoted and implemented through the Watershed Bill of Rights multi-media campaign, community symposiums, and citizen scientist monitoring program.
2. Clean Creek Program - FODC monitors 13 sites within the Deckers Creek watershed four times each year. At these sites, we conduct water quality testing, fish population sampling and identification, and macroinvertebrate collection and identification. Data are compiled into a *State of the Creek* report which is distributed to local schools and businesses, government agencies, community members, and dues-paying organization members.

The Deckers Creek Restoration Team holds quarterly meetings that are open to the public. Information about nonpoint source remediation projects and priorities will be freely available to those who attend these meetings.

ELEMENT F: IMPLEMENTATION SCHEDULE

Acid mine drainage

Stream Name	Stream Code	AMD Source	Priority Level	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Deckers Creek	WV-M-14	Bretz Matheny	High	3	4	4	4	4	4	4	4	4	4	4
Slabcamp Run	WV-M-14-R	SLANCINL	Moderate	2	3	4	4	4	4	4	4	4	4	4
		OLC 250	High	2	3	4	4	4	4	4	4	4	4	4
		OLC 300	High	2	3	4	4	4	4	4	4	4	4	4
		OLC 400	Moderate	2	3	4	4	4	4	4	4	4	4	4
UNT/Kanes Creek RM 2.36	WV-M-14-V-0.9	KCS3123	High	2	3	4	4	4	4	4	4	4	4	4
		KCS34Dis	High	2	3	4	4	4	4	4	4	4	4	4
Kanes Creek	WV-M-14-V	VP12A	High	1	2	3	4	4	4	4	4	4	4	4
		VP12B	High	1	2	3	4	4	4	4	4	4	4	4
		KCS1Feed	High	1	1	2	3	4	4	4	4	4	4	4
		VH3 Upgrades	High	1	1	2	3	4	4	4	4	4	4	4
		Blanket Drain #2	High	1	1	1	2	3	4	4	4	4	4	4
		MMRAMD	High	1	1	1	2	3	4	4	4	4	4	4
Dillan Creek	WV-M-14-S	DILCLV02	High	1	1	1	2	3	4	4	4	4	4	4
		DILDVRSN	High	1	1	1	2	3	4	4	4	4	4	4
		DilCR253	High	1	1	1	2	3	4	4	4	4	4	4
		DILJLCLV	Moderate	1	1	1	1	2	3	4	4	4	4	4
		DILCLV01	Moderate	1	1	1	1	2	3	4	4	4	4	4
Deckers Creek	WV-M-14	Brdg5AMD	High	1	1	1	1	2	3	4	4	4	4	4
Hartman Run	WV-M-14-A	Mlgrweir	Moderate	1	1	1	1	1	2	3	4	4	4	4
Aaron Creek	WV-M-14-B	AaronAMD	Moderate	1	1	1	1	1	2	3	4	4	4	4
Deckers Creek	WV-M-1	Richard	High	1	1	1	1	1	2	3	4	4	4	4
Slabcamp Run	WV-M-14-R	OLC 650	High	1	1	1	1	1	2	3	4	4	4	4
		OLC 750	High	1	1	1	1	1	2	3	4	4	4	4
Falls Run	WV-M-14-O	FallsAMD	Low	1	1	1	1	1	1	2	3	4	4	4
Glady Run	WV-M-14-P	Glady Run Strips	Moderate	1	1	1	1	1	1	2	3	4	4	4
Deckers Creek	WV-M-14	Dalton	Moderate	1	1	1	1	1	1	2	3	4	4	4
		RckFrgHT	Low	1	1	1	1	1	1	1	2	3	4	4
		RckFrgPVC	Low	1	1	1	1	1	1	1	2	3	4	4
		RckFrgRD	Low	1	1	1	1	1	1	1	2	3	4	4
Laurel Run/Deckers Creek	WV-M-14-T	Burke Road AMD	High	1	1	1	1	1	1	1	2	3	4	4
		Sharon5	Low	1	1	1	1	1	1	1	2	3	4	4
UNT/Kanes Creek RM 2.49	WV-M-14-V-1	SPTP	Moderate	1	1	1	1	1	1	1	1	2	3	4
		SandySeep	Moderate	1	1	1	1	1	1	1	1	2	3	4
UNT/Deckers Creek RM 5.70	WV-M-14-E	Valley Mining	Low	1	1	1	1	1	1	1	1	2	3	4
		Beulah Chapel	Low	1	1	1	1	1	1	1	1	2	3	4
Back Run	WV-M-14-Q	BckRnDiv	Low	1	1	1	1	1	1	1	1	2	3	4
UNT/Kanes Creek RM 2.49	WV-M-14-V-1	Nbraham	Low	1	1	1	1	1	1	1	1	2	3	4
UNT/Deckers Creek RM 17.28	WV-M-14-U	ZinnAMD	Low	1	1	1	1	1	1	1	1	2	3	4
Hartman Run	WV-M-14-A	HrtMonGen	Low	1	1	1	1	1	1	1	1	1	2	3
Deckers Creek	WV-M-14	Goat1A	Low	1	1	1	1	1	1	1	1	1	2	3
		Goat1B	Low	1	1	1	1	1	1	1	1	1	2	3
		Goat2	Low	1	1	1	1	1	1	1	1	1	2	3
Kanes Creek	WV-M-14-V	KCS2Culv	Low	1	1	1	1	1	1	1	1	1	2	3

1	Planning and Monitoring
2	Engineering Phase
3	Construction Phase
4	Post-Construction Monitoring

Table 49: Implementation schedule for AMD remediation activities.

Fecal coliform bacteria

Currently no implementation schedule exists for fecal coliform reduction. Future watershed wide assessment will be conducted with emphasis in TMDL listed tributaries and segments.

Other nonpoint pollution problems

Currently no implementation schedule exists for sediment control/stream bank stabilization or lead contamination. A stream bank stabilization plan has been developed for Aaron Creek, but will require landowner approval and funding to proceed. Decisions regarding future sediment control projects will be based upon the successes/failures of the Aaron Creek stream bank stabilization project. Several West Virginia University graduate students have approached FODC with an interest in evaluating sediment contamination in upper watershed channelized portion of Deckers Creek.

ELEMENT G: MILESTONES

Remediation will follow a trend of treating high priority through moderate and low priority AMD sources. The initial milestone anticipated from remediation activities will be subwatersheds that meet TMDLs. In the years following remediation at specific sites, chemical water quality monitoring will indicate no violations of standards downstream from the treated AMD source. Within three years following remediation benthic macroinvertebrate WVSCI scores and fish biomass scores will increase. As water quality in subwatersheds and flood control impoundments improves DCRT will consider the possibility of stocking fish and reestablishing water fowl habitat.

It is anticipated that recovery of remediated segments will occur incrementally, beginning with improved chemistry or reduced fecal loads or turbidity values (Table 51). Following improvement of physical parameters, biological systems are expected to improve. After considerable improvement of aquatic communities, FODC will work with entities in DCRT such as WVCA and WVDNR to initiate further ecosystem improvements.

Stream Name	Stream Code	Actions Planned	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Kanes Creek	WV-M-14-V	Construct BMPs	1	1	2	2	3	3	4	4	4	4	4	4	4	4	4	4
UNT/Kanes Creek RM 2.36	WV-M-14-V-0.9	Construct BMPs	1	1	2	2	3	3	4	4	4	4	4	4	4	4	4	4
UNT/Kanes Creek RM 2.49	WV-M-14-V-1	Construct BMPs	1	1	2	2	3	3	4	4	4	4	4	4	4	4	4	4
Swamp Run	WV-M-14-S-3	Mitigation	0	0	1	1	2	2	3	3	4	4	4	4	4	4	4	4
Dillan Creek	WV-M-14-S	Construct BMPs	0	0	0	1	1	2	2	3	3	4	4	4	4	4	4	4
Slabcamp Run	WV-M-14-R	Construct BMPs	0	0	0	0	1	1	2	2	3	3	4	4	4	4	4	4
Hartman Run	WV-M-14-A	Construct BMPs	0	0	0	0	0	1	1	2	2	3	3	4	4	4	4	4
Aaron Creek	WV-M-14-A	Construct BMPs	0	0	0	0	0	1	1	2	2	3	3	4	4	4	4	4
Falls Run	WV-M-14-O	Construct BMPs	0	0	0	0	0	0	1	1	2	2	3	3	4	4	4	4
Glady Run	WV-M-14-P	Construct BMPs	0	0	0	0	0	0	0	1	1	2	2	3	3	4	4	4
Laurel Run/Deckers Creek	WV-M-14-T	Construct BMPs	0	0	0	0	0	0	0	1	1	2	2	3	3	4	4	4
UNT/Deckers Creek RM 17.28	WV-M-14-U	Construct BMPs	0	0	0	0	0	0	0	1	1	2	2	3	3	4	4	4
UNT/Deckers Creek RM 5.70	WV-M-14-E	Construct BMPs	0	0	0	0	0	0	0	0	1	1	2	2	3	3	4	4
Back Run	WV-M-14-Q	Construct BMPs	0	0	0	0	0	0	0	0	1	1	2	2	3	3	4	4
Deckers Creek	WV-M-14	Construct BMPs	0	0	0	0	0	0	0	0	0	1	1	2	2	3	3	4

1	Improved Chemistry
2	Improved WVSCI
3	Improved Fish Metrics
4	Habitat Restoration

Table 50: Estimated timeline for subwatershed improvement.

ELEMENT H: SET OF CRITERIA TO EVALUATE LOAD REDUCTIONS

To ensure proper evaluation of load criteria, FODC will undertake an extensive monitoring campaign throughout the watershed and its tributaries. Emphasis will be placed on evaluating the effectiveness of BMPs constructed for treatment of AMD, fecal contamination, and sediment stabilization.

Parameters for post-construction monitoring:

Acidity, alkalinity, pH, conductivity, dissolved oxygen, oxidation-reduction potential, flow, aluminum (dissolved), iron (dissolved), manganese (dissolved), calcium (dissolved), and magnesium (dissolved).

In addition, benthic macroinvertebrate and fish communities will be sampled annually at strategic locations throughout the watershed. Data will evaluate quantity and diversity of species. Macroinvertebrate results will be assessed by calculation of the West Virginia Stream Condition Index (WVSCI) and fish communities will be evaluated by diversity, quantity per site, quantity per acre, and biomass per acre.

Constituents to evaluate sediment BMPs will consist of analysis of turbidity plus a visual assessment of the stream channel according to the Rosgen method. Features of the method consist of evaluating stream bank slope (incision), vegetation type, and substrate embeddedness. Utilization of bank erosion hazard index (BEHI) will require further research into protocols.

If evaluation of BMPs indicates a lack of efficacy the systems will be evaluated to determine the proper course of action. FODC will communicate with entities identified in Element D of this document to pursue technical or financial assistance. Future projects will be designed taking into consideration the effectiveness, or lack thereof, of former projects. AMD treatments systems that decrease below 90% load reduction will be improved through low impact maintenance tasks within one year.

ELEMENT I: MONITORING

Planning remediation measures, evaluating efficacy, and assessing the progress of the WBP will require extensive monitoring. Several agencies and organizations currently monitor the Deckers Creek watershed, and will continue to do so.

To ensure that funds are being used effectively, contaminant sources are identified, and treatment system efficacy is evaluated, FODC personnel will undertake several monitoring tasks:

1. Pre-design measurements:
   FODC will collect measurements of AMD pollutants and flows within the entire Deckers Creek Watershed throughout each year. Such data are necessary to quantify contaminant loads and aide in development of remediation designs.
2. Effects of Best Management Practices:
   Before and after construction of the BMPs, FODC will collect quarterly measurements of AMD pollutants and flows at completed AMD remediation project sites. Quarterly measurements will also be collected at the outlets of TMDL subwatersheds. These measurements will be used to evaluate the effect of the BMPs.
3. Benthic macroinvertebrate monitoring:
   FODC will arrange for benthic macroinvertebrate surveys in the Deckers Creek watershed before and after BMPs are installed to determine the effect of the BMPs on aquatic communities.

Monitoring for tasks 1 and 2 will include field measurements of pH, conductivity, dissolved oxygen, temperature, oxidation-reduction potential, and flow at each site, and collection of water samples for analysis of pH, conductivity, hot acidity, alkalinity, sulfate, dissolved aluminum, total iron, total manganese, total calcium, and total magnesium.

FODC will continue to monitor other areas of the Deckers Creek watershed to plan new projects to address nonpoint source pollution. Data will be submitted by FODC to WVDEP in semi-annual and project close-out reports. Data will also be disseminated to WVDEP through quarterly DCRT meetings. At the request of WVDEP, FODC will provide in database format any data that WVDEP may deem useful.

Additional data will be collected by WVDEP and NRCS at select project sites within Deckers Creek watershed. NRCS, under an agreement with U.S. Army Corps of Engineers, collects quarterly data within UNT/Deckers Creek RM 5.70 subwatershed. WVDEP-OAMLR and WVDEP-OSR will collect data at existing and future AML and BFS project locations. WVDEP-Division of Water and Waste Management (DWWM) has collected data in preparation of the 2014 TMDL and will continue to collect lead data in the UNT/Deckers Creek RM 18.48 subwatershed. State and federal agency collected data has been openly shared with FODC.

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