WATERSHED BASED PLAN FOR THE DECKERS CREEK WATERSHED

Preston and Monongalia Counties, West Virginia

March 2005

Submitted to:

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Division of Water and Waste Management
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Executive summary

The Deckers Creek watershed comprises 64 square miles in Preston and Monongalia Counties, West Virginia. The West Virginia Integrated Water Quality Monitoring and Assessment Report, which includes the state’s 303(d) list, identifies eight streams, including the mainstem, that are impaired by nonpoint source pollutants. Seven streams are impaired by acid mine drainage pollutants and one by lead. There is also evidence of impairment by nonpoint sources of fecal coliform bacteria and sediment. Enough information is available to enumerate sources, estimate costs and plan remediation for the nonpoint acid mine drainage sources. Addressing the other pollutants will require additional data collection. A clean-up plan, the Total Maximum Daily Load document, calls for reductions of metal loads for 13 subwatersheds. This watershed based plan identifies 17 high-priority acid mine drainage sources that must be treated in order to meet the required metal reductions in ten of these subwatersheds. Recent monitoring data on the remaining three subwatersheds do not confirm the need for metal reductions. Pollutant loads from the 17 high-priority sources must be reduced in order to meet the requirements of the clean-up plan. Passive treatment methods can reduce loads from 16 of the 17 high-priority sources by 90% at a cost of $5.9 million. The remaining source, the Richard mine, will require ongoing, active treatment. The Deckers Creek Restoration Team, a coalition of state and federal agencies, local individuals, groups, and businesses, and the watershed organization, Friends of Deckers Creek, will carry out this watershed based plan with funding from the Office of Surface Mining, the Abandoned Mine Land Trust Fund, nonpoint source pollution funds from the United States Environmental Protection Agency, and other sources. Parallel efforts are underway to raise funds for ongoing, active treatment of the drainage from the Richard mine.

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ACKNOWLEDGEMENTS

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SUGGESTED REFERENCE

Christ, M. 2005. Watershed based plan for the Deckers Creek watershed, Preston and Monongalia Counties, West Virginia. Morgantown, WV: Friends of Deckers Creek. March.

LIST OF ABBREVIATIONS

µg/L	Micrograms per liter
µg/L	Micrograms per liter
Al	Aluminum
AMD	Acid mine drainage
AML	Abandoned mine land
BFS	Bond forfeiture site
cfu	Colony-forming unit
DCRT	Deckers Creek Restoration Team
DWWM	Division of Water and Waste Management (within WVDEP)
EQB	Environmental Quality Board
Fe	Iron
FODC	Friends of Deckers Creek
gpm	Gallons per minute
mg/L	Milligrams per liter
Mn	Manganese
MRB	Manganese removal bed
MRCD	Monongahela Resource Conservation District
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
NRCS	Natural Resources Conservation Service
NTU	Nephelometric turbidity unit
OAMLR	Office of Abandoned Mine Lands and Reclamation (within WVDEP)
OLC	Oxic (or open) limestone channel
OSM	Office of Surface Mining, Reclamation, and Enforcement
PA	Problem area
PAD	Problem area description
Pb	Lead
pH	Intensity of acid or base reaction in a solution (negative log of hydrogen ion activity)
PSD	Public service district
RAPS	Reducing and alkalinity producing system
RM	River mile, the distance from the mouth of a stream upstream to a particular point
SAPS	Successive alkalinity producing system
SMCRA	Surface Mining Control and Reclamation Act
SRG	Stream Restoration Group (within OAMLR)
SWS	Subwatershed
TMDL	Total Maximum Daily Load
UDCI	Upper Deckers Creek impoundment
UNT	Unnamed tributary
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
VFP	Vertical flow pond
WBP	Watershed based plan
WCAP	Watershed cooperative agreement program
WVCA	West Virginia Conservation Agency
WVDEP	West Virginia Department of Environmental Protection

1. WATERSHED DESCRIPTION

The Deckers Creek watershed covers roughly 64 square miles in Monongalia and Preston Counties, West Virginia. 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 (Figure 1). The unincorporated towns of Brookhaven, Richard, Dellslow, Rock Forge, Sturgisson, Greer and Mountain Heights in Monongalia County, and Bretz and Arthurdale in Preston County also lie within the watershed.

Deckers Creek rises on Chestnut Ridge, which approximately follows the line between Preston and Monongalia Counties, flows east and then north through a valley that parallels the ridge. This area is the Valley District of Preston County. It then cuts a gorge through that ridge as it flows northwest. Deckers Creek flows into the Monongahela River in Morgantown. The Monongahela flows north to Pittsburgh, where it joins the Allegheny River to form the Ohio River.

Forested land makes up the majority of the watershed (Table 1). The watershed is most heavily settled in and near Morgantown. There are smaller population centers and some agricultural land in the Preston County portion of the watershed. Unsettled and forested land dominates the portion of the watershed taken up by Chestnut Ridge. In the 1970s, the West Virginia Soil Conservation Agency and the United States Soil Conservation Service implemented measures to protect land in the Preston County portion of the watershed from flooding. The measures included seven impoundments, five for flood control and two for waterfowl habitat, and channelization of approximately six miles of streams.

In this document, streams and subwatersheds (SWSs) within the Deckers Creek watershed are identified in three ways: by name, where one exists, by stream codes (WVDEP, 2005a), and by the SWS numbers used by the Total Maximum Daily Load (TMDL) document for the Monongahela River watershed (USEPA, 2002). For example, the stream that flows into Deckers Creek from the north in Sabraton, two miles from its mouth, is Hartman Run or M-8-0.5A, or the stream of SWS149. Impoundments built for flood protection are referred to as Upper Deckers Creek Impoundments (UDCIs) #1 through #7. The most important of these is UDCI #1 (See section 5.1), which serves as a public water supply, distributed by Preston County Public Service District #1.

Table 1: Land use classes in the Deckers Creek watershed

Land use	Acres	Percent
Forest	28,681	71.3
Farmland	6,270	15.6
Urban land	2,937	7.4
Mined land	1,621	4.0
Other (water, barren, roads)	706	1.7
Total	40,251	100.0

Source: NRCS, 2000

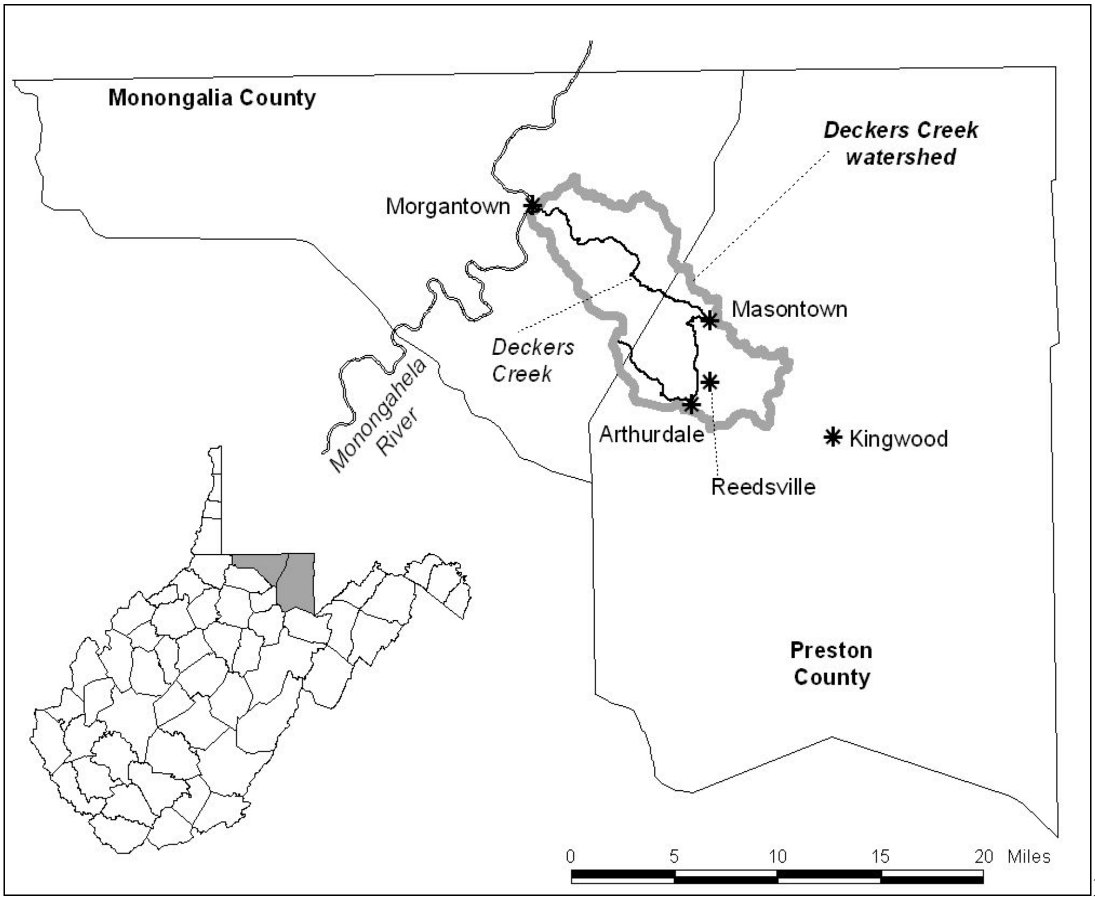

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Figure 1: Location of the Deckers Creek watershed

2. WATER QUALITY STANDARDS

All stream segments in the Deckers Creek watershed should, at a minimum, be fishable and swimmable, and should be clean enough to contain healthy communities of indigenous aquatic species. The federal Clean Water Act, state Water Pollution Control Act, and federal and state regulations have set standards to protect designated uses of the streams. Designated uses for streams in the Deckers Creek watershed include public water supply (Category A), maintenance and propagation of aquatic life (warm water fishery streams, Category B1), and water contact recreation (Category C). The numeric and narrative water quality standards shown in Table 2.

Table 2: Selected West Virginia water quality standards

	Section	Aquatic life	Human health	
		Category B *Warm water fishery*	*Category A* *Public water supply*	*Category C* *Recreation*
Aluminum[b] (dissolved)	8.1	Not to exceed 87 µg/L (chronic) or 750 µg/L (acute)	NS[c]	NS
Biological impairment	3.2.i	[N]o significant adverse impact to the…biological [component] of aquatic ecosystems shall be allowed.		
Fecal coliform	8.13	NS	Maximum allowable level of fecal coliform content for Primary Contact Recreation (either MPN or MF) 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 ten percent of all samples taken during the month.	
Iron (total)	8.15	Not to exceed 1.5 mg/L (chronic)	Not to exceed 1.5 mg/L	NS
Lead	8.16	Not to exceed chronic and acute concentrations that vary with hardness[e]	Not to exceed 50 µg/L	NS
Manganese[d] (total)	8.17	NS	Not to exceed 1.0 mg/L	NS
pH	8.23	No values below 6.0 nor above 9.0. Higher values due to photosynthetic activity may be tolerated.		
Turbidity	8.32	No point or non-point source to West Virginia's waters shall contribute a net load of suspended matter such that the turbidity exceeds 10 NTU's over background turbidity when the background is 50 NTU or less, or have more than a 10% increase in turbidity (plus 10 NTU minimum) when the background turbidity is more than 50 NTUs.[f]		

Source: 46 CSR 1. Sections refer to this rule.

[b]When the TMDL was developed for the Monongahela River watershed, an acute total aluminum criterion of 750 µg/L was in effect. Since then, the aluminum criterion was changed to dissolved aluminum, and a chronic criterion was added. At the time that this plan is being written, the West Virginia Environmental Quality Board has suspended the chronic dissolved aluminum criterion of 87 µg/L in all but trout waters until July 2007.

[c]NS indicates no standard for a particular designated use.

[d]At the time that this plan is being written, USEPA is considering whether or not to approve a modification to the state manganese criterion that would make it apply only upstream from known drinking water sources.

[e]The chronic dissolved lead equation is: $Pb = e^{(1.273[\ln(hardness)]-4.705)} \times CF$. The acute dissolved lead equation is: $Pb = e^{(1.273[\ln(hardness)]-1.46)} \times CF$. The correction factor CF is also dependent upon hardness, and has the value: CF= 1.46203-[(ln hardness)(0.145712)].

[f]See 46 CSR 1 Sections 8.32 and 8.32.1 for special circumstances for the turbidity standard.

3. NONPOINT SOURCE POLLUTION IN DECKERS CREEK

This watershed based plan (WBP) addresses four types of pollution that must be controlled if all stream segments in the Deckers Creek watershed are to meet water quality standards. WVDEP's 303(d) list (WVDEP, 2004) indicates that two types, AMD and lead, impair stream segments in the Deckers Creek watershed (Table 3). Available data at this point will support a plan for remediation of AMD only. A TMDL plan (USEPA, 2002) calls for reductions in the metal loads from watersheds contributing to these segments.

Table 3: Deckers Creek watershed stream segments on West Virginia's 303(d) list

Streams	Code	Miles	Sources
AMD			
Deckers Creek	M-8	24.7	12
Kanes Creek	M-8-I	4.3	9
UNT/Kanes Creek RM 2.6	M-8-I-1	0.8	2
Laurel Run	M-8-H	3.5	2
Dillan Creek	M-8-G	5.4	6
Slabcamp Run	M-8-F	1.5	1
Glady Run	M-8-D	1.2	1
Deep Hollow	M-8-A.7	2.3	7
Hartman Run	M-8-0.5A	1.6	2
Total		**45.3**	**42**
Lead[a]			*Acres of fill*
UNT/Deckers Creek RM 18.6	M-8-J	2.5	45

Source: WVDEP, 2004.

[a]Approximately 10 additional acres of possible lead fill have been identified inside the Deckers Creek watershed but outside of the watershed UNT/Deckers Creek RM 18.6.

Friends of Deckers Creek (FODC) has gathered data suggesting that two other types of pollution, fecal coliform bacteria and sediment, impair certain segments. The fecal coliform pollution is caused by point sources as well as nonpoint sources, and permittees are taking steps to control those sources. Numbers of sources for each type of pollution are listed in Table 4. Because data will currently support only an AMD plan, this WBP proposes additional monitoring for nonpoint pollutants other than AMD.

Table 4: Streams with evidence of nonpoint source pollution, but without 303(d) listings

Streams	Code	Miles	Sources
Fecal coliform bacteria (sites with readings >400 cfu (100 mL)$^{-1}$)[a]			
Deckers Creek	M-8	RM 0 to 4	Combined sewer overflows, possible failed septic systems and straight pipes
Hartman Run	M-8-0.5A	1.6	Possible failed septic systems and straight pipes
Aarons Creek	M-8-A	RM 0 to 2.6	Livestock in creek, possible failed septic systems and straight pipes
Knocking Run	M-8-A.5	1.9	Possible failed septic systems and straight pipes
UNT/Deckers Creek RM 3.6	Not assigned	1.8	Possible failed septic systems and straight pipes
Tibbs Run	M-8-B	RM 0 to 2.1	Possible failed septic systems and straight pipes
Total	**6 segments**	**14**	
Sediment (embedded streambed, moving sands in streambed)[b]			
Deckers Creek	M-8	RM 15.9 to 20.5	Channelization
Aarons Creek	M-8-A	RM 0 to 2.6	Possibly from construction practices
Dillan Creek	M-8-G	RM 0 to 1.3	Channelization
Laurel Run	M-8-H	RM 0 to 0.3	Channelization
Kanes Creek	M-8-I	RM 0 to 0.4	Channelization
Total	**5 segments**	**9.2**	

[a]Fecal coliform data were collected by FODC(2001) and MUB (2000). [b]FODC observations.

3.1. Acid mine drainage

Coal from the Upper Kitanning, Lower and Upper Freeport, Bakerstown and Pittsburgh seams have been mined in the Deckers Creek watershed. All of these seams contain pyrite and other minerals with sulfur. When these minerals encounter air and water, they oxidize to form sulfuric acid and dissolved metals. The resulting solution also dissolves aluminum from other minerals which it contacts. The resulting solution is known as acid mine drainage (AMD).

AMD may form whenever disturbance to the rocks exposes the coal and pyrite to air and water. In the Deckers Creek watershed, AMD has been generated at coal mines that fall into three categories. First, there are two coal mines in the watershed that currently hold permits for their activities (Table 5). Although AMD is generated at these sites, the mines treat the water before it is discharged off the site, under regulation by National Pollutant Discharge Elimination System (NPDES) permits. Second, bond forfeiture sites (BFSs) have had mining permits revoked. The WVDEP has taken over responsibility for treating AMD at these sites (Table 6). Finally, abandoned mine lands (AMLs) were mined before passage of the Surface Mining Control and Reclamation Act (SMCRA) in 1977. There are 69 AML sites in the Deckers Creek watershed (Table 7). 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 (USEPA 2002). 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.

Table 5: Active mining permits in the Deckers Creek watershed

Name of owner	Name of mine	Mining permit	NPDES permit	Receiving stream
Decondor Coal Company, inc.	Mountain Run Mine No. 5	U014782	WV0063258	UNT/Kanes Creek RM 2.6
Patriot Mining Company (Anker Energy)	Mine #1	E004100	WV1007050	Kanes Creek

Source: WVDEP, 2005b

Table 6: Bond forfeiture sites in the Deckers Creek watershed

Company Name	Permit Number	Receiving stream	Notes
Valley Mining Co.	S-17-82	Deep Hollow	Treatment measures were installed in 2004
Hillcrest Construction Co., Inc.	S-33-83	Deep Hollow	Little AMD
Pinnacle Mining Co.	S-62-85	Deep Hollow	No AMD
Pinnacle Mining Co.	S-1028-86	Deep Hollow	No AMD
WOCAP Energy Resources	O-77-82	Kanes Creek	No AMD

Source: WVDEP, 2002

Table 7: Abandoned Mine Lands in the Deckers Creek watershed

Problem area name (PA number)	Status	Subwatershed	County	USGS Quad
Aaron Creek Portal (92)	No AMD	Aarons Creek	Monongalia	Morgantown South
Atkins & Ryan Subsidence (459)	No AMD	Hartman Run	Monongalia	Morgantown North
Back Run Highwall (1324)	Low	Direct Drain	Preston	Masontown
Beulah Chapel Portal (1141)	High	Deep Hollow	Monongalia	Morgantown South
Beulah Hollow Portal (91)	Low	Deep Hollow	Monongalia	Morgantown South
Borgman Refuse And Portals (5409)	Low	Kanes Creek	Preston	Newburg
Bretz (Anderson) Subsidence (5833)	No AMD	Direct Drain	Preston	Masontown
Bretz (Methany) Mine Drainage (5810)	High	Direct Drain	Preston	Masontown
Burk Mine Drain (6009)	High	Laurel Run	Preston	Masontown
Clinton Braham (2192)	High	Kanes Creek	Preston	Morgantown South
Comer Highwall & Portals (3792)	Low	Knocking Run	Monongalia	Morgantown North
Dalton (1975)	High	Direct Drain	Monongalia	Masontown
Dawson (2058)	Low	Deep Hollow	Monongalia	Morgantown South
Deckers Creek #1 (1105)	Low	Direct Drain	Monongalia	Morgantown North
Deckers Creek Watershed (4010)	Watershed	NA		Masontown
Deep Hollow Portals (90)	No AMD	Deep Hollow	Monongalia	Morgantown North
Depot Street Subsidence II (4441)	No AMD	Direct Drain	Preston	Masontown
Dewey Hastings (4565)	No AMD	Aarons Creek	Monongalia	Morgantown South
Dillan Creek (5333)	Watershed	Dillan Creek	Preston	Masontown
Dillan Creek #1 (2820)	High	Dillan Creek	Preston	Masontown
Dillan Creek #2 (1035)	Low	Dillan Creek	Preston	Masontown
Dillan Creek Pa #3 (1036)	No AMD	Dillan Creek	Preston	Masontown
Dogtown Road Waterline (4460)	No AMD	Kanes Creek	Preston	Newburg
Dump Highwall (3870)	No AMD	Hartman Run	Monongalia	Morgantown North
Earl Reiner (1135)	No AMD	Hartman Run	Monongalia	Morgantown North
Elkins Coal & Coke Mining Facility (5120)	Constructed	Direct Drain	Preston	Masontown
Gladys Run Strips (1734)	High	Glady Run	Preston	Masontown
Harold Rehe (2225)	No AMD	Direct Drain	Preston	Masontown
Hartman Run Drainage (1099)	High	Hartman Run	Monongalia	Morgantown North
Hartman Run Drainage II (6008)	High	Hartman Run	Monongalia	Morgantown North
Hawkins Mine Discharge (3455)	High	Kanes Creek	Preston	Newburg
Kanes Creek Area Waterline (5064)	No AMD	Kanes Creek	Preston	Masontown
Kanes Creek North (1732)	Low	Dillan Creek	Preston	Masontown
Kanes Creek South (2003)	High	Kanes Creek	Preston	Masontown
Kanes Creek South Reclamation Project (5900)	High	Kanes Creek	Preston	Newburg
Kanes Creek Tipple (2002)	High	Kanes Creek	Preston	Masontown
Laurel Run #1 (2005)	Low	Laurel Run	Preston	Masontown
Masontown (Fullenberger) Subsidence II (5011)	No AMD	Direct Drain	Preston	Masontown
Masontown (Polce) Subsidence (5203)	No AMD	Direct Drain	Preston	Masontown
Masontown Subsidence (4373)	No AMD	Direct Drain	Preston	Masontown
Mellons Chapel Portal (89)	No AMD	Deep Hollow	Monongalia	Morgantown South
Morgan Mine Road AMD (5990)	High	Kanes Creek	Preston	Newburg
Morgantown (Dorinzi) Subsidence (4639)	No AMD	Hartman Run	Monongalia	Morgantown North
Morgantown Airport Subsidence (4145)	No AMD	Hartman Run	Monongalia	Morgantown North
Mount Vernon Strip (1323)	Low	Laurel Run	Preston	Masontown

Table 7, continued

Problem area name (PA number)	Status	Subwatershed	County	USGS Quad
Neil Braham (2191)	Low	Kanes Creek	Preston	Morgantown South
Ponderosa Pines Opening (1143)	Low	Aarons Creek	Monongalia	Morgantown South
Reedsville (Conner) Subsidence (5539)	No AMD	UNT/Deckers RM 17.3	Preston	Masontown
Richard Refuse (1142)	No AMD	Direct Drain	Monongalia	Morganton South
Sabraton (Hriblan) AMD (5815)	Low	Direct Drain	Monongalia	Morgantown North
Sabraton (Huggins) Portal (4919)	No AMD	Knocking Run	Monongalia	Morgantown North
Slab Camp - Friends Of Deckers Ck. (5902)	Constructed	Slabcamp Run	Preston	Masontown
Slabcamp Run #2 (1999)	Constructed	Slabcamp Run	Preston	Masontown
Superior Hydraulics (3738)	High	Direct Drain	Monongalia	Morgantown South
Superior Hydraulics (4024)	No AMD	Direct Drain	Monongalia	Morgantown South
Tibbs Run #2 Portal (2452)	Low	Tibbs Run	Monongalia	Morgantown South
Tibbs Run Portals And Tipple (2011)	Low	Tibbs Run	Monongalia	Morgantown South
Union PSD Subsidence (460)	No AMD	Tibbs Run	Monongalia	Morgantown South
Upper Deckers Creek - Impoundment 5 (4863)	Constructed	Kanes Creek	Preston	Newburg
Valley Highwall #3 (3068)	High	Kanes Creek	Preston	Kingwood
Valley Point #12 (1456)	High	Kanes Creek	Preston	Valley Point
Woodland U.M. Church Subs. (5533)	No AMD	Hartman Run	Monongalia	Morgantown North
WV - Monongalia - FEA (954061)	No AMD	Hartman Run	Monongalia	Morgantown

Sources: OSM, 2005; WVDEP files. PA numbers are tracking numbers for AML problem areas assigned by WVDEP.

AMD sources differ in severity. This WBP identifies two priority levels for AMD sources. 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 (Table 8). 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-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 in Table 8 and Table 9.

Table 8: High-priority AMD sources in the Deckers Creek watershed

Subwatershed	Site
Deckers upstream from UDCI #1	Dalton (1975)
Kanes Creek	Valley Point #12 (1456)
	Valley Highwall #3 (3068)
	Kanes Creek South Site #1 (=Kanes Creek Tipple, 2002)
	Kanes Creek South Site #3 (2003)
	Sandy Run spring (status pending)
	Clinton Braham (2192)
	Morgan Mine Road AMD (5990)
	Hawkins mine drainage (3455)
Laurel Run	Burk mine drain (6009)
Dillan Creek	Dillan Creek #1 (2820)
Deckers from Slabcamp to Back Run (SWS 99)	Bretz (Methany) mine drainage (5810)
Glady Run	Gladys Run strips (1734)
Deep Hollow	Beulah Chapel portal (1141)
Deckers from Deep Hollow to Aarons Creek (SWS 20)	Richard mine (=Superior Hydraulics, 3738)
Hartman Run	Hartman Run drainage (1099)
	Hartman Run drainage II (6008)

Table 9: Low-priority AMD sources in the Deckers Creek watershed

Subwatershed	Site
Kanes Creek	Borgman Refuse And Portals (5409)
	Neil Braham (2191)
UNT/Deckers Creek RM 17.3	Zinn Chapel sites
Laurel Run	Laurel Run #1 (2005)
	Mount Vernon Strip (1323)
Dillan Creek	Dillan Creek #2 (1035)
Deckers from Back Run to Glady Run	Back Run Highwall (1324)
Tibbs Run	Tibbs Run #2 Portal (2452)
	Tibbs Run Portals And Tipple (2011)
Deep Hollow	Beulah Hollow Portal (91)
Knocking Run	Comer Highwall & Portals (3792)
	Deckers Creek #1 (1105)
Deckers from Aarons Creek to Hartman Run	Sabraton (Hriblan) AMD (5815)
Aarons Creek	Ponderosa Pines Opening (1143)

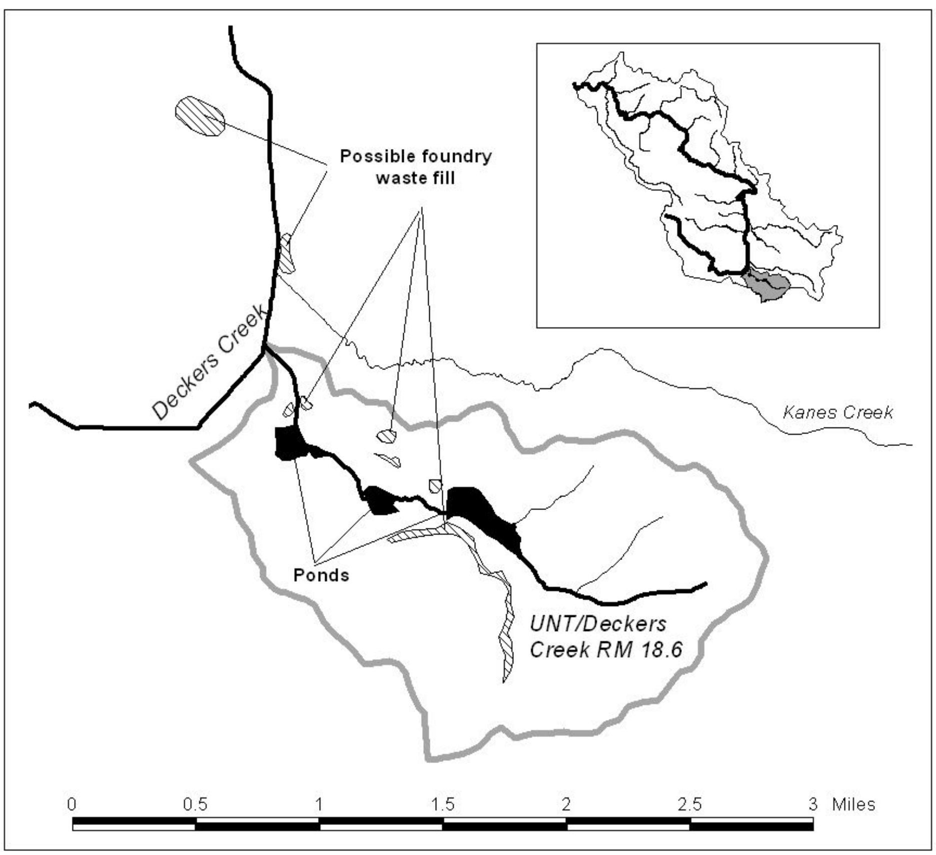
The list of AMD sources is not complete. Additional sites may be found that discharge AMD, or AMLs thought to have no AMD may prove to be sources. Any additional sites will be assessed and added to any future revisions of this plan (Section 10).

Streams receiving AMD are commonly impaired according to aluminum (Al), iron (Fe) and manganes (Mn) concentrations. Examination of the data, however, indicates that violations by Mn are less common than violations by the other metals. Eight segments of Deckers Creek are impaired with regard to Mn (WVDEP, 2004). However, for many of the segments, Mn loads are close to target loads (USEPA, 2002), and reductions may not be necessary.

3.2. Lead

One tributary (UNT/Deckers Creek RM 18.6; M-8-J; SWS 210) 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 2). Concentrations of lead violating the aquatic life designated use have been found in the streamwater. 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.

Figure 2: Lead sources to UNT/Deckers Creek RM 18.6

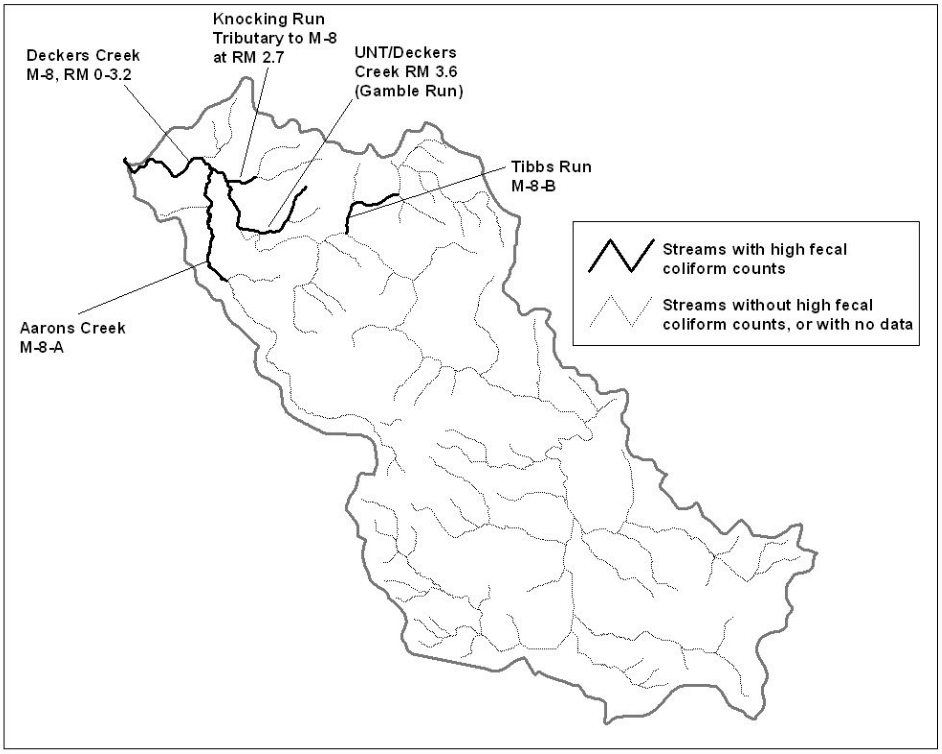


3.3. Fecal coliform bacteria

Nonpoint sources of fecal coliforms to streams that may be impaired include residences, businesses or whole communities with failed septic systems or straight pipes, livestock with direct access to streams, and possibly wildlife areas. Data collected by the Morgantown Utility Board (MUB) and by Friends of Deckers Creek (FODC) indicate four tributaries and a portion of the mainstem where fecal coliform counts have exceeded 400 cfu $(100\ mL)^{-1}$ (Figure 3). Numbers of sources have not yet been quantified.

Point sources may account for some of the fecal coliform pollution, and those problems are being addressed by the permittees. MUB has approximately 20 combined sewer overflows (CSOs) that discharge to the lower 3.2 miles of Deckers Creek. The Masontown sewage treatment plant has released untreated water when stormwater entering the system has exceeded capacity. Both entities are taking steps to eliminate these discharges. WVDEP has recently enforced compliance on one other company that was failing to meet its NPDES permit.

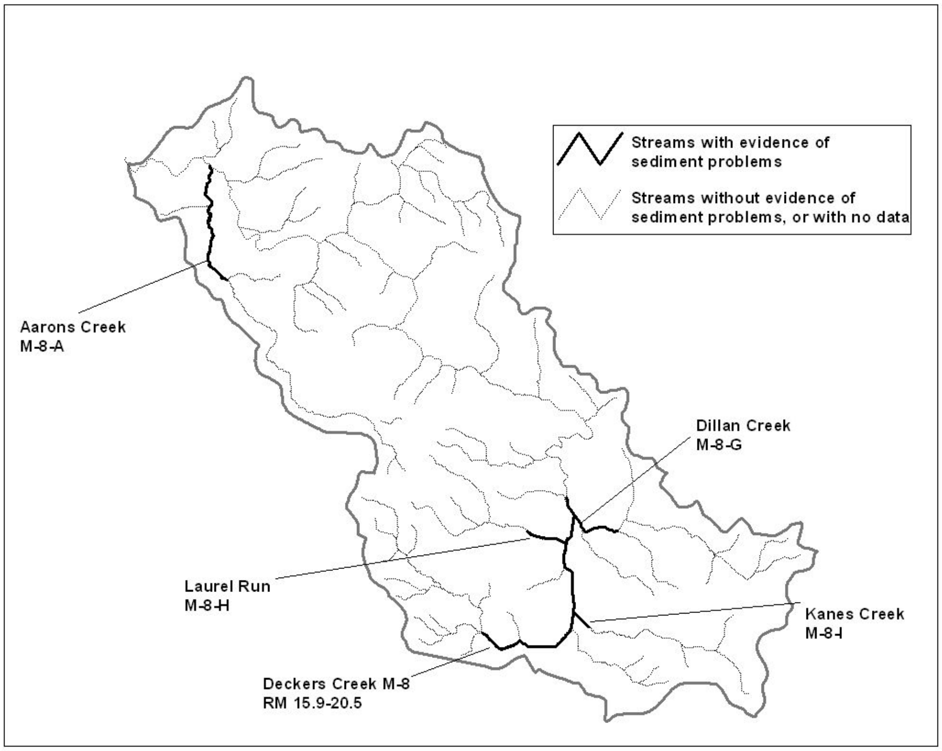
Figure 3: Locations of streams with high fecal coliform counts



3.4. Sediment

No segments are listed as impaired by sediments. However, Aarons Creek has embedded rocks, suggesting possible sediment input, possibly from inadequately controlled construction practices and unstable stream banks. 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. 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 (Figure 4).

Figure 4: Location of stream segments that may be impaired by sediment



4. MEASURES FOR ELIMINATING NONPOINT SOURCE POLLUTION

Achieving the goal of eliminating nonpoint source (NPS) pollution in the Deckers Creek watershed will require a large team of cooperating entities to implement a wide range of pollution control measures.

4.1. Acid mine drainage

4.1.1. Remediation

AMD can be eliminated by active or passive methods. 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 treatment methods include land reclamation, in which a surface mine, a refuse pile or spoil are landscaped to prevent contact between pyrite and water. Passive treatment also includes a number of water treatment measures (Table 10) in which AMD is neutralized by contact with limestone or other alkaline materials.

Watzlaf et al. (2004) match different passive treatment methods with different kinds of AMD according to chemistry. Net alkaline drainage should be treated with aeration ponds. Net acidic water with concentrations of Al, iron in the ferric state and dissolved oxygen concentrations no greater than 1 mg/L may be treated with anoxic limestone drains (ALDs). 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. Deep mine sources in the Deckers Creek watershed usually contain too much Al, ferric iron and oxygen and are generally unfit for ALDs. They will require RAPSs for treatment.

In addition to several RAPSs, treating AMD in the Deckers Creek watershed will rely on land reclamation, wet seals, OLCs, and in at least one case, active treatment.

4.1.2. Prevention

In recent year, OSM and WVDEP have observed a policy of refusing permits to mines that are likely to create perpetual AMD problems. New permit applications are stretching the boundaries of this policy. It is the most important safeguard preventing additional AMD pollution.

4.1.3. Agents

Passive 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 (Table 11).

There is little funding available for operating and maintaining active treatment facilities. Active treatment expenses include the cost of chemicals, energy to mix them into the AMD, disposal of the sludge, maintenance, and labor. Most available funding sources will support only the one-time costs of construction (Table 11). Certain AMD sources, in particular, the Richard Mine (PA 3738), require ongoing treatment. Friends of Deckers Creek has raised some funds and is prepared to raise additional funds to support maintenance efforts. Current funding mechanisms will support only small amounts of maintenance. FODC and DCRT are seeking ways to generate operations and maintenance funds for active treatment, which will be needed at one site.

Table 10: Passive AMD treatment methods

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 water from abandoned Upper Freeport mines	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	
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 retention time
Open Limestone Channel (OLC)	Controls water path, prevents seeping 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.
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 11: Agents and their roles in AMD remediation in the Deckers Creek watershed.

Agent[a]	Site ID	Plan[b]	Funds	O&M	Design[c]	Project Management[d]	Notes
DCRT	X	X	-	-	C	-	Includes all cooperating entities
Local governments	TBD	TBD	TBD	TBD	-	-	Town and city councils and county commissions will participate as they see fit
MRCD	X	X	-	TBD	C	-	Small O&M role, most likely related to vegetation maintenance, is possible
NRCS	X	X	X	-	C,E	X	Can fund design and construction through PL566 funds; has design and project management expertise
WVCA	X	X	-	TBD	C	-	Contributes expertise in water resource management and coordination with NRCS and conservation districts
OAMLR	X	X	X	X	C,E	X	Can plan, design and execute projects using AML Trust Fund disbursements; can participate in O&M through set-aside fund
OSM	-	X	X	-	C,E	-	Makes WCAP funds available
WVU	X	X	-	-	C	-	Has extensive expertise in AMD remediation
DWWM	X	X	X	-	C,E	X	Manages 319 funds disbursed to state
Landowners	X	X	-	TBD	C	-	Permit all activities on their land, may play role in monitoring condition of treatment measures
FODC	X	X	-	TBD	C	TBD	Convenes DCRT to ensure all remediation activities go forward. May raise funds and play large O&M role

[a]See List of Abbrevations. [b]Planning includes developing conceptual designs, writing proposals for funding, and distributing responsibility for other remediation tasks. [c]C indicates conceptual design, E indicates engineering design. [d]Includes running a bid to select a contractor, inspecting work and completing all financial transactions and reporting. Key: X: will play a role; TBD: role to be determined

4.2. Lead

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 measure 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.

Research to narrow down the source of the lead pollution will be required before any remediation can take place. WVDEP has slated completion of a TMDL for lead pollution in UNT/Deckers Creek RM 18.6

for 2017 (WVDEP, 2004). Hopefully, WVDEP and FODC can accomplish much of the research well before the 2017 target date.

4.3. Fecal coliform bacteria

As in the case of lead pollution, additional data will be required for eliminating fecal coliform pollution. Once sources are identified, DCRT will seek advice and technical and financial assistance from several quarters. 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 any fecal coliform pollution by livestock. DCRT will approach home and business owners, the WVDEP, extension agents, county sanitarians and the National Small Flows Clearinghouse for solutions to fecal coliform pollution by failed septic systems and straight pipes. Point source dschargers are also expected to decrease unpermitted discharges. Prevention of additional fecal coliform pollution will depend on the vigilance of citizens, citizens'groups and WVDEP.

4.4. Sediment

Further monitoring to identify sediment sources and additional research on sediment control methods are required to determine appropriate control measures for this NPS pollutant. Streambank stabilization, in-stream structures, natural stream design and streamside buffer strips are likely to be a part of the solution. Citizens' groups and WVDEP are expected to prevent additional sources of sediment to the creek. WVDEP, FODC, NRCS and possibly the Canaan Valley Institute will begin the process of solving the current sediment input problems.

5. REDUCTIONS IN NONPOINT SOURCE POLLUTION LOADS

Available data will support development of a plan only for AMD elimination. This section compares loads of pollutants detected in streams to loads of pollutants known to come from specific AMD sources. Because loads vary with different hydrological conditions, matches between source loads and stream loads are only approximate. Field observations of changes in water quality above and below pollutant sources provide evidence that remediation of those sources will benefit the streams.

The TMDL (USEPA, 2002) and the 303(d) list (WVDEP, 2004) suggest where projects are needed, but they do not match perfectly. The TMDL calls for reductions in some subwatersheds with unimpaired stream segments, and does not call for reductions in some subwatersheds with impaired segments. Table 12 provides an overview of how such discrepancies are resolved in this WBP.

Measurements needed to compare source loads with in-stream loads are available in only a few cases. Furthermore, when multiple in-stream load estimates are available, they frequently differ by orders of magnitude. Nevertheless, in all the subwatersheds for which source and in-stream load measurements are available, the planned reductions achieve the loads in the TMDL for at least one set of measurements (Table 13). This success is taken as evidence that the inventory of sites is close to complete, and that the high-priority sources in less data rich subwatersheds have also been identified. Note that several subwatersheds have already met TMDLs according to some of the measurements. Nevertheless, more recent observations confirm that they are impaired and require remediation.

Eight segments are impaired with regard to Mn (WVDEP, 2004). However, many of the subwatersheds achieve or almost achieve the Mn target loads, or may achieve them after the benefits of current treatments are measured. In particular, Kanes Creek and three direct drain subwatersheds to Deckers Creek meet their Mn targets (Table 13). According to FODC data, however, UNT/Kanes Creek RM 2.6 violates the Mn standard. This stream was not listed at the time the TMDL was written. Although Deep Hollow, the tributary to Deckers in Dellslow, exceeds its load, the improvements from water treatment at a BFS have not yet been measured. Effects on Al and Fe loads, as well as Mn loads, of passive treatment installations on Slabcamp Run and Dillan Creek have also not been measured. Treatment measures for Mn are proposed only for UNT/Kanes Creek RM 2.6.

The following sections describe each subwatershed containing high or low-priority AMD sources.

Table 12: Actions planned in each subwatershed described by the TMDL

Subwatershed[a]	Stream segment	TMDLs[b]	Number of major sources or alternative plan
Reductions required and streams impaired			
17	Glady Run	Al Fe Mn	1 major source
19	Deep Hollow	Al Fe Mn	1 major source
20	Deckers, Deep Hollow to Aarons Creek	Al Fe	1 major source
23	Slabcamp Run	Fe Mn	Monitor effects of recently installed project
24	Deckers Creek, Back Run to Glady Run	Fe	No major sources
99	Deckers Creek, Slabcamp Run to Back Run	Fe	1 major source
102	Laurel Run, mainstem	Al Fe Mn	1 major source
149	Hartman Run	Al Fe Mn	2 major sources
206	Upper Kanes Creek	Al Fe	8 major sources
208	Upper Dillan Creek	Al Fe Mn	1 major source
Reductions not required, but stream impaired			
103	Deckers Creek, above UDCI #1		1 major source
Streams impaired, but no TMDLs allocated			
15	Lower Dillan Creek and UNT RM 0.3		No major source
96	Deckers, Kanes Creek to Laurel Run		"
97	Deckers, Laurel Run to Dillan Creek		"
98	Deckers, Dillan Creek to Slabcamp Run		"
146	Deckers, Tibbs Run to Deep Hollow		"
147	Deckers, UNT RM to Tibbs Run		"
148	Deckers, Glady to UNT RM		"
150	Deckers, Aarons Creek to Hartman Run		"
196	Lower Deckers Creek		"
197	Lower Deckers Creek		"
198	Lower Deckers Creek		"
205	Lower Kanes Creek		"
207	Dillan Creek RM 1.0 to 1.7		"
209	Deckers, RM 18.6 to UDCI #1		"
Reductions required, streams not impaired, no action currently planned			
18	Aarons Creek	Fe	Iron may not be from AMD
21	Tibbs Run	Fe	Occasional Al violations
210	UNT/Deckers Creek RM 18.6	Fe	No impairment from AMD
No reductions required, stream not impaired			
16	UNT/Dillan Creek RM 1.0		
22	Back Run		
101	UNT Laurel Run RM 1.6		

Notes: [a]See USEPA, 2002, Appendix 6 for location of subwatersheds. [b]Metals for which load allocations are established in USEPA, 2002.

Table 13: Load measurements (lbs/yr) from the TMDL and other sources, target loads, source loads, and possible reductions

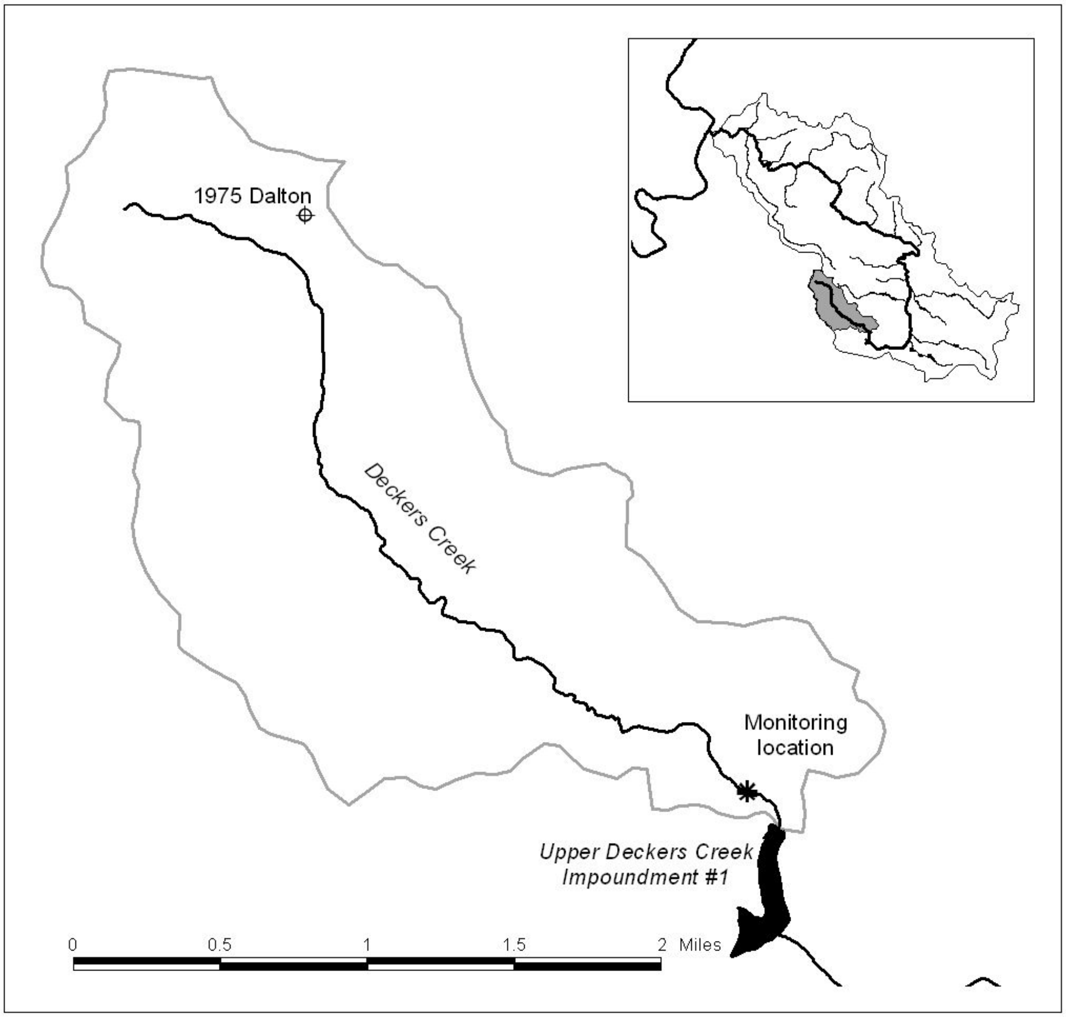
Watershed	Metal	Loads *TMDL*[a]	Loads *Range*[b]	Target[a]	Source Loads[c]	Range following remediation[d]
Deckers Creek	Al	1,410	1,400-6,600	1,410	130	1,280-6,480
M-8, above UDCI #1	Fe	9,787	1,200-9,800	9,787	4	1,200-9,800
	Mn	694	480-1,400	694	70	417-1340
Kanes Creek	Al	11,791	8,000-33,000	2,437	11,400	0-22,700
M-8-I, SWS 206	Fe	52,987	12,000-67,000	7,516	30,000	0-40,000
	Mn	2,633	2,600-8,700	2,633	644	2,020-8,120
Laurel Run	Al	41,530	400-42,000	3,214	NA	NA
M-8-H, SWS 102	Fe	197,754	2,500-198,000	10,943	NA	NA
	Mn	6,862	28-6,900	4,200	NA	NA
Dillan Creek	Al	8,014	200-24,000	1,648	13,800	0-11,580
M-8-G, SWS 208	Fe	40,838	360-41,000	8,629	5,100	0-36,410
	Mn	2,153	1,300-2,300	1,610	2,200	1,300-2,300[e]
Deckers Creek,	Al	424	NA	424	NA	NA
Slabcamp to Back Run	Fe	1,601	NA	1,528	NA	NA
M-8 RM 15.9-16.3, SWS 99	Mn	495	NA	495	NA	NA
Glady Run	Al	3,436	400-3,400	631	NA	NA
M-8-D, SWS 17	Fe	14,546	470-15,000	2,661	NA	NA
	Mn	1,019	100-1,000	706	NA	NA
Deep Hollow	Al	9,213	200-9,000	1,618	NA	NA
M-8-A.7, SWS 19	Fe	65,652	55-66,000	6,386	NA	NA
	Mn	2,682	70-4,200	2,293	NA	NA
Deckers Creek, Deep Hollow	Al	19,161	19,000-221,000	2,991	59,000	0-168,000
to Aarons (including Richard	Fe	70,269	70,000-272,000	7,485	143,000	0-143,000
Mine) M-8 RM 2.7-6.3, SWS 20	Mn	3,271	3,300-18,000	3,271	3,200	420-15,000
Hartman Run	Al	9,945	6,100-9,900	1,765	NA	NA
M-8-0.5A, SWS 149	Fe	46,109	1,300-46,000	5,811	NA	NA
	Mn	3,699	1,300-3,500	1,933	NA	NA

[a]From USEPA (2002). [b]From SRG (2004), Stewart and Skousen (2002b) or FODC (unpublished data). [c]From SRG (2004) or FODC (unpublished data). [d]Approximate range post remediation calculated as range before remediation minus 90% of source loads. [e]No Mn measures planned, TMDL current loads used for final loads

5.1. Deckers Creek above Reedsville Farm Pond (M-8 RM 21.2 to 24.7; SWS 103)

The uppermost 3.5 miles of Deckers Creek are mildly impaired by acid. The pH averages 5.6 and Al concentrations average 0.5 mg/L (Christ, 2005). The one known source of AMD in this watershed, PA 1975, discharges 5 gpm with a pH of 4.5 (OAMLR files). Pollutant loads for that site have not been measured, but this watershed is close to meeting targets and any reduction in acid load should remove it from the 303(d) list. This watershed and this AMD source are given a high priority in order to ensure that the uppermost part of Deckers Creek achieves standards.

Figure 5: AMD sources to Deckers Creek upstream of the Reedsville Farm Pond (UDCI #1)



5.2. Unnamed Tributary to Deckers Creek at RM 18.6 (M-8-J; SWS 210)

The watershed of this 2.5-mile stream contains no AMLs and is not on the 303(d) list as impaired by acid mine drainage. pH values and Fe and Mn concentrations are all within standards, and Al concentrations average 0.14 mg/L (Stewart, 2000). There are several reclaimed mines in the Bakerstown coal seam. Such mines often discharge acceptable water after they are reclaimed, due to the layer of alkaline shale found above this coal seam. The TMDL calls for a reduction in Fe from a BFS of 11 lbs/yr, but the WVDEP has not shown any BFS on their inventory in this watershed (WVDEP, 2002). Because this tributary is so mildly impacted and has no clear AMD sources, no AMD remediation is planned here.

More information on this watershed and lead pollution in it appears in section 3.2.

5.3. Kanes Creek (M-8-I; SWS 205 and 206)

The Kanes Creek stream system consists of a 4.3-mile main stem with an impoundment from RM 2.3 to 2.5 and tributaries entering at RM 2.4, 2.6 and 3.2 (Figure 6). All of Kanes Creek and the UNT at RM 2.6 appear on the 303(d) list. FODC has documented that UNT RM 2.4 and UNT RM 3.2 are also impaired.

The Kanes Creek subwatershed contains eight high-priority and three low-priority AMD sources. Loads from six of the eight high-priority sources have been measured by FODC or by NRCS. A seventh source, Sandy Run spring, contributes to a small subwatershed of the Kanes Creek subwatershed. “Clinton Braham” (PA 2912) is in the same subwatershed and accounts for 20% of the acidity load. Sandy Run spring, therefore, is presumed to account for 80% of the acidity, or four times the load of AML 2912. The importance of the last site, Hawkins mine drainage (PA 3455), is based on visual evidence (see photo below, from 2004).

According to the estimates of the sources and of the subwatershed loads in the TMDL, reducing the high-priority sources by 90% will bring loads of aluminum and manganese below the TMDL targets (Table 14). It is likely that sufficient iron will be eliminated as well because the TMDL appears to have overestimated loads compared to other measurements. Furthermore, the unquantified major source, Hawkins mine drainage, is the farthest downstream of all the sources, and may have strongly influenced the estimate of the watershed load.

Monitoring on the subwatershed, including the minor sources, will continue. In the event that load reductions for major sources do not bring the creek up to water quality standards, additional remediation work will be done at the minor sources (Table 15).

Table 15: Minor AMD sources in the Kanes Creek watershed

Source	Data source and notes
Borgman refuse and portals (5409)	This AML project has three sites, only one of which is in the Deckers Creek watershed. No load estimates for that site are available. OAMLR has begun to develop a remediation project for the site.
Neil Braham (2191)	This small seep adds AMD to Kanes Creek immediately upstream of UNT RM 2.6, which is a much greater insult. If alkalinity from upstream remediation measures does not protect the creek from this source, a remediation project for it will be developed.
Upper Deckers Creek Impoundment #5 (4863)	OAMLR reclaimed this site and built a SAPS in 1996. Large flows from this site have not been observed in the last few years. Measurements from 1998-2001 suggest large loads that are inconsistent with recent observations. This site will be monitored and addressed if remediation at major sources fails to improve Kanes Creek

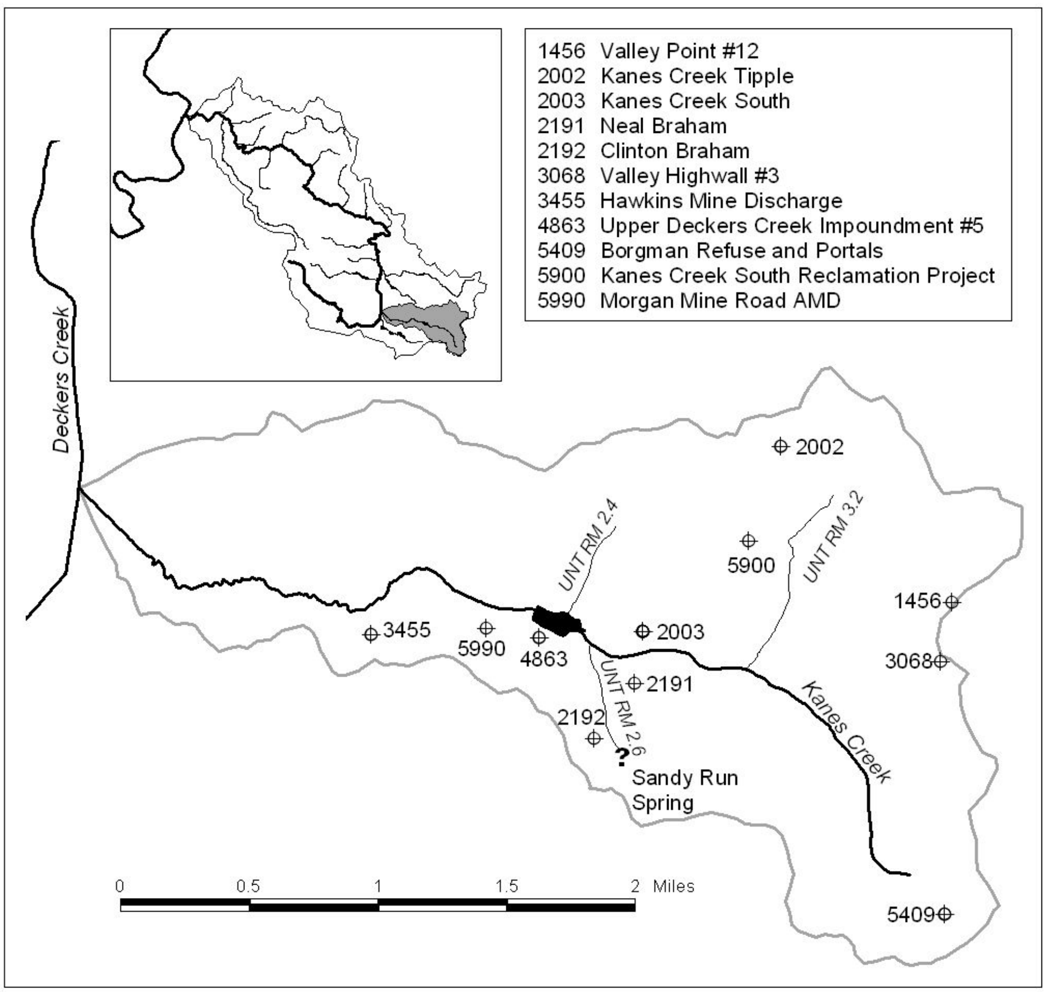


Figure 6

Table 14: Loads (lbs/yr) of AMD to Kanes Creek measured at the sources, and expected metal loads following remediation

	Al	Fe	Mn	Data source and notes
Major sources, measured loads				
Valley Point #12 (1456)	1,470	4,616	21	NRCS
Kanes Creek South (2003)	2,635	3,486	161	FODC
Clinton Braham (2192)	1,099	3,225	75	FODC
Kanes Creek Tipple (2002)	614	2,472	41	FODC
Valley Highwall #3 (3068)	1,290	1,919	14	NRCS
Morgan Mine Road AMD (5990)	862	1,569	32	FODC
Major sources, unmeasured loads				
Sandy Run spring	3,396	12,900	300	Estimate
Hawkins Mine Discharge (3455)	-	-	-	No data
Total of major sources	**11,366**	**30,187**	**644**	
Effects of remediation				
TMDL current load	12,000	53,000	2,600	
Expected reduction (90% of major sources)	10,229	27,168	580	
Remainder	**1,771**	***25,832***	**2,020**	
Target from TMDL	**2,400**	***7,500***	**2,600**	

Table 15: Minor AMD sources in the Kanes Creek watershed

Source	Data source and notes
Borgman refuse and portals (5409)	This AML project has three sites, only one of which is in the Deckers Creek watershed. No load estimates for that site are available. OAMLR has begun to develop a remediation project for the site.
Neil Braham (2191)	This small seep adds AMD to Kanes Creek immediately upstream of UNT RM 2.6, which is a much greater insult. If alkalinity from upstream remediation measures does not protect the creek from this source, a remediation project for it will be developed.
Upper Deckers Creek Impoundment #5 (4863)	OAMLR reclaimed this site and built a SAPS in 1996. Large flows from this site have not been observed in the last few years. Measurements from 1998-2001 suggest large loads that are inconsistent with recent observations. This site will be monitored and addressed if remediation at major sources fails to improve Kanes Creek

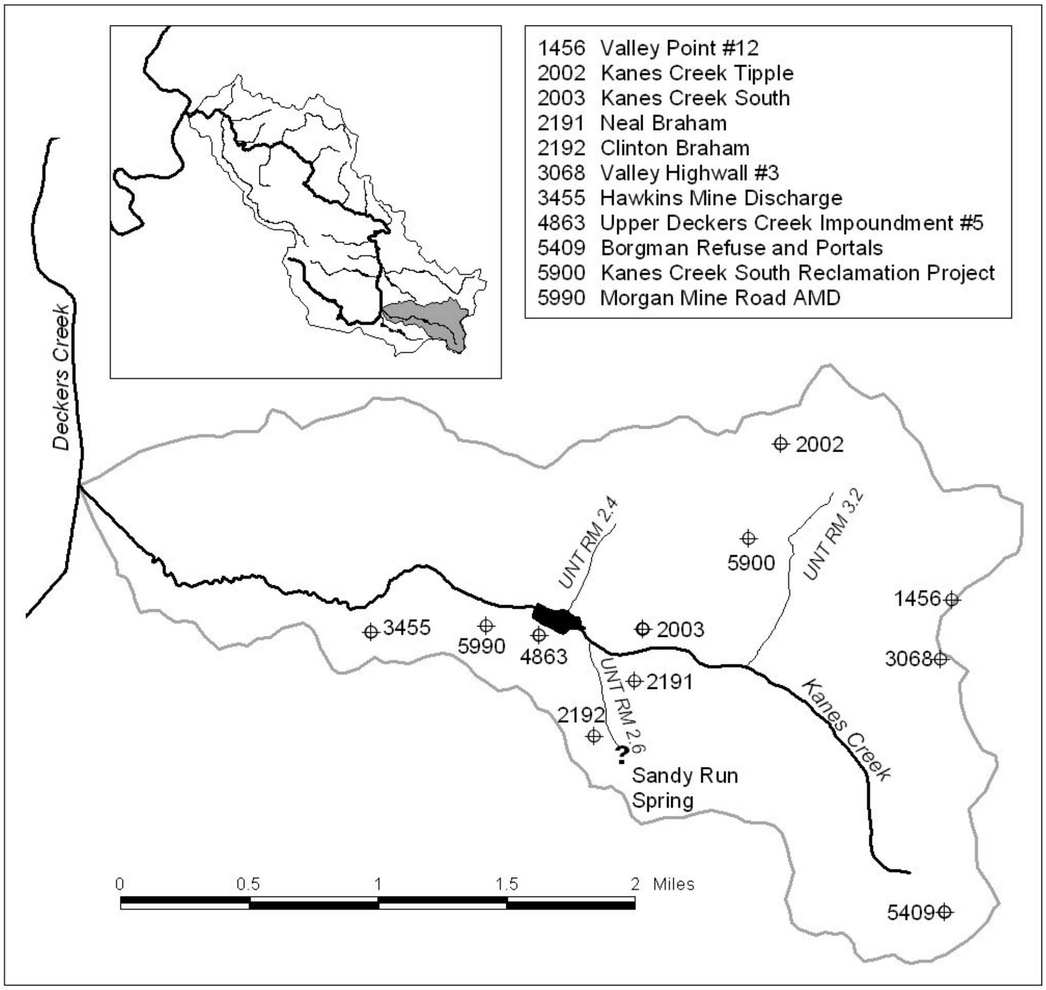
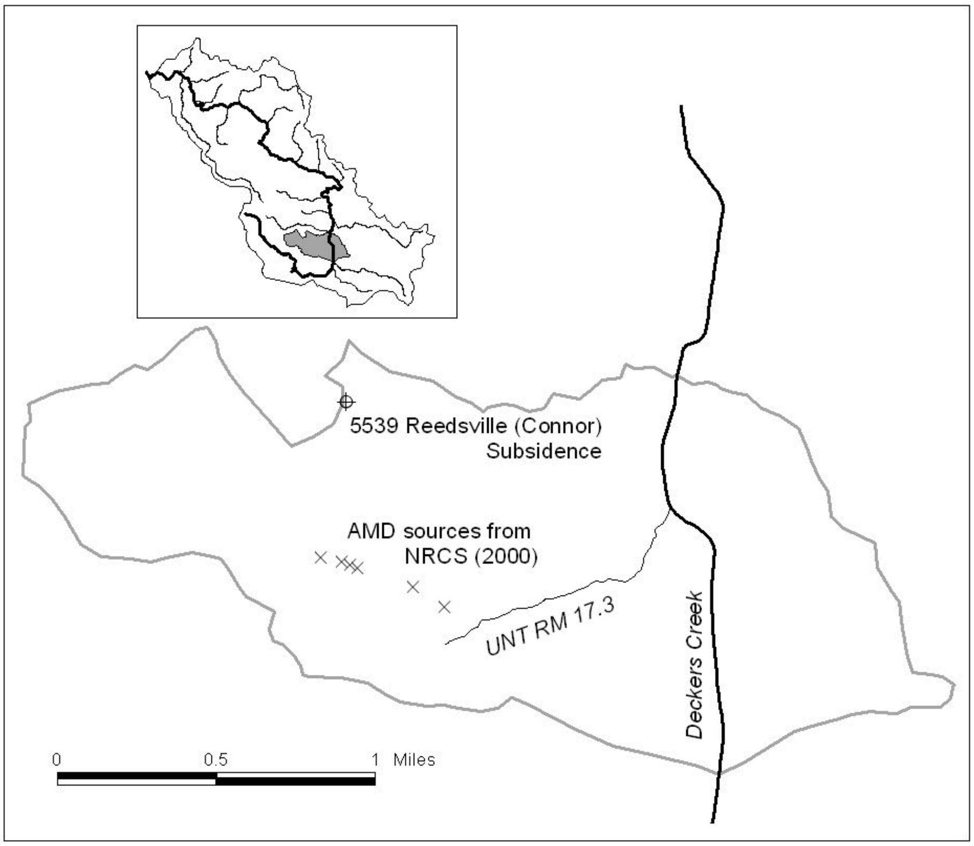


Figure 6: AMD sources to Kanes Creek

5.4. Deckers Creek from Kanes Creek to Laurel Run (M-8 RM 18.2 to 16.9, SWS 96)

According to the TMDL, sources in this subwatershed do not exceed any load allocations for AMD pollutants. NRCS (2000) identified Al, Fe and Mn sources of 730, 350 and 70 lbs/yr, respectively, to UNT/Deckers Creek RM 17.3, which is in this subwatershed, but measurements of that tributary near its mouth indicate that it does not contribute significant pollution to the mainstem of Deckers Creek. The pH averages 6.6, and Al, Fe and Mn concentrations average 0.2, 0.4 and 0.4 mg/L, respectively. The one AML in this subwatershed is a subsidence complaint with no description of AMD. The sources identified by NRCS may impair segments of the UNT, but the site receives a low priority for the remediation of the Deckers Creek watershed.

Figure 7: AMD sources in subwatershed 96, including UNT/Deckers Creek RM 17.3

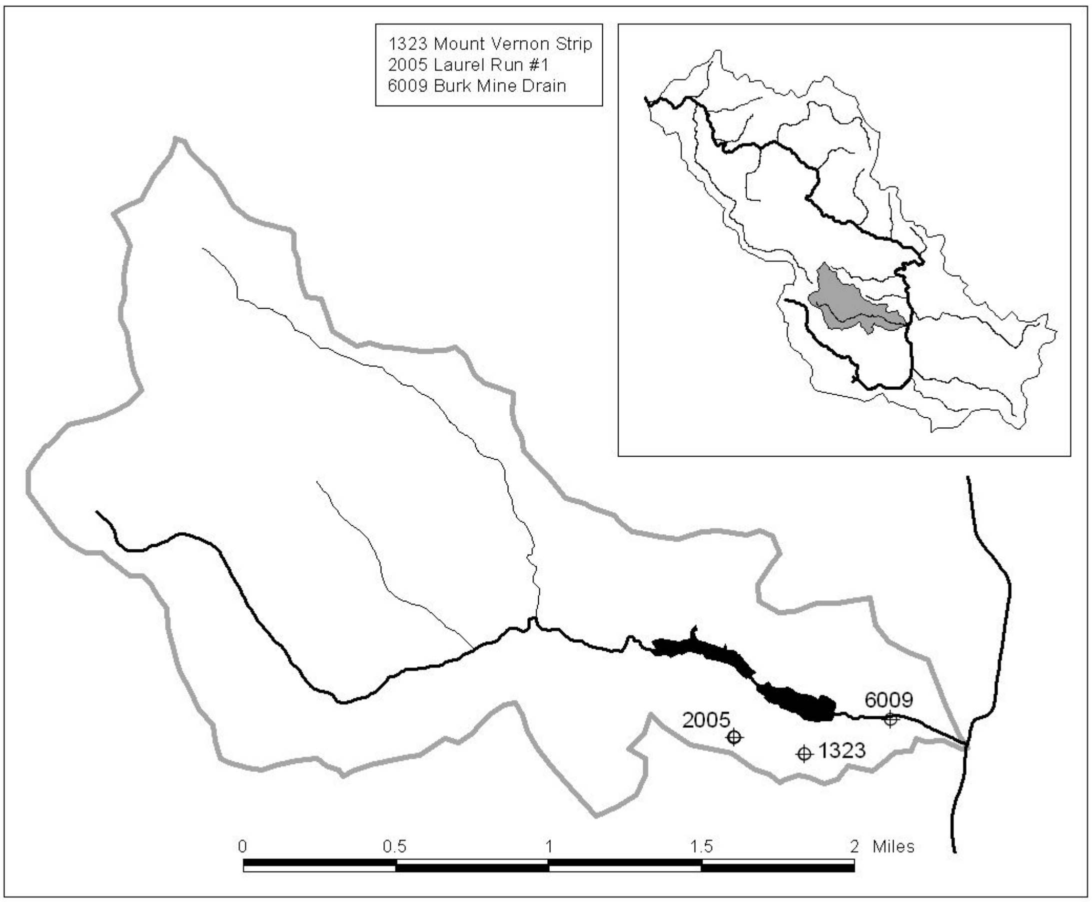


5.5. Laurel Run (M-8-H; SWS 100, 101 and 102)

The Laurel Run stream system consists of a 3.5 mile main stem with tributaries entering at RM 1.6 and 1.9 (Figure 8). There are also two impoundments on the mainstem. All tributaries enter above the known sources of AMD. The TMDL calls for a small reduction in Al and Mn loads to the segment above RM 1.6 (SWS 100), but cites no data sources for the conclusion (USEPA, 2002). The main stem passes three AMD sources, including Mount Vernon Strip (1343), Laurel Run #1 (2005) and the Burk Mine Drain (6009).

NRCS (2000) measured AMD loads from several sources associated with PAs 1343 and 2005. Those loads (595, 50 and 91 lbs/yr Al, Fe and Mn, respectively) account for a small fraction of the loads that have been measured at the mouth (Table 13). Those sources are therefore assigned a low priority. The difference is likely due to Burk mine drain (PA 6009), which is assigned a high priority.

Figure 8: AMD sources to Laurel Run

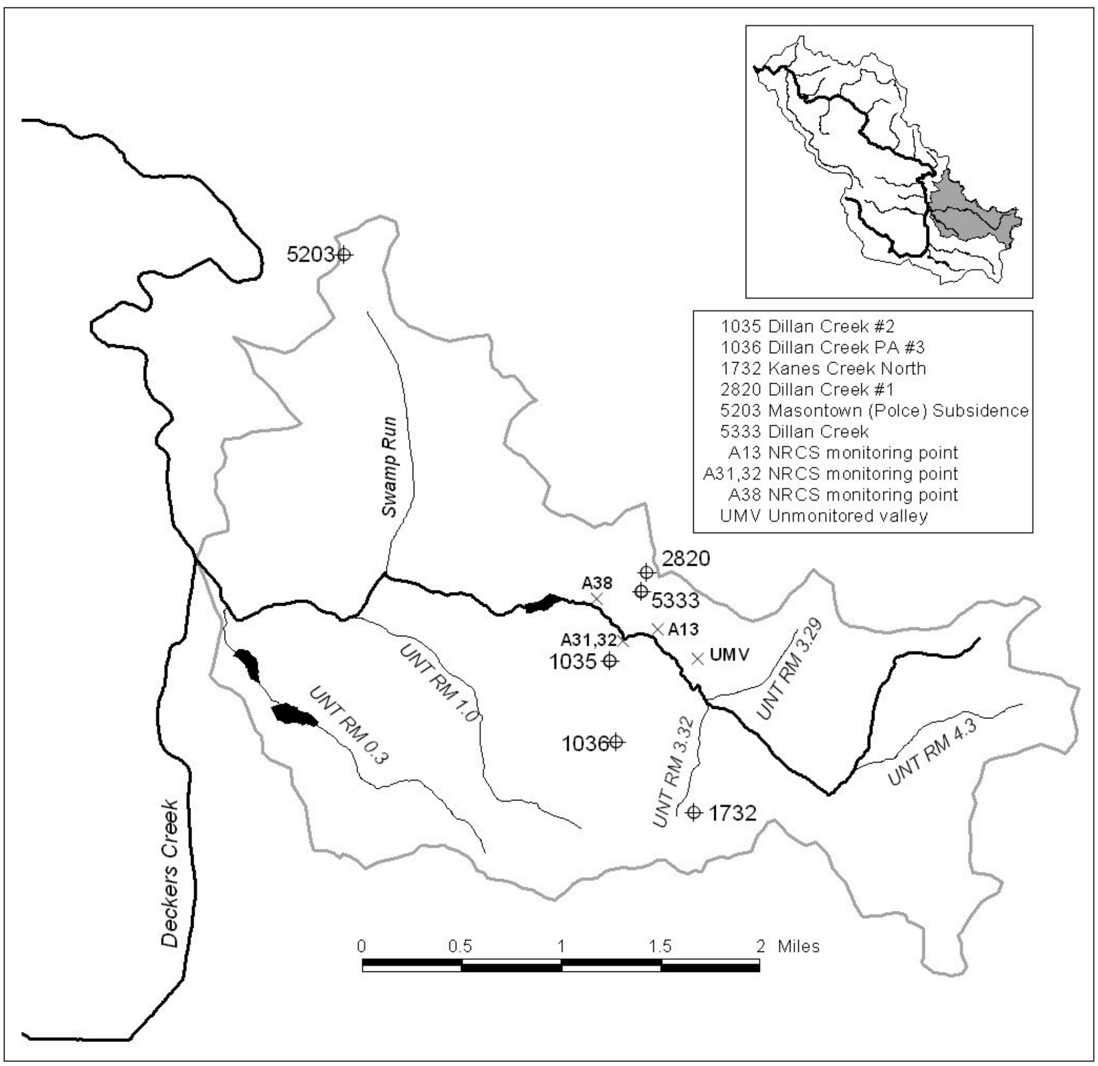


5.6. Dillan Creek (M-8-G; SWS 15, 16, 207, 208)

The 5.4 mile long mainstem of Dillan Creek encounters tributaries at RM 0.3, 1.0, 1.3 (Swamp Run), 3.29, 3.32 and 4.3 (Figure 9). There is a flood-control impoundment (Upper Deckers Creek Impoundment #4) from RM 2.1 to 2.3. Most of the AMD load is added to Dillan Creek between RM 2.1 and 3.1. At most times the AMD is neutralized as Dillan Creek joins with Swamp Run, a highly buffered stream draining a carefully reclaimed Bakerstown coal mine.

The AMD between RM 2.1 and 3.1 enters Dillan Creek from three small valleys on the north side and one on the south. OAMLR has reclaimed strip-mined land in the western most valley on the north side (A38 in Figure 9), and has eliminated a pond and placed some OLCs in two more. However, even after that work had been completed, AMD from these sources drives the pH of Dillan Creek from above 6 to below 4. One of these partially-reclaimed sources contributes Al, Fe and Mn loads of 11,000, 4,000 and 1,700 lbs/yr, respectively (see A13 on Figure 9, NRCS, 2000). The partially-reclaimed sources are assigned a high priority. A smaller source on the south side of Dillan Creek (see A31,32 on Figure 9) contributes only 110, 80 and 60 lbs/yr of Al, Fe and Mn, respectively (NRCS, 2000). This source is assigned a low priority.

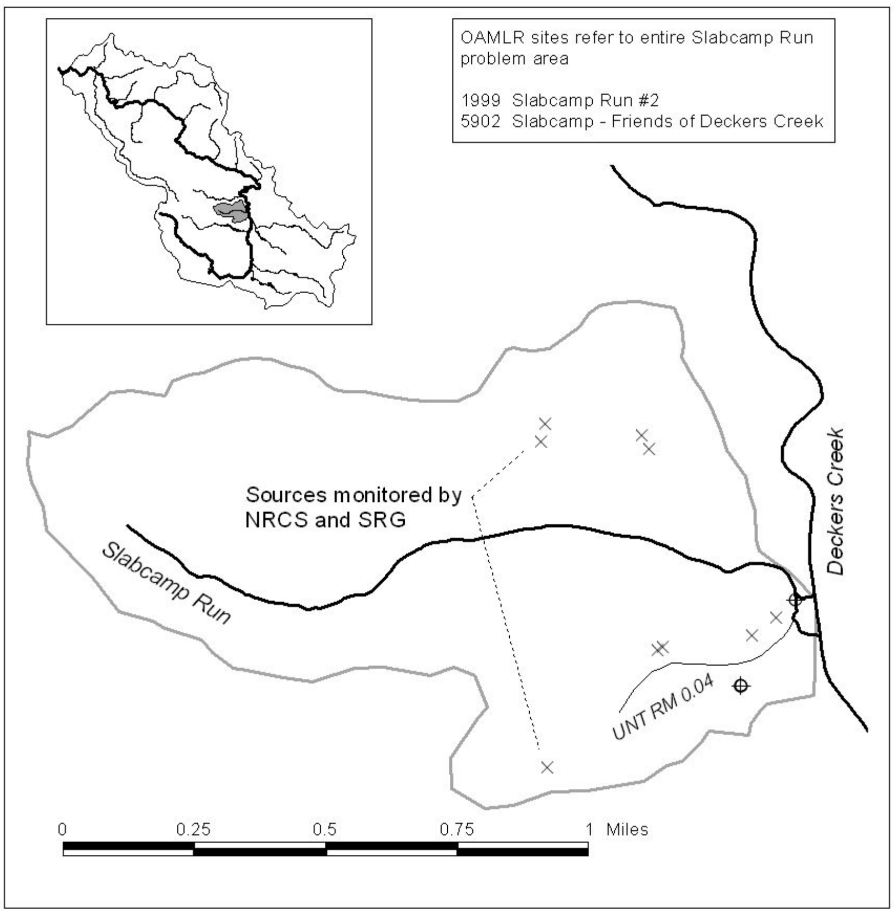
Figure 9: AMD sources to Dillan Creek



5.7. Slabcamp Run (M-8-F; SWS 23)

This 1.5-mile stream (Figure 10) is small but extremely impaired. A tributary at RM 0.04 is also polluted. Slabcamp Run delivers some of the most concentrated AMD to Deckers Creek of all the tributaries. Most of the AMD flows from six portals and a few acres of spoil. OAMLR, with support from FODC and the Nonpoint Source Program in WVDEP, constructed measures to address this site in 2004 (Slabcamp Run #2, PA 1999). No further work on this site will take place until the remaining loads after the project are clearly documented. Ongoing monitoring is evaluating the effectiveness of the project.

Figure 10: AMD sources to Slabcamp Run

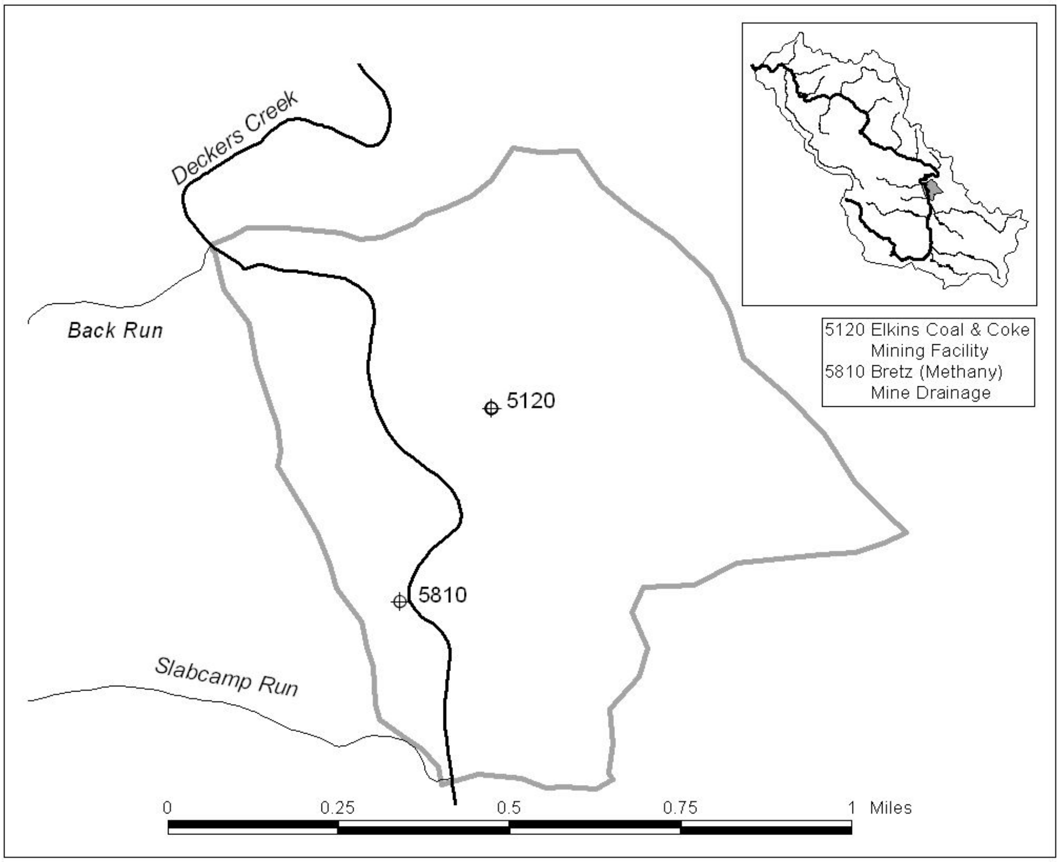


5.8. Deckers Creek from Slabcamp Run to Back Run (M-8 RM 14.9 to 15.9; SWS 99)

The TMDL calls for a small reduction in Fe loads from this subwatershed, and a much larger reduction in Fe loads from the next subwatershed downstream (Deckers Creek from Back Run to Glady Run, see section 5.9). However, the TMDL document sites no measurement records for subwatershed 99. It is therefore likely that loads requiring remediation calculated to lie in subwatershed 24 actually lie in subwatershed 99.

One major source has been identified in subwatershed 99. The Bretz (Methany) mine drainage (PA 5810) delivers concentrated AMD (pH ~2.8) from an underground mine. The volume of this flow has not been measured. Based on visual assessment, however, it is given a high priority. PA 5120 (Elkins Coal and Coke) consists of a few mine entries and a large number of coke ovens. The site was reclaimed in 2002 by OAMLR. However, acid water still drains into the creek from a number of sites along the bank. Additional treatment at PA 5120 will await better determination of its AMD loads.

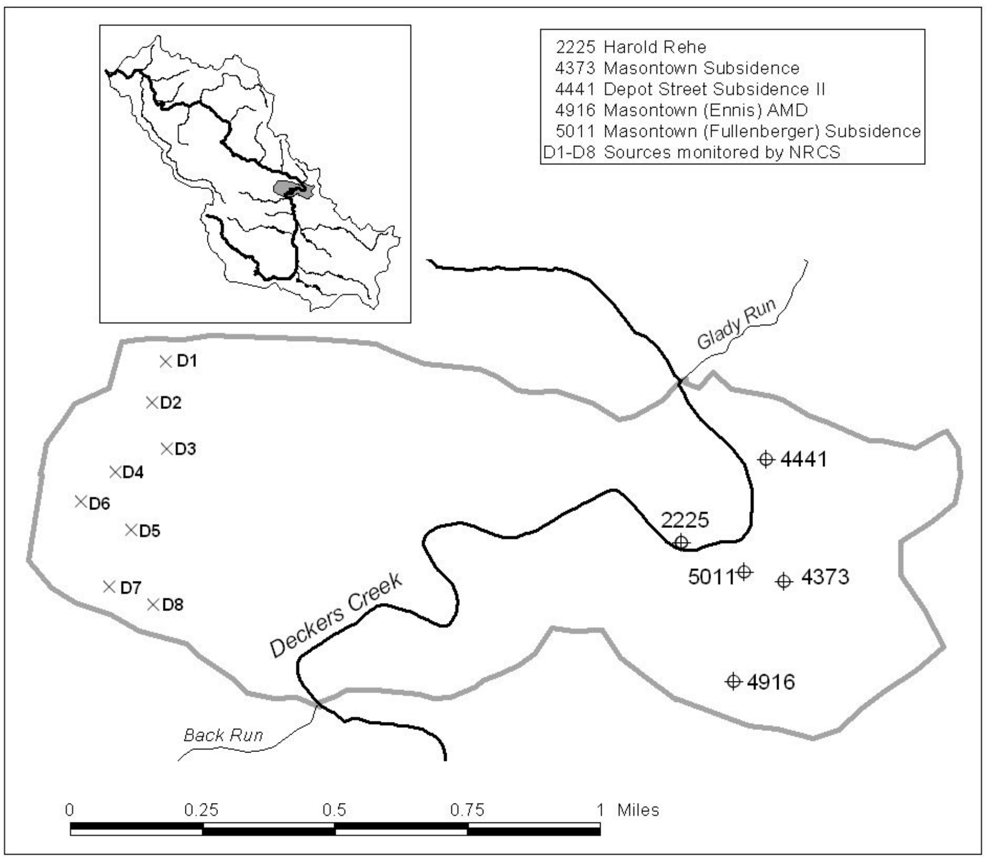
Figure 11: AMD sources to Deckers Creek between Slabcamp Run and Back Run



5.9. Deckers Creek from Back Run to Glady Run (M-8 RM 13.2 to 14.9; SWS 24)

This 1.6-mile stretch of Deckers Creek (Figure 12) passes by a large reclaimed area (PA 2225) and several subsidence complaints (PAs 4373, 4441 and 5011) that have been addressed. One AMD source (4916) has a high pH and probably does not contribute significantly to the load of this subwatershed. NRCS documented some AMD flowing from the abandoned "Goat" mines (sites D1-D8 on Figure 12). According to NRCS data, those seeps contribute average loads of 4200, 520 and 610 lbs/yr of Al, Fe and Mn, respectively, to Deckers Creek (NRCS, 2000). This is small compared to the 187,008 lbs/yr source of Fe described in the TMDL. The load of Fe from this subwatershed is not consistent with the much more moderate loads of Al and Mn, and may be erroneous. The only known sources, those associated with the Goat mines, have a low priority.

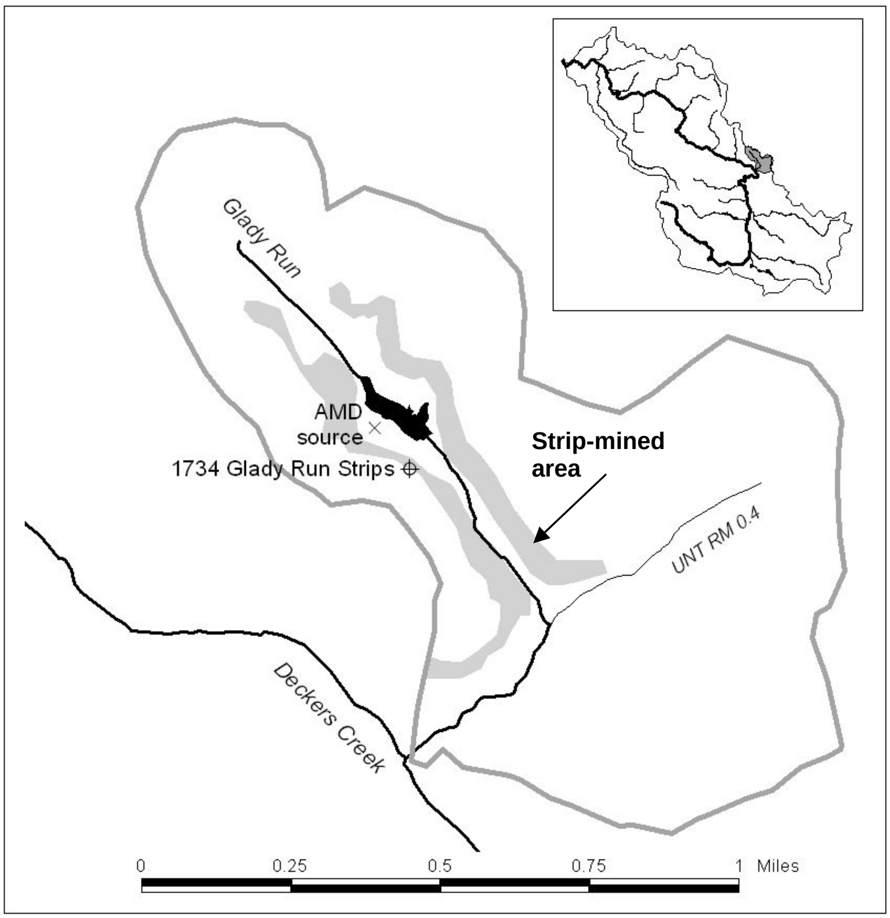
Figure 12: AMD sources to Deckers Creek between Back Run and Glady Run



5.10. Glady Run (M-8-D; SWS 17)

Glady Run is a 1.2-mile stream with an impoundment and one substantial tributary at RM 0.4 (Figure 13). Both of these streams are impaired by AMD. OAMLR describes a PA (1734) without listing specifics of the AMD sources. This site was investigated by FODC's OSM Summer Intern in 2004 (Bird, 2004). The Masontown quadrangle indicates roughly 37 acres of strip mining (USGS, 1983). For cost estimates, 10 acres are assumed to contribute AMD. In addition, there is one moderate seep from a deep mine. The large pond in this generally wooded site would provide excellent recreation. Remediation here is given a high priority because the stream will not attain standards without remediation.

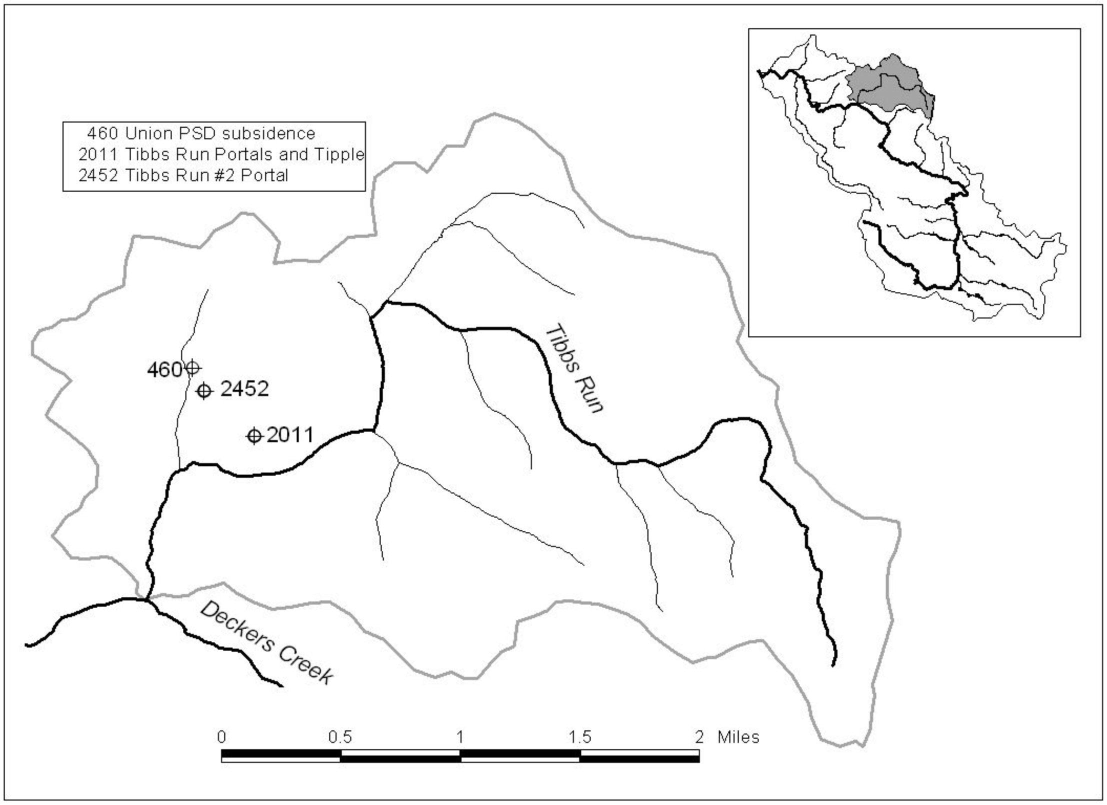
Figure 13: AMD sources to Glady Run



5.11. <u>Tibbs Run (M-8-B; SWS 21)</u>

Tibbs Run is one of the largest tributaries to Deckers Creek (Figure 14). The TMDL called for small reductions in Al, although it is not listed as an impaired stream (WVDEP, 2004). Measurements between 1998 and 2001 suggested that Tibbs does not exceed target loads. Recent measurements taken during high water, however, indicate that Al targets are exceeded. Although there are a number of mine openings, most are to a coal seam that dips away from the Tibbs Run watershed. The two known sources are reclaimed portals. Several residents have contacted FODC concerning AMD draining from PA 2452. Water quality in Tibbs indicates that the sources are not large, and are given a low priority.

Figure 14: AMD sources to Tibbs Run

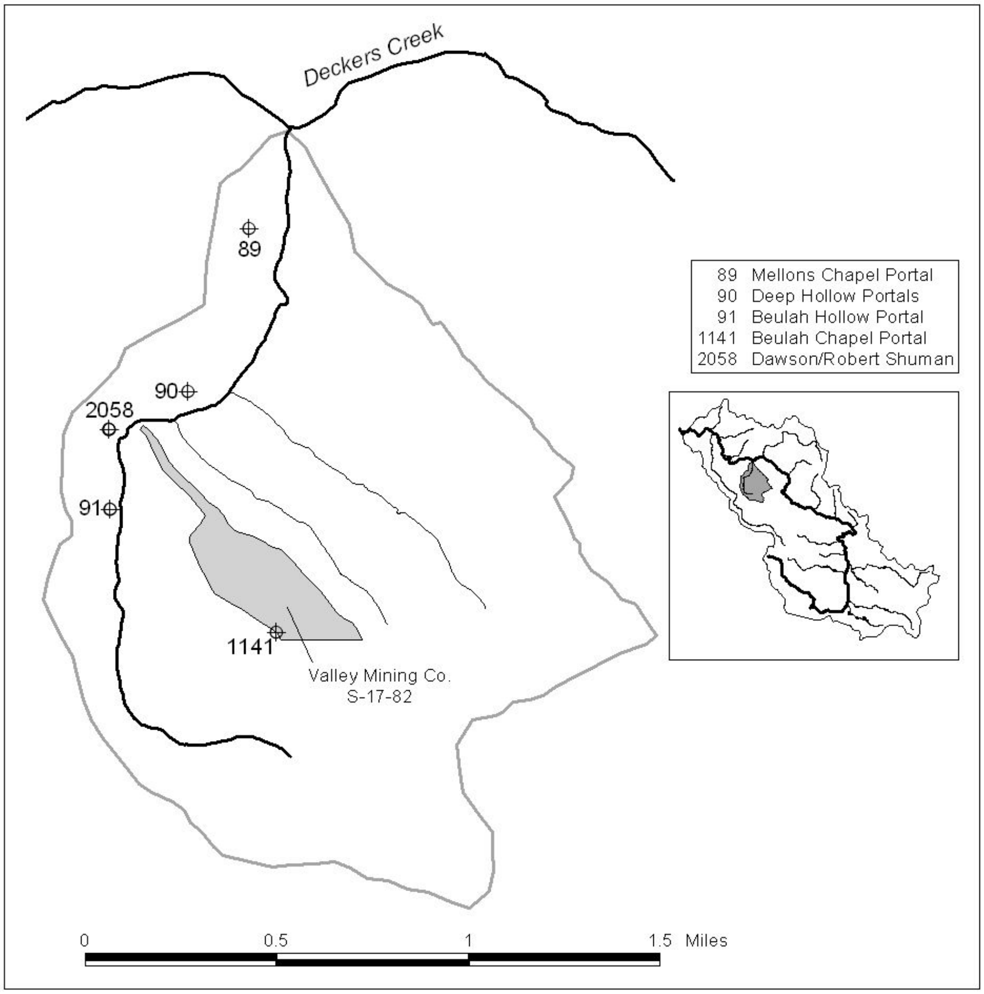


5.12. Deep Hollow (M-8-A.7; SWS 19)

The watershed of this 2.3 mile tributary contains not only five AMLs but also four BFSs. The largest AMD source among the BFSs, Valley Mining Co. (Permit S-17-82), has recently been addressed by the WVDEP Office of Special Reclamation.

There are no measurements on AMD loads from any of the AML sources. PAs on two of the sites (89 and 90) mention no AMD. The BFS discharges into water that already carries AMD. Its source, Beulah Chapel Portal (PA 1141) is given a high priority. Beulah Hollow Portal (PA 91) discharges one gpm (chemistry not measured) and is considered a low-priority source.

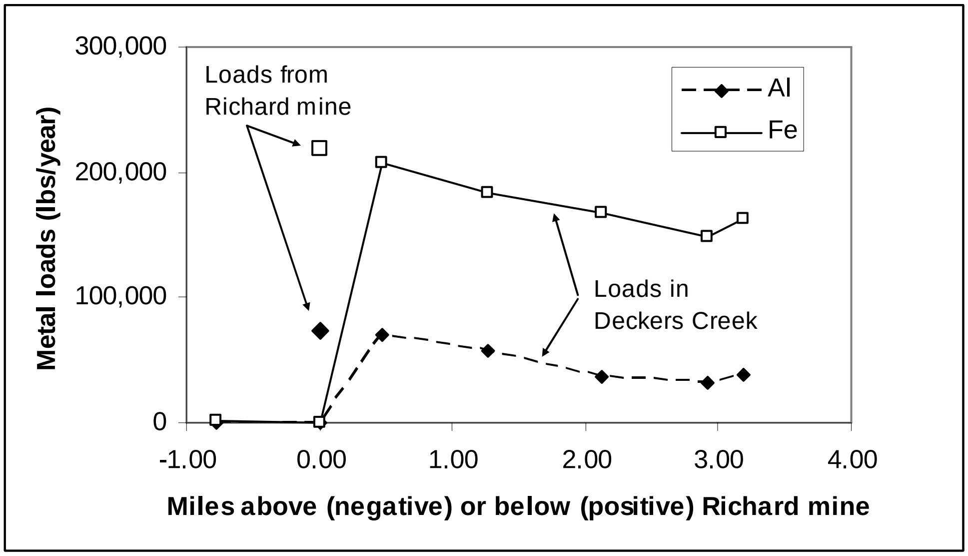
Figure 15: AMD sources to Deep Hollow



5.13. Deckers Creek from Deep Hollow to Aarons Creek (M-8 RM 2.2 to 5.7)

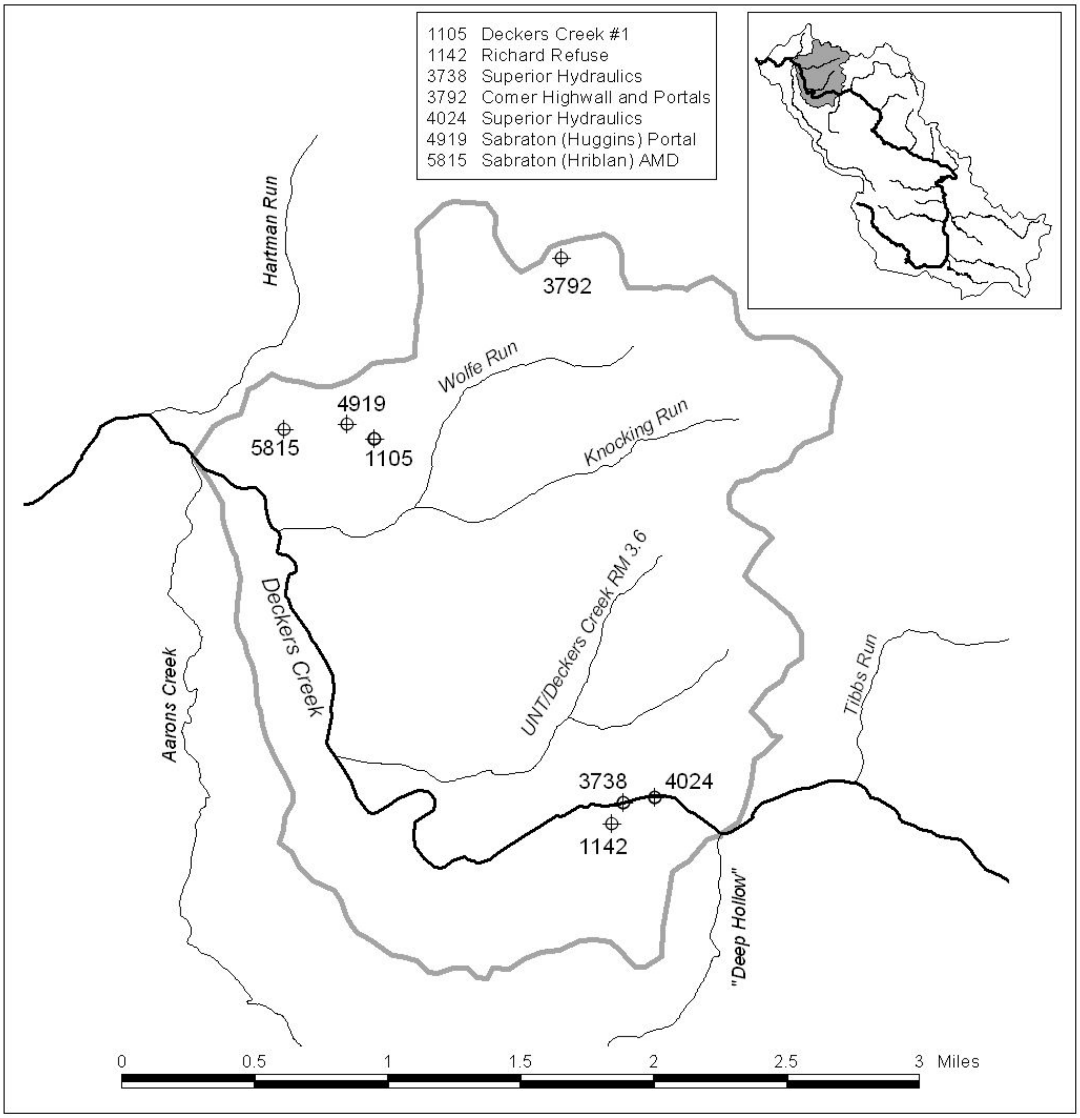
The Richard mine (discharging at Superior Hydraulics, PA 3738) delivers the single greatest AMD contribution to Deckers Creek in its entire length. It loads Deckers Creek with Al, Fe and Mn at rates of 59,000, 143,000 and 3,200 lbs/yr (Stewart and Skousen, 2002b). Pollutants from the mine can be tracked downstream in Deckers Creek, and account for most of the load it carries through the City of Morgantown (Figure 16).

Figure 16: Al and Fe loads from the Richard mine compared with loads in Deckers Creek upstream and downstream, measured October 29, 2001 (adapted from Christ, 2002).



Other AMD sources are reported in PADs for this segment (Figure 17), but are low-priority sites. The Richard mine is in the Upper Freeport seam, but sources on the northwest side of this subwatershed are from abandoned mines in the Pittsburgh seam. Three of these sources (1105, 3792 and 4919) are low-priority sites because Knocking Run, to which they contribute, is not impaired by AMD. The fourth site (5815) is small, runs directly to Deckers Creek, and has a circumneutral pH on some monitoring visits. It is also a low priority.

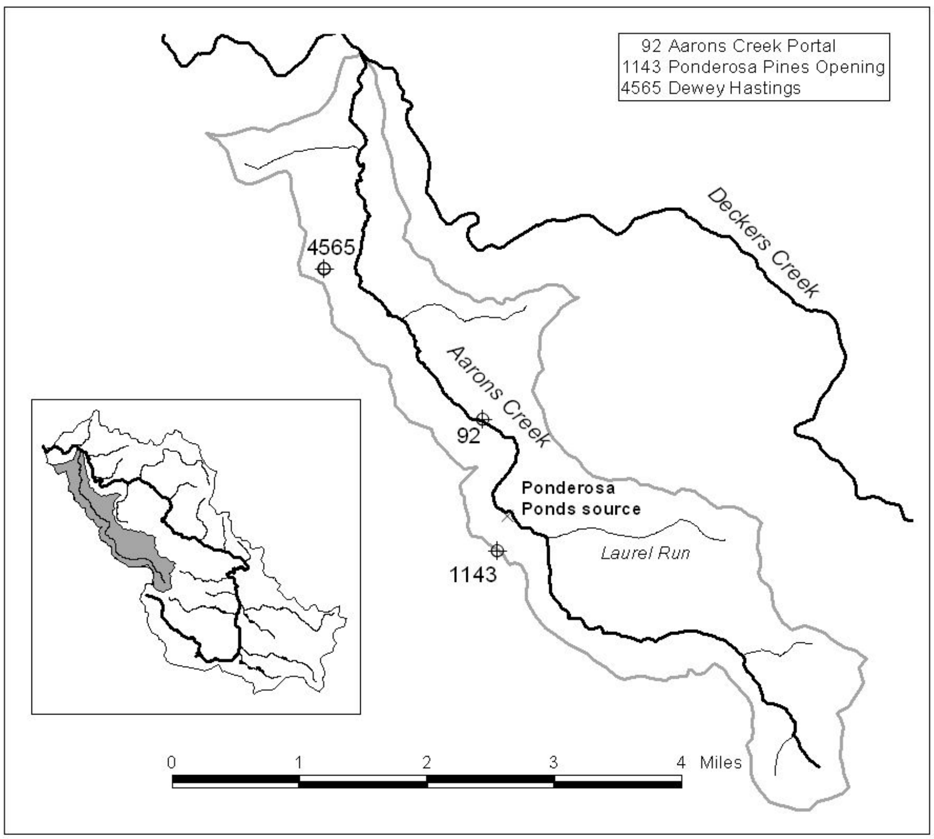
Figure 17: AMD sources to Deckers Creek between Deep Hollow and Aarons Creek



5.14. Aarons Creek (M-8-A; SWS 18)

Aarons Creek, the longest tributary to Deckers Creek (Figure 18) is relatively unimpacted by AMD. The TMDL calls for small reductions in its iron load, but the stream is not listed as impaired. Recent measurements consistently show high pH values, substantial alkalinity and low metal concentrations. Higher metal concentrations are generally associated with rain events and suspended sediment. One source in the watershed is given a low priority for remediation. NRCS (2000) measured loads of 360, 100 and 11 lbs/yr of Al, Fe and Mn, respectively, at Ponderosa Ponds (near site 1143, "Ponderosa Pines Opening," for which water discharges are not recorded). At site 92, the PAD indicates that water flows into, rather than out of, Aarons Creek Portal (OAMLR files). No information is available for site 4565 (Dewey Hastings) but fish have been seen in Aarons Creek nearby downstream.

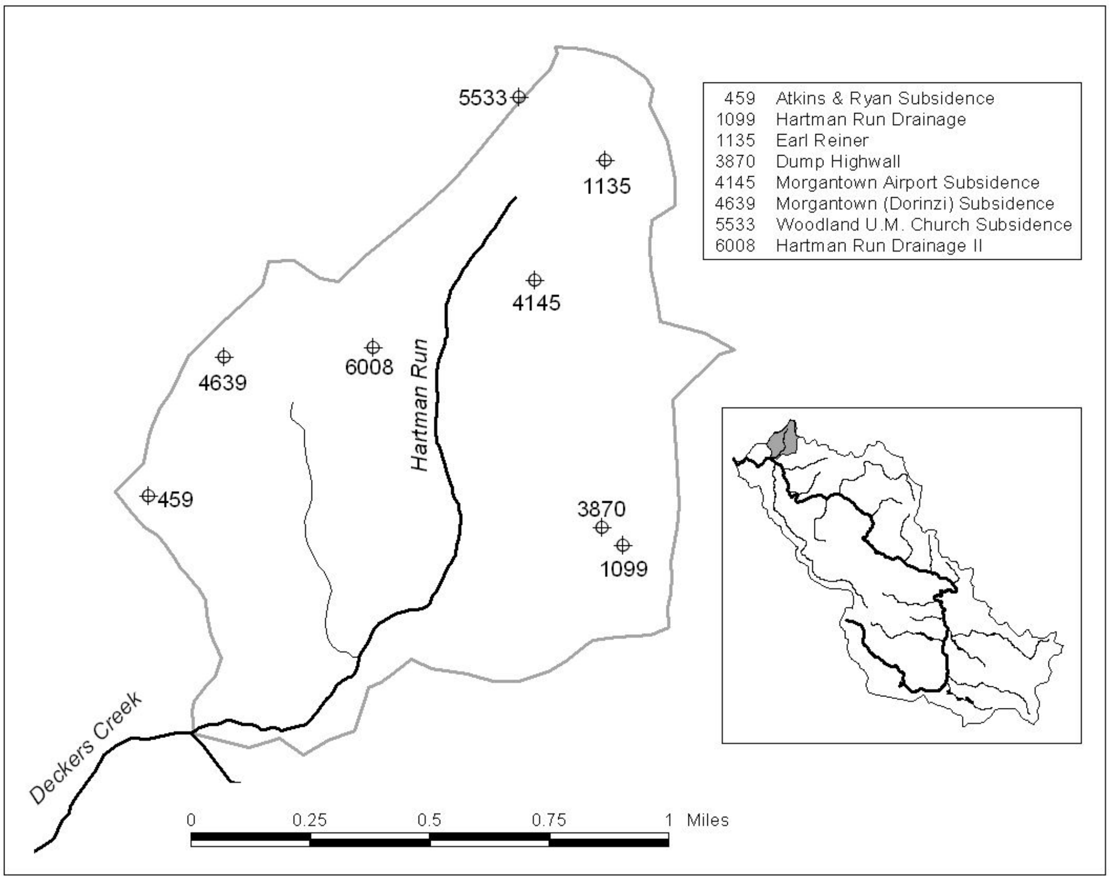
Figure 18: AMD sources to Aarons Creek



5.15. Hartman Run (M-8-0.5A; SWS 149)

Hartman Run is the last tributary to Deckers Creek before it flows into the Monongahela River (Figure 19). Its northern half is ringed by a ridge upon which Morgantown's airport and the "Mileground," an important commercial street, are located. The Pittsburgh coal seam lies just below this ridge, and has been heavily mined, causing a number of mine drainage (PAs 1099 and 6008) and subsidence problems (459, 1135, 4145, 4639 and 5533). Hartman Run varies in chemical characteristics. It often carries enough AMD to violate standards, but also hosts fish at times. Recent grouting to solve some of the subsidence problems may have diverted flow of water within the mine pool toward Hartman Run. The major sources of AMD are both high-priority sites.

Figure 19: AMD sources to Hartman Run



6. COSTS OF REMEDIATION MEASURES

There is not enough information available to estimate the costs of reducing all the AMD sources, let alone all the nonpoint source pollutants, to acceptable levels. This plan therefore estimates costs for eight of the high-priority AMD sources and extrapolates from those the costs for remediation at other high-priority sites. The estimated cost of this WBP is $5.9 million.

Eight of the high-priority sites have been sampled enough to estimate remediation costs (Table 16). Those costs include construction, engineering and project management. Construction costs include four treatment measures: land reclamation, wet seals, open limestone channels (OLCs) and reducing and alkalinity producing systems (RAPS). Land reclamation, valued at $10,000/acre, is included in costs whenever PADs or observation suggests that an area of acid-producing material is contributing to the AMD loads. Wet seals ($5,000 each) are required where water springs from underground, usually through an abandoned portal. OLCs are required to control the path of any AMD on site. The amount of OLC is estimated at 100 feet for each wet seal, 100 feet for every acre of reclamation, and 100 feet for every RAPS. OLC construction costs $35/foot. The AMDTreat program (OSM, 2005) was used to determine a cost for a RAPS, using the hot acidity values of AMD sampled on site and a design flow. Design flow was either the maximum flow value observed, or twice the observed flow if only one estimate exists. Engineering and project management costs are each estimated as 10% of the construction costs. For sources to UNT/Kanes Creek RM 2.6, the one stream where data consistently indicates Mn impairment, the cost of MRBs with one-day retention times was also added.

One site, Hawkins Mine Drainage (3455), may be connected to the mine pool of an operation with an NPDES permit. Its cost is not included in this iteration of the plan.

Table 16: Cost (in thousands of dollars) calculations for high-priority, data-rich AMD sources

Site	Reclamation		Wet seals		RAPS			MRB[a]	OLC		EPM[b]	**Project totals**
	Area	Cost	Count	Cost	Flow	Acidity	Cost	Cost	Length	Cost	Cost	**Cost**
	Ac.	*$1000*		*$1000*	*gpm*	*mg/L*	*$1000*	*$1000*	*Feet*	*$1000*	*$1000*	***$1000***
Clinton Braham (2192)[c]	2	20	1	5	10	695	78	4	400	14	23	**144**
Kanes Creek South (2003)[c]	0	0	0	0	147	290	448	0	100	4	90	**542**
Kanes Creek Tipple (2002)[c]	0	0	0	0	12	1,250	163	0	100	4	33	**200**
Morgan Mine Road AMD (5990)[c]	0	0	1	5	35	520	195	0	200	7	41	**248**
Sandy Run spring[d]	2	20	1	5	22	257	65	10	400	14	21	**135**
Superior Hydraulics (3738)[e]	0	0	0	0	600	1,000	6,000	0	100	4	1,200	**7,204**
Valley Highwall #3 (3068)[f]	2	20	4	20	52	354	198	0	700	25	53	**316**
Valley Point #12 (1456)[f]	0	0	2	10	77	460	374	0	300	11	79	**474**
Grand total												**9,263**
Superior Hydraulics limited to $1,000,000												***3,059***

[a]Manganese Removal Bed. [b]Engineering and project management costs. [c]Data from FODC. [d]Data based on load and flow from Sandy Run (=UNT/Kanes Creek RM 2.6) less the contributions of the Clinton Braham (2192) source. [e]Data from Stewart and Skousen, 2002b. [f]Data from NRCS.

According to these calculations, the most expensive site will be the Richard mine (draining at Superior Hydraulics, PA 3738). It is unlikely, however, that a RAPS will be used to decrease pollution from that site. Calculations by AMDTreat (OSM, 2005) indicate that such an installation would require more than 50 acres. The DCRT is currently gathering data to estimate the cost of installing a chemical treatment plant for this mine. $1,000,000 is a reasonable estimate for the capital expenses for such a plant. Operations and maintenance costs for the site are not included in the plan.

The total cost for the data rich sites, excluding the Richard mine, is $2,239,000, or an average of $320,000 per site. This cost is used as an estimate for the average of the remaining nine high-priority sites. The total cost for high-priority remediation sites in the Deckers Creek watershed is therefore $5.9 million:

$$\$3,059,000 + 9 \times \$320,000 = \$5,939,000$$

7. EDUCATION COMPONENT

In order for the nonpoint source management measures to be successful, indeed, to be built in the first place, many constituencies will have to participate. The program below is designed to communicate with those constituencies.

Friends of Deckers Creek has conducted a number of activities to educate watershed residents and users about the problems and potentials of the watershed. These avenues will also be used to communicate the goals and progress of the WBP:

- Clean Creek Program

  FODC monitors 13 sites in the watershed four times each year and assesses water quality using chemical means. In addition, FODC assesses communities of fish and of benthic macroinvertebrates once each during the year. Data are compiled in an annual *State of the Creek* report which is distributed to local libraries, schools, government personnel and citizens. This tool also helps target areas where remediation is needed and supports the evaluation of completed projects.

- The CarpFest

  FODC hosts an annual festival for watershed residents and visitors. This festival is called the CarpFest and takes place in the fall. The festival has an education component and informational booths as well as live music, food vendors and children's activities.

- DeckersCreek.org

  FODC maintains a website with information about Deckers Creek, links to other watershed groups, and information about watershed remediation.

- Deckers Creek Currents

  FODC publishes a newsletter three times each year to inform subscribers about the progress of remediation projects in the watershed, and about other information of interest. Subscriptions are free.

- Natural history brochures

  FODC has published two natural history brochures, *Ferns of the Deckers Creek Rail Trail* and *Wildflowers of the Deckers Creek Rail Trail*. FODC has also prepared a birding checklist for the Deckers Creek watershed and is preparing it for publication as a brochure.

- Other publications

  FODC, in collaboration with other groups, has published other reports, including *Deckers Creek stream quality inventory, Acid mine drainage in Deckers Creek: what we know so far, Remediation of Deckers Creek: a status report*, and *Friends of Deckers Creek volunteer stream monitoring manual.*

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.

West Virginia Department of Environmental Protection will hold a public meeting in the watershed to gather suggestions for monitoring locations prior to its five-year monitoring effort beginning in 2009. WVDEP will include information at this meeting on the status of plans for eliminating nonpoint source pollution in the watershed.

8. IMPLEMENTATION SCHEDULE

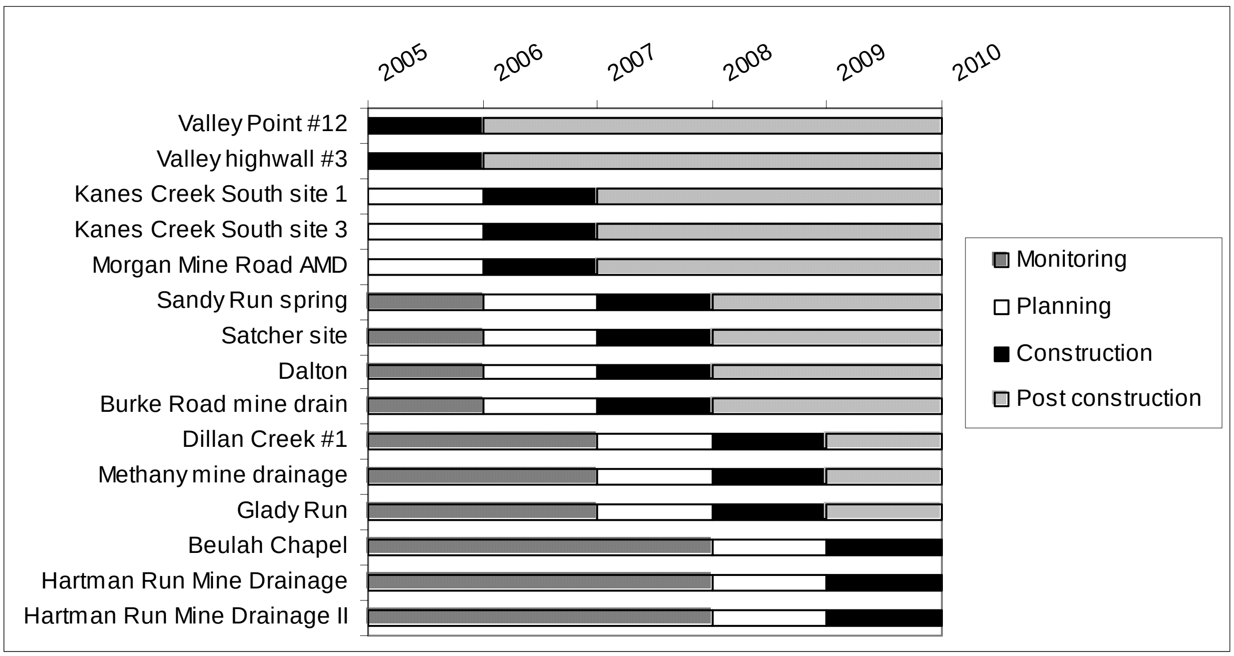
8.1. Acid mine drainage

Remediation of Deckers Creek sources will follow two tracks simultaneously. In one track, the DCRT will pursue remediation of the high-priority AMD sources, from upstream sites to downstream sites. In the other track, DCRT or a similar group will pursue the long-term, difficult project of treating the discharge from the Richard mine. These projects are expected to be finished by 2011. During the same period, monitoring to address lead, fecal coliform and sediment will occur, and plans will be developed and funding secured to address those problems.

In the first track, sites will be addressed from upstream to downstream. The DCRT will executes projects from the top of Kanes Creek going downstream, then address the one site upstream from Kanes Creek, and then address sites according to the order in which they contribute to Deckers Creek (Figure 20).

Because the second track, the Richard mine, will depend on funds to support operations and maintenance, expenditures on that track are not related to USEPA 319 funds. A coalition of Morgantown area residents, including FODC, Trout Unlimited, the Morgantown Area Chamber of Commerce and others are establishing a trust fund and seeking contributions to address the Richard mine.

Figure 20: Implementation schedule for high-priority AMD sources



8.2. Other nonpoint pollution problems

Specific plans for the elimination of other nonpoint pollution problems, specifically lead, fecal coliform bacteria and sediment, cannot be developed without additional data. This WBP includes a plan to gather the data necessary to address these pollution sources. A later revision of this plan will set out an implementation schedule. The plan proceeds in three phases.

<u>Phase 1: Preliminary monitoring</u> (2005-2006): As described in Section 3, above, several areas with occasional or constant lead, fecal coliform and sediment problems have been identified. During the first

two years, this WBP calls for confirming the impairment in those areas and identifying the most important sources.

Measurable goals: identify major areas of impairment and methods for determining how they can be addressed.

Phase 2: Source monitoring and planning (2007-2008): During the second phase, monitoring will focus on gathering information needed to eliminate the problems. Procuring funds to implement remediation measures will also occur during this phase.

Measurable goals: Revise WBP to include implementation of remediation measures for other pollutants. Secure funding for implementation.

Phase 3: Implementation (2009-2013): During this phase, measures to reduce the loads of lead, fecal coliform bacteria and sediments that impair the creek will be executed.

Measurable goals: Eliminate impairment by lead, fecal coliform bacteria and sediment from the Deckers Creek stream system.

9. REMEDIATION MILESTONES

Setting the most upstream AMD sources first in the schedule will produce fast results in headwater stream segments. In the year following remediation at a particular site, chemical water quality monitoring will indicate no violations of standards downstream (at least as far as the next major source). In the second year following remediation, a large increase in benthic macroinvertebrate numbers and community scores (e.g., the West Virginia Stream Condition Index, or WVSCI), will be noted. The third year following treatment will bring improvements in the fish community. In streams that are isolated from the mainstem by effects of other major AMD sources, DCRT will, in consultation with the West Virginia Division of Natural Resources, consider stocking fish.

Segments where these changes are predicted are listed in Table 17.

Table 17: Expected improvements in stream segments due to remediation activities

Subwatershed	Segments	Projects causing improvement	Expected year for improvement		
			Meets standards	*Improved WVSCI*	*Improved fish communities*
Kanes Creek	Mainstem above RM 3.2	Valley Highwall #3	2006	2007	2008
	UNT RM 3.2, above contribution from Kanes Creek Tipple	Valley Point #12	2006	2007	2008
	Mainstem above RM 2.6	Kanes Creek Tipple	2007	2008	2009
	Entire subwatershed	Clinton Braham, Sandy Run spring, Morgan Mine Road AMD, Hawkins Mine Drainage, Kanes Creek South	2008	2009	2010
Laurel Run	Entire subwatershed	Burk Mine Drain	2008	2009	2010
Deckers Creek	Mainstem above Dillan Creek	Dalton site, and Kanes and Laurel subwatersheds	2008	2009	2010
Dillan Creek	From headwaters to Swamp Run	Dillan Creek #1	2009	2010	2011
Deckers Creek	Mainstem above Deep Hollow	Bretz (Methany) mine drainage, Glady Run Strips	2009	2010	2011
Deep Hollow	Entire subwatershed	Beulah Chapel portals	2010	2011	2012
Hartman Run	Entire subwatershed	Hartman Run Mine Drainage I and II	2010	2011	2012
Deckers Creek	Entire watershed	Cumulative projects, additional adaptive projects	2011	2012	2013

10. ADAPTIVE MANAGEMENT OF WATERSHED GOALS

The DCRT will have opportunities to modify the plan at the first DCRT meeting of each calendar year. Changes in the plan should be considered as new data on sources, loads or impairment come to light, new AMD treatment techniques are recognized, and as success of previous projects is recognized. The plan should continually be modified to reduce pollutant loads and to remove stream segments and stream miles from the impaired list.

11. MONITORING

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

<u>WVDEP Watershed Assessment Program:</u> According to WVDEP's five-year watershed management framework cycle, the agency performs in-depth monitoring of the state's watersheds every five years. The next monitoring year for the Monongahela River, which includes the Deckers Creek watershed, is scheduled to begin in summer 2009. These monitoring data will be helpful to show whether streams are improving or declining in quality. In addition to AMD water chemistry, technicians collect benthic macroinvertebrates to determine biological impairments and fecal coliform data to determine bacteria impairments. Technicians also perform sediment-related assessments. WVDEP will then use these data, plus data collected by other agencies and organizations, to make impairment decisions for the next 303(d) list.

<u>WVDEP Stream Restoration Group:</u> The Stream Restoration Group (SRG), which works within OAMLR, collects source data when WVDEP is designing a remediation project. SRG also monitors past OAMLR projects to assess their efficacy, and performs occasional sweeps across the whole watershed to help target projects.

<u>FODC monitoring programs</u>: FODC has a number of ongoing monitoring programs, and regularly initiates additional programs for specific purposes. The organization's central monitoring activity is the Clean Creek Program, which assesses water quality and pollution loads through chemical and physical measurements at 13 sites four times every year. It also assesses water quality through the fish and macroinvertebrate communities at those sites once a year. In FODC's Volunteer Monitoring Program, volunteers measure pH and conductivity at a variety of sites chosen to reveal important information. For example, one set of sites that a volunteer would monitor would reveal the effect of pollution from the Richard mine by monitoring sites above and below it on Deckers Creek. FODC is currently cooperating with OAMLR to monitor the effects of the recent project on Slabcamp Run.

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