WATERSHED BASED PLAN FOR THE WOLF CREEK WATERSHED OF THE NEW RIVER

From the headwaters to the mouth, Fayette County, West Virginia

September 2006

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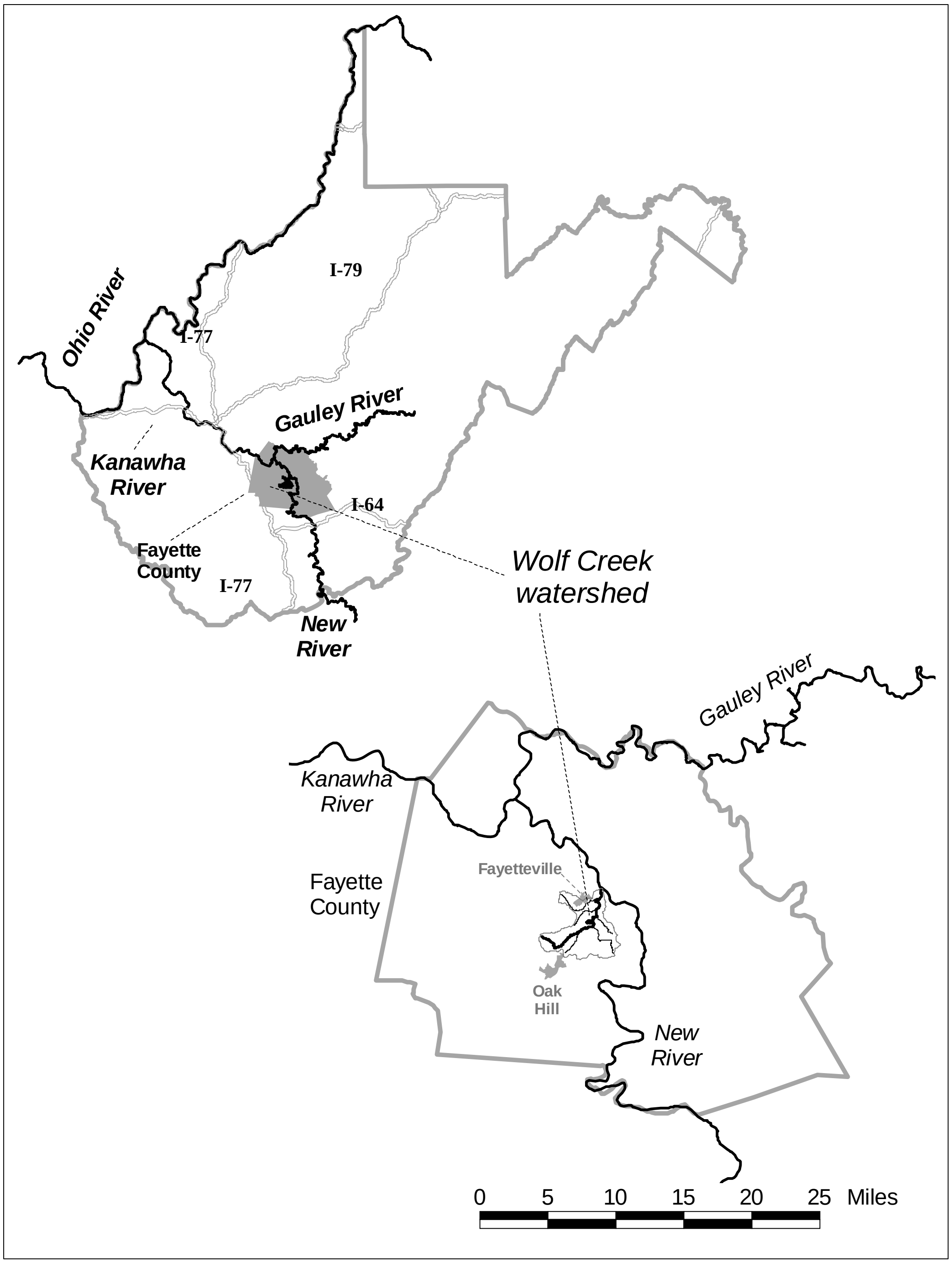
ABBREVIATIONS

Al	aluminum
AMD	acid mine drainage
AML	abandoned mine land
cfu/100 mL	colony-forming unit per 100 milliliters
dis.	dissolved
Fe	iron
LAI	Lombardo Associates, Inc.
lb	pound
mg/L	milligram per liter
Mn	manganese
MPPRP	Maryland Power Plant Research Project
NRAC	Natural Resource Analysis Center
OAMLR	Office of Abandoned Mine Lands and Reclamation
OLC	oxic (or open) limestone channel
OSM	Office of Surface Mining, Reclamation, and Enforcement
PAN	Plateau Action Network
RM	river mile
SRG	Stream Restoration Group
TMDL	total maximum daily load
tot.	total
µg/L	microgram per liter
UNT	unnamed tributary
USACE	United States Army Corps of Engineers
VISTA	Volunteers In Service To America
WVDEP	West Virginia Department of Environmental Protection
WOPEC	Working on People's Environmental Concerns

1. INTRODUCTION

This Watershed Based Plan covers the entire Wolf Creek watershed in West Virginia from the headwaters near Oak Hill to its confluence with the New River near the Fayette Station Bridge (Figure 1). The following background information on the Wolf Creek watershed is quoted from a recent storm water management and flood hazard mitigation plan (Parsons Brinckerhoff, 2004).

Figure 1: The Wolf Creek watershed in West Virginia



1.1 General information

"The Wolf Creek watershed is located in the center of Fayette County, West Virginia. Parts of Fayetteville and Oak Hill are located within the watershed. The northern boundary of the watershed runs through the northern section [of] Fayetteville, following High Street southeast to East Maple Street, turning northeast at East Maple Street and following it to Huse Street. At Huse Street, the boundary turns southeast, bisecting Park Drive before turning northward again and exiting the city limits. The southern boundary of the watershed runs through the northern section of Oak Hill, following Summerlee Road eastward to Highway 16, turning south at Highway 16 and following west of the highway to Dickenson Street. At Dickenson Street, the boundary turns east, crossing Highway 16 and Adkins Avenue and exiting the city limits at Gatewood Road. The Fayetteville Reservoir, which provides emergency drinking water to the residents of Fayetteville, is also located within the Wolf Creek watershed. The reservoir, formed by the damming of Wolf Creek, is located approximately ½ mile north [of] the confluence of Wolf Creek and Short Creek" (Parsons Brinckerhoff, 2004, p. 6).

"The Wolf Creek watershed, which encompasses approximately 10,947 acres, lies within the Allegheny Plateau. Valleys in the watershed tend to be narrow with very steep sides (20-30 percent slopes). The plateau areas between the stream valleys tend to be more gently rolling. Slopes of less than 10 percent are common in these areas. The headwaters of Wolf Creek are located in the southwestern part of the watershed above Lochgelly. Wolf Creek flows in a northeasterly direction for approximately 10.5 miles before emptying in the New River. Wolf Creek originates at an elevation of approximately 2,000 feet. The stream gradient in the upper reaches is fairly gentle, averaging less than 5 percent until just below its confluence with House Branch. At this point, the stream channel steepens dramatically, dropping from an elevation of 1760 feet to 880 feet in a distance of just over one mile as it flows into the New River" (Parsons Brinckerhoff, 2004, p. 6).

"The headwaters of Wolf Creek flow through areas that were surface mined for coal at one time and have since been reclaimed or capped. The Wolf Creek tributary originating on the Summerlee mine site [referred to as the unnamed tributary at river mile 8.7 in this Watershed Based Plan] flows through a wooded wetland between the culvert at Summerlee Road and the residential development approximately 1,000 feet to the east. The wetland is bounded on the north by Summerlee Road and the south by the abandoned railroad bed. Another wetland [that] begins at the confluence of the Summerlee tributary and Wolf Creek on the south side of Summerlee Road continues to US 19, stopping as the stream passes under the road and continuing again until the stream reaches US 19 again. A small wetland, a consequence of road construction and commercial development, is located along Wolf Creek as it flows along US 19 adjacent to the Fayette Plaza/Fayette Landing shopping center. The majority of the remainder of the wetlands in the watershed is associated with ponds and impoundments" (Parsons Brinckerhoff, 2004, p. 6).

"Wolf Creek flows through or adjacent to developed or agricultural land a majority of its length between its headwaters and the Fayetteville Reservoir. Tree cover, where it exists is generally a mix of oak, poplar, and maple, with few evergreens. An exception to this is the area of Wolf Creek between Adkins Branch and Levisee Branch, where the stream flows through an area with a dense canopy of hemlock, rhododendron, and pine. North of the reservoir, Wolf Creek flows through the National Park Service's New River Gorge National River. The character of Wolf Creek changes dramatically along this section. The channel is rocklined and strewn with boulders, the gradient steepens, and the flow rate increases" (Parsons Brinckerhoff, 2004, pp. 6-8).

"Five named tributaries flow into Wolf Creek: Adkins Branch, Levisee Branch, Short Creek, Crooked Run, and House Branch. Several unnamed tributaries also flow into Wolf Creek, the most notable of which is the one flowing from the Summerlee mine site. The headwaters of Adkins Branch, Levisee Branch, and Short Creek flow through areas that are predominantly agricultural, often flowing into ponds near their sources before continuing downstream. The downstream sections of Adkins Branch and Levisee Branch flow through areas that are predominantly forested and relatively undisturbed by development. The upper reach of Short Creek flows through an area that is predominantly agricultural with little or no tree cover or buffering. The lower reach flows through a narrow evergreen forest. Crooked Run originates in an area dominated by agriculture and residential development. Below the agricultural and residential areas, Crooked Run flows through a woodland dominated by oak, poplar, and maple, with few evergreens, unlike Adkins and Levisee Branches. House Branch flows through an evergreen forest for most of its length, except for an area dominated by oak, poplar, and maple on either side of Highway 16. A tributary to House Branch originates west of Fayetteville and flows through town adjacent to Lively [S]treet and under West Maple Street before joining House Branch" (Parsons Brinckerhoff, 2004, p. 8).

1.2 Land use/Land cover

Land use in the Wolf Creek watershed has been divided into 12 categories, as shown in Table 1.

Table 1:Land use in the Wolf Creek watershed

Land use	Acres	Percent of total land use
Forest	6,903	63%
Agriculture	2,059	19%
Residential	1,230	11%
Mining	190	2%
Commercial and services	142	1%
Mixed urban	134	1%
Industrial	101	1%
Transportation	101	1%
Water (Ponds and reservoirs)	35	<1%
Mixed industrial and commercial	28	<1%
Barren land - transitional	22	<1%
Water treatment facility	2	<1%
Total	**10,947**	**100%**

Source: Parsons Brinckerhoff (2004).

1.2.1 Forest

"Currently, 6,903 acres, or over half of the watershed (63 percent), are covered by forest. The majority of the forest is comprised of deciduous trees. Narrow bands of evergreen forest occur along Adkins Branch and its tributaries, Levisee Branch and its tributaries, House Branch, and the lower reaches of Wolf Creek" (Parsons Brinckerhoff, 2004, p. 12).

1.2.2 Agriculture

"Approximately 2,059 acres (19 percent) of land within the watershed is currently used for agricultural purposes. The majority of the farmland is located in two sections of the watershed:

(the area between the east side of Highway 16, the north side of Wolf Creek, the south side of Crooked Run, and the west side of Gatewood Road) and the southern and eastern (along or adjacent to Gatewood Road). Much of the farmland in the upper reaches of the watershed is used for grazing dairy cows and beef cattle" (Parsons Brinckerhoff, 2004, pp. 12).

1.2.3 Residential

"Approximately 1,230 acres (11 percent) of land within the watershed are currently being used for residential purposes. The majority of the residential development within the watershed occurs along the Highway 16 corridor from Oak Hill in the upper reach of the watershed to Fayetteville in the lower reach of the watershed. The other area of residential development follows the eastern and southern perimeter of the watershed along the Gatewood Road corridor. Residential development in the interior of the watershed is sparse. Most of the residential development within the watershed consists of single-family housing on small lots" (Parsons Brinckerhoff, 2004, p. 12).

1.2.4 Commercial and services

"Commercial and service-related uses currently occupy 142 acres of land ([about] one percent) in the watershed. These uses are concentrated along the US 19 and Highway 16 corridors, mainly in and near Oak Hill and Fayetteville. The largest commercial development occurs along US 19 at its intersection with Highway 16 and Lochgelly Road. A large shopping center (Fayette Plaza and Fayette Landing) is located on the west side of US 19. Banks, gas stations and fast food restaurants are also located at or adjacent to this intersection" (Parsons Brinckerhoff, 2004, p. 12).

1.2.5 Water (Ponds and reservoirs)

"Ponds and reservoirs account for less than one percent of the total land area within the watershed. The majority of the ponds are associated with agricultural uses and are located in the southern and eastern portions of the watershed. The Fayetteville Reservoir is the largest waterbody (excluding streams) in the watershed" (Parsons Brinckerhoff, 2004, p. 12).

2. MEASURABLE WATER QUALITY GOALS

All stream segments in the Wolf 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 determined a set of interlinked water quality goals. Designated uses for the streams in the Wolf Creek watershed include public water supply (Category A), maintenance and propagation of aquatic life (warm water fishery streams) (Category B1), maintenance and propagation of aquatic life (trout waters) (Category B2), and water contact recreation (Category C). The numeric and narrative water quality standards shown in Table 2 are relevant for the nonpoint source pollution problems addressed by this Watershed Based Plan.

Table 2: Selected West Virginia water quality standards

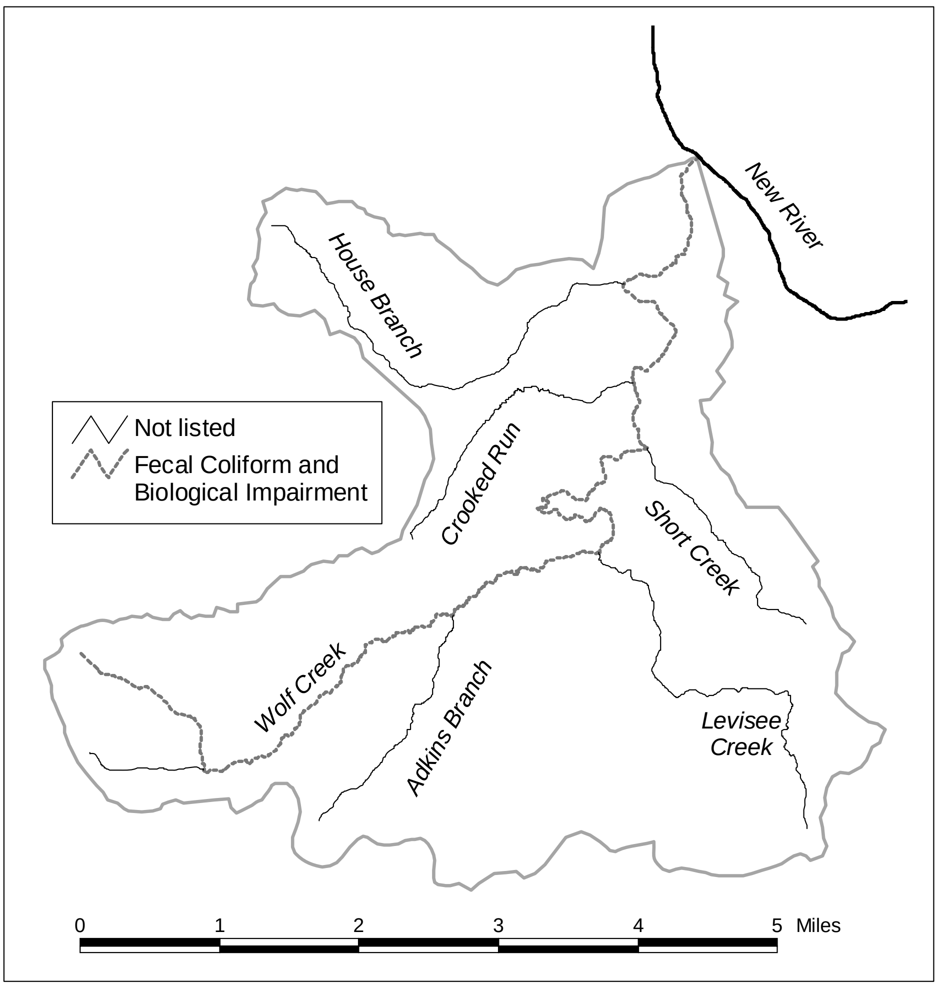
<table>
<tr><th></th><th></th><th colspan="2">Aquatic life</th><th colspan="2">Human health</th></tr>
<tr><th>Parameter</th><th>Section</th><th>Category B1 (Warm water fishery streams)</th><th>Category B2 (Trout waters)</th><th>Category A (Public water supply)</th><th>Category C (Water contact recreation)</th></tr>
<tr><td>Aluminum (dissolved)</td><td>8.1</td><td colspan="2">Not to exceed 87 µg/L (chronic) or 750 µg/L (acute)</td><td>None</td><td>None</td></tr>
<tr><td>Biological impairment</td><td>3.2.i</td><td colspan="4">[N]o significant adverse impact to the…biological [component] of aquatic ecosystems shall be allowed.</td></tr>
<tr><td>Fecal coliform</td><td>8.13</td><td>None</td><td>None</td><td colspan="2">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.</td></tr>
<tr><td>Iron (total)</td><td>8.15</td><td>Not to exceed 1.5 mg/L (chronic)</td><td>Not to exceed 0.5 mg/L (chronic)</td><td>Not to exceed 1.5 mg/L</td><td>None</td></tr>
<tr><td>Manganese (total)</td><td>8.17</td><td>None</td><td>None</td><td>Not to exceed 1.0 mg/L</td><td>None</td></tr>
<tr><td>pH</td><td>8.23</td><td colspan="4">No values below 6.0 nor above 9.0. Higher values due to photosynthetic activity may be tolerated.</td></tr>
</table>

Source: 46 Code of State Rules Series 1. Sections refer to this rule. Section 6.2.d clarifies the manganese criterion: "The manganese human health criterion shall only apply within the five-mile zone immediately upstream above a known public or private water supply used for human consumption." The chronic dissolved aluminum criterion of 87 µg/L has been suspended in all but trout waters until July 2007.

3. SOURCES OF NONPOINT SOURCE POLLUTION THAT MUST BE CONTROLLED

Streams that do not meet water quality standards are placed on a statewide list of impaired streams called the 303(d) list. Improving water quality so that these streams are once again clean and can be removed from this list is the primary goal of this plan. As shown in Figure 2, the entire length of Wolf Creek is on the 2004 303(d) list for fecal coliform and biological impairment (WVDEP, 2004). The draft 2006 303(d) list, not yet approved by the United States Environmental Protection Agency (USEPA), retains the listing for biological impairment but refines the fecal coliform listing by including two discrete segments rather than the entire length of Wolf Creek (WVDEP, 2006a). The draft 2006 list also includes House Branch, Crooked Run, and Short Creek for fecal coliform (WVDEP, 2006a).

Figure 2: Impaired stream segments in the Wolf Creek watershed



Source: WVDEP (2004).

No streams in the watershed were listed as impaired for acid mine drainage (AMD) in 2004 (WVDEP, 2004). Still, this Watershed Based Plan considers AMD pollution based on other data sources. The draft 2006 303(d) list, for example, lists the unnamed tributary at river mile 8.7, which drains the Summerlee site, as being impaired by aluminum, iron, and pH (WVDEP, 2006a). AMD may also contribute to biological impairments.

3.1 Acid mine drainage

AMD pollution in excess of water quality standards has been documented by the Plateau Action Network (PAN), the West Virginia Department of Environmental Protection (WVDEP), and others. Severe AMD has been found in seeps and gullies on the Summerlee site, which drains to an unnamed tributary of Wolf Creek at river mile 8.7, near its headwaters.

Table 3 summarizes recent water quality data collected in Wolf Creek itself, and Table 4 summarizes data collected in tributaries. According to these data, the Summerlee site discharges strong AMD to the tributary that enters Wolf Creek at river mile 8.7. The acidity from this tributary is gradually neutralized and metals are removed and diluted as Wolf Creek flows to the New River.

The steepest declines in metals concentrations occur in this unnamed tributary (KN-10-M). Iron and manganese concentrations decline by about 75%, and dissolved aluminum concentrations decline by about 25% from river mile 0.8 to the mouth of this tributary.

In Wolf Creek itself, violations of AMD-related water quality criteria are common down to at least river mile 6.9. Data from river mile 5.1 show no pH violations, but do not include any metals data. Even at river mile 3.3, AMD-related violations occur, but average pH and metals values meet standards. Some violations of the iron and dissolved aluminum criteria have been documented within one-half mile of the mouth of Wolf Creek. Unknown sources other than the Summerlee site may account for some of the metals loads encountered near the mouth of Wolf Creek.

Wetlands may be responsible for some of these improvements in Wolf Creek and in the unnamed tributary that drains the Summerlee site. Wetlands are discussed below in Section 3.1.3.

Table 3: Instream data for pH, metals and fecal coliform bacteria in Wolf Creek

River mile	Description	Statistic	pH (SU)	Al (dis) (mg/L)	Fe (mg/L)	Mn (mg/L)	Fecal coliform (cfu/ 100 mL)	Sources (No. samples)
0.1 - 0.2	Near mouth	N	194	13	16	16	189	NPS (174), PAN (4), DWWM (16)
		Avg.	8.06	0.08	0.27	0.09	86	
		% viol.	0	25	13	0	19	
0.5	Near crossing of WV Route 82	N	4		4	4	4	PAN (4)
		Avg.	8.3		0.21	0.5	219	
		% viol.	0		25	0	25	
2.6	Near hairpin turn in WV Route 82	N	11				11	DWWM (11)
		Avg.	6.72				65	
		% viol.	0				0	
3.1 - 3.3	Near crossing of Wolf Creek Road	N	6	2	6	6	6	PAN (4), DWWM (2)
		Avg.	6.83	0.02	0.4	0.5	200	
		% viol.	33	0	33	17	50	
5.1	Near Wolf Creek and Jeffries Roads	N	9				10	DWWM (10)
		Avg.	6.7				64	
		% viol.	0				20	
6.9	Below Route 16 overpass	N	12	7	11	11	5	KH (7), PAN (4), DWWM (1)
		Avg.	6.1	0.86	1.27	1.68	940	
		% viol.	50	71	73	64	80	
7.3	Upstr. from US 19 (lowest crossing)	N	7	7	7	7		KH (7)
		Avg.	3.84 - 5.85	1.6	0.3	1.7		
		% viol.	100	NA	NA	NA		
7.6	Below UNT at Lochgelly interchange	N	11	7	11	11	4	KH (7), PAN (4)
		Avg.	3.2 - 7.4	3.8	1.1	1.9	686	
		% viol.	64	NA	NA	NA	75	
7.8	Below middle US 19 overpass	N	4		4	4	4	PAN (4)
		Avg.	7.07		0.9	1.6	147	
		% viol.	0		75	75	25	
8.1	Below most upstream wetland	N	7		7	7	7	KH (7)
		Avg.	2.54 - 4.24		2.5	3	3.5	
		% viol.	100		NA	NA		
8.6 - 8.7	Below UNT KN-10-M	N	11	1	11	11	4	KH (7), PAN (4)
		Avg.	2.13 - 5.51	9.1	92	4.5	10	
		% viol.	100	100	NA	NA	0	
8.8 - 9.1	Above KN-10-M	N	12	1	1	1	11	KH (1), DWWM (11)
		Avg.	6.77	0.01	0.7	0.1	2220	
		% viol.	0	0	100	0	91	

Note: Data sources: DWWM=WVDEP (2006b), Hilton=Hilton (2005), KH= Kimley-Horn (2005a), NPS=NPS (2006), PAN=Scott and Eades (1999). Percent of measurements violating standards is not available for sites including data from Kimley-Horn, because the report contained averages, rather than individual data. NA is used for these sites.

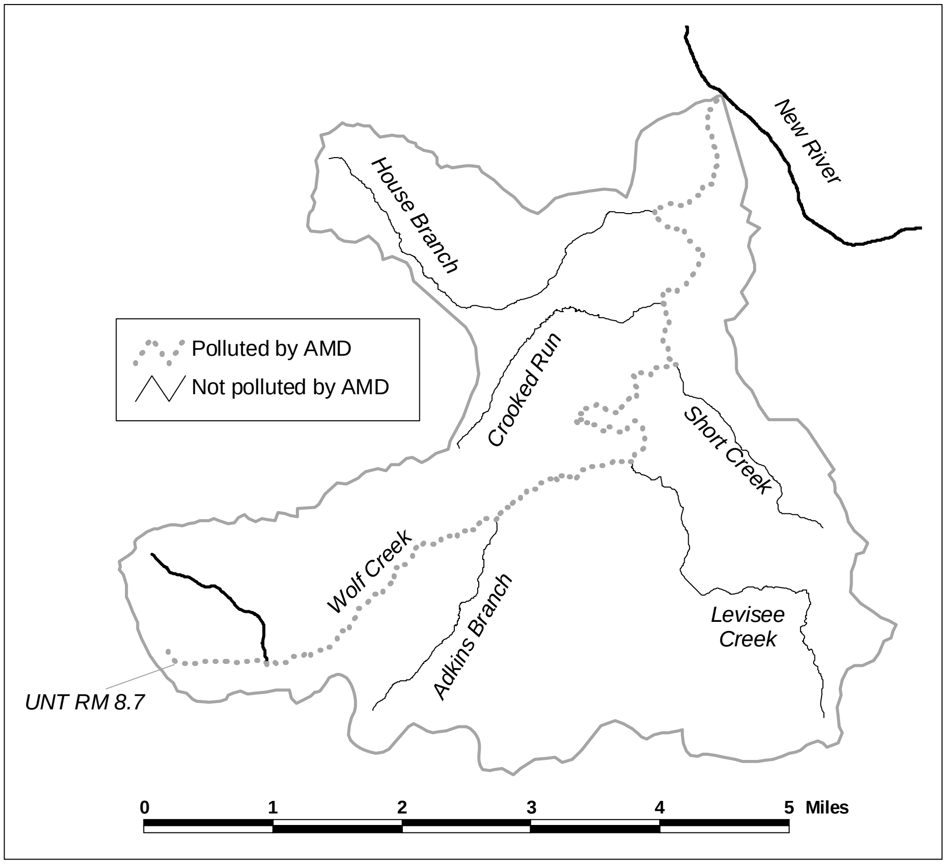
Table 4: Instream data for pH, metals and fecal coliform bacteria in tributaries to Wolf Creek

Stream code	River mile	Description	Statistic	pH (SU)	Al (dis) (mg/L)	Fe (mg/L)	Mn (mg/L)	Fecal coliform (cfu/ 100 mL)	Sources (No. samples)
KN-10-A	0.7	House	N	12				11	DWWM (12)
		Branch	Avg.	7.17				359	
			% viol.	0				45	
KN-10-B	0.1	Crooked Run	N	11				11	DWWM (11)
			Avg.	6.88				243	
			% viol.	0				36	
KN-10-C	0	Short	N	9				9	DWWM (9)
		Creek	Avg.	6.69				109	
			% viol.	0				22	
KN-10-D	0.1	Levisee	N	11				11	DWWM (9)
		Creek	Avg.	6.6				54	
			% viol.	9				9	
KN-10-M	0.05	KN-10-M	N	3	1	3	3		KH (3)
		near mouth	Avg.	3.03 - 3.59	29.6	40.9	5.2		
			% viol.	100	100	NA	NA		
KN-10-M	0.2 -	KN-10-M	N	13	12	13	13	11	KH (2),
	0.25	near Bethel	Avg.	3.2	16.9	45	6.3	3	DWWM (11)
		Baptist Church	% viol.	100	100	100	100	0	
KN-10-M	0.59	KN-10-M after	N	2		2	2		KH (2)
		first wetland	Avg.	2.91 - 2.99		97.6	11.8		
			% viol.	100		NA	NA		
KN-10-M	0.8	KN-10-M	N	16	1	15	15	4	Hilton (1),
		below	Avg.	2.91	38.2	173	19	9	PAN (4),
		Summerlee site	% viol.	100	100	100	100	0	SRG (11)

Note: Data sources: DWWM=WVDEP (2006b), Hilton=Hilton (2005), KH= Kimley-Horn (2005a), NPS=NPS (2006), PAN=Scott and Eades (1999). Percent of measurements violating standards is not available for sites including data from Kimley-Horn, because the report contained averages, rather than individual data. NA is used for these sites.

According to Tables 3 and 4, and as shown in Figure 3, Wolf Creek and the unnamed tributary at river mile 8.7 are polluted by AMD. These streams correspond with those included in the draft 2006 303(d) list: the unnamed tributary of Wolf Creek at river mile 8.7 is listed for AMD pollutants, and Wolf Creek itself is listed for biological impairment (WVDEP, 2006a).

Figure 3: Streams in the Wolf Creek watershed with acid mine drainage pollution



Source: Scott and Eades (1999) and WVDEP (2006b).

Because there are no active mines, and because the watershed's two bond forfeiture sites do not discharge AMD, abandoned mine lands (AMLs) are the only known source of AMD in the Wolf Creek watershed (WVDEP, 2005a and 2006c).

3.1.1 Abandoned mine lands

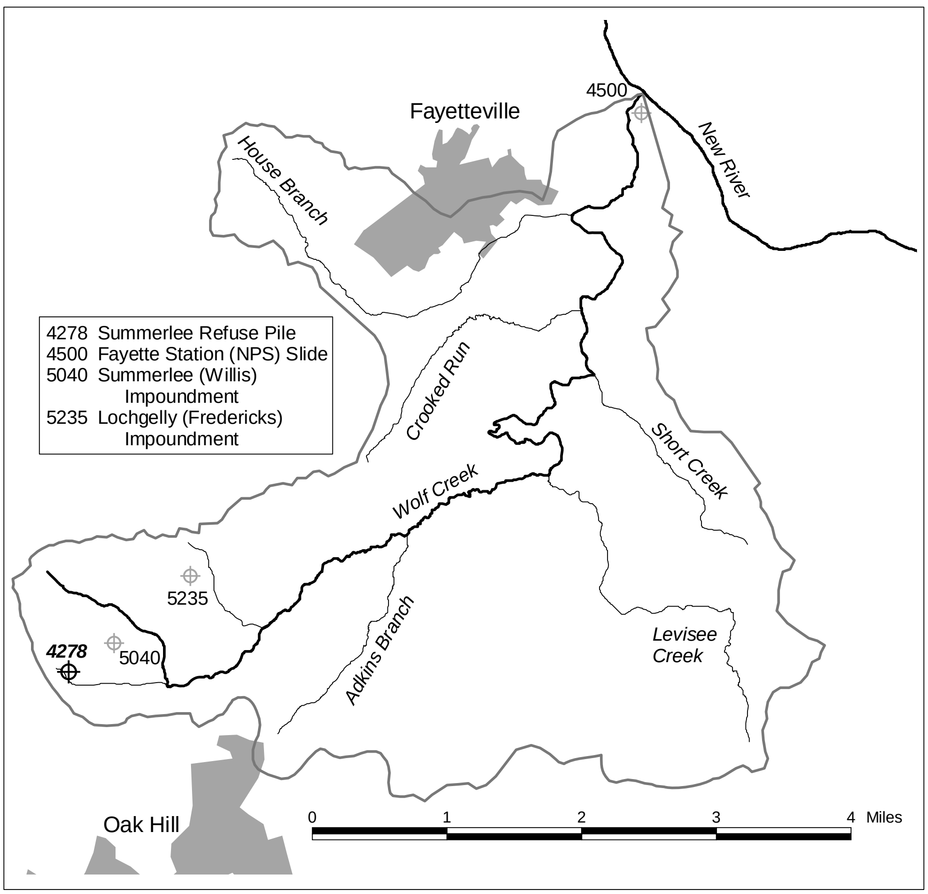
Only four AMLs are known to exist in the Wolf Creek watershed. Of these, one site is known to discharge AMD, two may discharge AMD, and one does not discharge AMD. These sites are listed in Table 5 and mapped in Figure 4. The methods used to classify these sites are not foolproof. If new information indicates that an AML does, in fact, discharge AMD, the Watershed Based Plan will be updated as appropriate.

Table 5: Abandoned mine lands in the Wolf Creek watershed

Site name (Problem area no.)	Location
Known AMD	
Summerlee Refuse Pile (4278)	Unnamed tributary to Wolf Creek, RM 8.7
Possible AMD	
Fayette Station (NPS) Slide (4500)	Wolf Creek near mouth
Lochgelly (Fredericks) Impoundment (5235)	Unnamed tributary to Wolf Creek, RM 8.1
No AMD	
Summerlee (Willis) Impoundment (5040)	Unnamed tributary to Wolf Creek, RM 8.7

Source: OSM (2006a) and WVDEP (Various dates). AMD=acid mine drainage.

Figure 4: Abandoned mine lands in the Wolf Creek watershed



Source: OSM (2006a) and WVDEP (Various dates).

3.1.1.1 Summerlee Refuse Pile

The key to eliminating AMD from almost all of the Wolf Creek watershed is to eliminate the polluted drainage from the Summerlee site. Although this site was reclaimed by WVDEP, it still discharges AMD. WVDEP and PAN are currently developing plans to address this site. The extent of the problem is explained by Bio-Chem Testing:

> "A mine and coal processing facility was operated at the head of Wolf Creek by Mountain Laurel Resources known as the Summerlee Site. In the early 1980's, Mountain Laurel Resources filed bankruptcy and the land was reclaimed by the [O]ffice of Abandoned Mine Lands in the mid 1990's. … [T]he primary concern of the site is the water drainage…. [It] is classic acid mine drainage that is very acidic and loaded with iron, aluminum and manganese. The water that drains from this site forms a tributary which flows into Wolf Creek and consequently impairs Wolf Creek. The impairment resulted in the West Virginia Department of Natural Resources (WVDNR) to remove Wolf Creek from its trout stocking list and required the town of Fayetteville further downstream to drill wells to supplement the town's drinking water." (Kimley-Horn, 2005a, Attachment A)

3.1.1.2 Fayette Station (NPS) Slide

The extremely large Kaymoor mine has a portal near the mouth of Wolf Creek. The portal discharge is responsible for the dangerous impoundment and dangerous slide at this site. The quality of the water discharged at this site is not known. Because it is near the mouth of Wolf Creek, it only has the potential to pollute a very small portion of the watershed. However, the short band of polluted water may form a barrier for fish migrating to and from the New River.

3.1.1.3 Lochgelly (Fredericks) Impoundment

A pond constructed from mine refuse is beginning to overflow at this site. No water quality data are available. The water may have ceased seeping through the spoil due to concrete waste that has been added to the pond.

3.1.2 Bond forfeiture sites

According to WVDEP (2006c), the bond forfeiture sites in the Wolf Creek watershed shown in Table 6 do not contribute AMD to Wolf Creek. These sites are not eligible for Section 319 funding because they are considered point sources of pollution. Reclamation at bond forfeiture sites is addressed by the WVDEP Division of Land Restoration through the Special Reclamation Fund.

Table 6: Bond forfeiture sites in the Wolf Creek watershed

Company	Permit no.	Receiving stream	Stream code	AMD?	Date revoked	Date reclaimed
Harvey Energy Corp.	S-3070-86	House Branch	KN-10-A	No	9/16/92	11/6/04
Tri-County Mining, Inc.	P-3038-86	Wolf Creek headwaters	KN-10	No	11/1/87	6/9/89

Source: WVDEP (2006c).

3.1.3 The impact of wetlands on acid mine drainage

A series of wetlands are thought to help treat AMD pollution in the Wolf Creek watershed. One wetland is located on the unnamed tributary that drains the Summerlee site, while the rest are located along Wolf Creek.

An important wetland is located along Wolf Creek between river miles 8.5 and 8.7, and may be responsible for the metals reductions shown in Table 3 that have been documented between river mile 8.6-8.7 and river mile 8.1 (West Virginia Water Research Institute, 2005 and Scott and Eades, 1999). The wetland may fail to retain all the metals under certain flow regimes.

Some wetlands will be removed during construction of the new Lochgelly Road interchange, slated to be built near river mile 7.6. Removal of these wetlands could impact downstream water quality in two ways.

First, loss of the wetlands' biogeochemical processes such as sulfate reduction would slow the continued recovery of water quality in Wolf Creek. In addition, if the material from the wetlands were removed from an anaerobic environment, metals that may have accumulated over decades may become soluble and enter the stream. These potential impacts cannot be quantified with current data.

In addition, as the watershed continues to develop, wetland removal may take place in other areas, further reducing natural AMD treatment in Wolf Creek.

3.2 Fecal coliform

In 2004, WVDEP placed the entire length of Wolf Creek on the 303(d) list for fecal coliform impairment. No tributaries, however, were listed at that time (WVDEP, 2004). The draft 2006 list, if approved, would list two segments of Wolf Creek—near the headwaters and near the mouth—and would also add House Branch, Crooked Run, and Short Creek (WVDEP, 2006a). WVDEP is developing a total maximum daily load (TMDL) to address these impairments, which is scheduled for release in 2007.

The fecal coliform impairment and sources are described by BioChem Testing, Inc.:

> "There are numerous sources for the high fecal counts at various locations along Wolf Creek. Many houses are not connected to a public treatment facility and have either home septic pits or straight pipes directly discharging into the stream. Much of the plateau around Fayetteville is also pastureland that contributes heavily to the fecal counts from livestock and wildlife and, during storm events, can explain the variation of counts at a single site." (Kimley-Horn, 2005a)

The Kimley-Horn (2005a) report also identifies many possible bacteria sources, including:

- livestock pasture,
- farmland,
- storm water runoff from residential areas,
- poor septics,
- straight pipes,
- raw sewage, and
- public restrooms.

Recent fecal coliform data are summarized above in Tables 3 and 4. Wolf Creek above the tributary that drains the Summerlee site shows the highest average concentrations of fecal coliform. Other monitoring sites along Wolf Creek also show high average values and high percentages of violation.

Based on tributary data summarized in Table 4, House Branch, Crooked Run, and Short Creek, show the highest average fecal coliform levels and the highest percent exceedances. These streams correspond exactly with those proposed for listing in the 2006 draft 303(d) list.

3.3 Biological impairment

WVDEP lists streams as biologically impaired based on a survey of benthic macroinvertebrate communities. A West Virginia Stream Condition Index score is generated from this survey. Streams with a score of 60.6 or less are considered biologically impaired and placed on the list. Entire stream lengths are typically considered impaired, and the cause of impairment is listed as unknown until more data are collected prior to the TMDL development process. While no tributaries of Wolf Creek were listed, the entire length of Wolf Creek has been listed for biological impairment on the 2004 303(d) list. A TMDL to address this impairment is scheduled for 2007 (WVDEP, 2004).

3.3.1 Current sources of biological impairment

Biological impairment can be the result of pollution from a number of different sources including AMLs, residential developments, air deposition, open dumps, poor storm water management, and transportation corridors. A survey by PAN in 1999 identified a number of known and suspected pollution sources that could be contributing to the biological impairment in the creek (Scott and Eades, 1999):

- a gob pile and heavy metals from the abandoned Summerlee site,
- the parking lot at Fayette Square plaza,
- exposed and disturbed hillsides,
- an industrial complex,
- an old strip bench at top of basin above a gob pile,
- a junkyard along a stream,
- an auto repair shop beside the junkyard,
- an abandoned car yard,
- gas stations,
- a highway maintenance storage area, and
- a wetland full of trash below Lamplighter Road.

These observations from 1999 are further supported by more recent field reviews and data. According to a 2004 storm water management and flood hazard mitigation plan:

> "Field reviews in 2003 and 2004 indicate that the 1999 findings still hold true and that conditions have not improved. Although no water samples were taken during the field reviews, annual water monitoring by members of the PAN indicates that the water quality trends are similar to those noted during the 1999 study. In addition to the AMD from the Summerlee mine site, the following was observed during the field reviews:
>
> - Wetlands in the upper watershed still appear to be under stress. Scrap metal and trash was observed in the wetland below Lamplighter Road.
> - The salvage yard on Lochgelly Road covers Wolf Creek. No erosion or sediment control measures were observed and, in addition to erosion and sedimentation, it is possible that runoff from the site may contain contaminants from scrap vehicles.
> - Stormwater runoff from the Fayette Plaza/Fayette Landing shopping center is directed straight into Wolf Creek. There is nothing in place to treat the runoff or slow it down.
> - Much of the stream bank along Wolf Creek above the reservoir was heavily eroded and silt was evident on the stream bottom. Much of the stream channel appears to be downcutting to adjust for increases in runoff volumes and/or velocities." (Parsons Brinckerhoff, 2004, p. 29)

In addition, "… PAN members discovered the abandoned Summerlee dump. The dump drains into Wolf Creek. Water sampling at the site revealed high lead levels." (Parsons Brinckerhoff, 2004, p. 28)

While a variety of possible sources of biological impairment have been proposed, AMD is likely the major source in the unnamed tributary that drains the Summerlee site, and is likely a major factor in Wolf Creek itself.

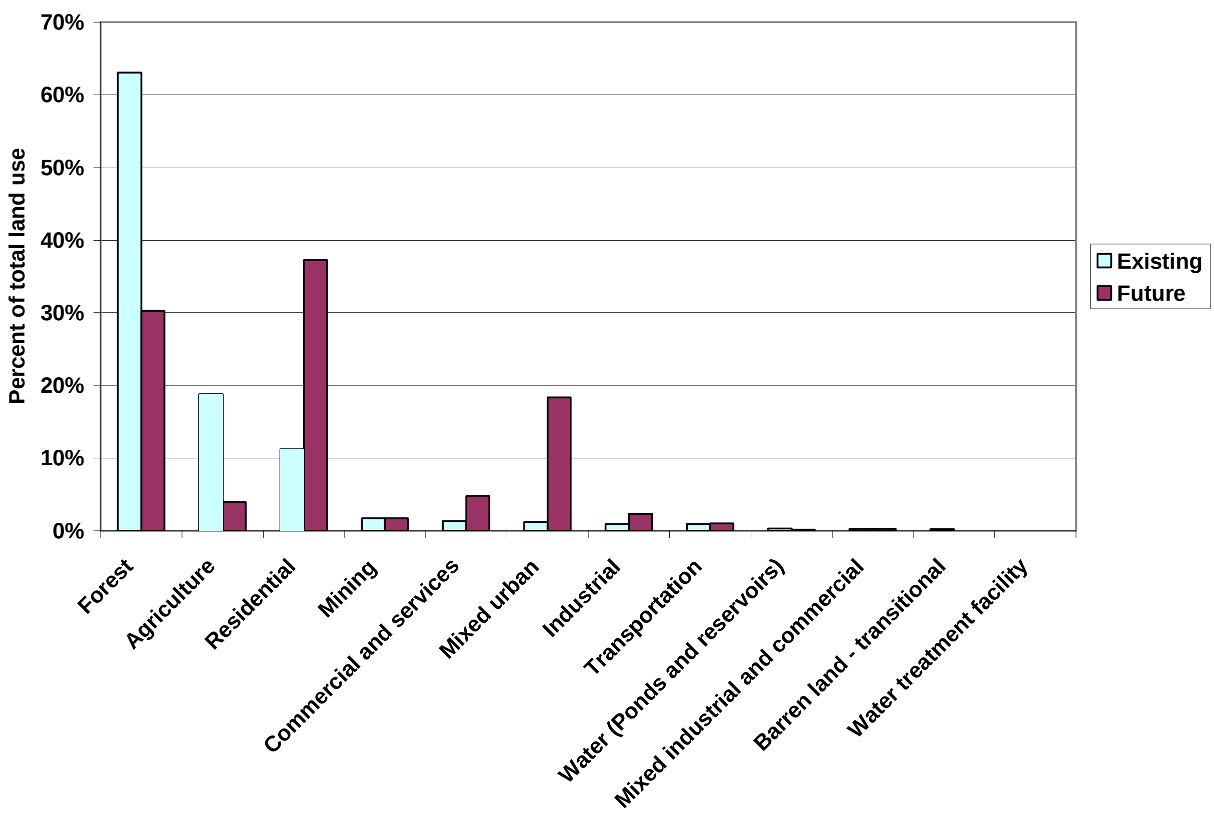
3.3.2 Future threats to biological health

Future threats to the biological health of Wolf Creek also exist. First, the Wolf Creek watershed is located in the heart of one of the most popular tourist destinations in West Virginia. The New and Gauley Rivers and the surrounding area draw thousands of whitewater enthusiasts, rock climbers, and other tourists each year. Figure 5 highlights projected changes in land use, as calculated in a recent storm water management plan (Parsons Brinckerhoff, 2004).

Major changes predicted for the watershed include dramatic decreases in farmland and agriculture, and dramatic increases in residential and mixed urban land uses. Biological impairment could result from these land use changes due to increased storm water runoff, increased flooding, wetland impacts, increased sediment, and stream channel alterations due to increased storm water volumes and increased flooding.

In addition, the West Virginia Division of Highways will soon install an interchange in Oak Hill to separate US 19 and Lochgelly Road (Fayette County Route 21/18) and WV 16 (East Main Street) (Kimley-Horn, 2005b). This project is expected to remove 4.23 acres of wetlands and impact 2,474 linear feet (0.38 acres) of perennial stream and 590 linear feet (0.041 acres) of intermittent stream (Kimley-Horn, 2005b). This interchange will likely increase the amount of storm water runoff and pollution entering Wolf Creek. And with fewer acres of wetlands, AMD treatment will be reduced.

Figure 5: Projected future land use for the Wolf Creek watershed



Source: Parsons Brinckerhoff (2004). The current and build out scenarios are shown.

4. NONPOINT SOURCE MANAGEMENT MEASURES

4.1 Acid mine drainage

This section describes the various measures that may be used to control AMD. Numbers in parentheses following the name of the method indicate the potential load reductions when the method is used correctly and in the proper situation.

4.1.1 Land reclamation

- **Removing acid-forming material (95%).** This method has the potential to eliminate the acid load completely if all of the acid-forming material can be removed.
- **Isolating acid-forming material from flowpaths (50%).** See the next two items. It is difficult to estimate the efficacy of these measures exactly. On the one hand, some AMD is often visible seeping from the edges of reclaimed areas. On the other hand, a measurement of AMD loads frequently shows such seeps are small compared to loads from nearby mine openings.
- **Sealing from above.** Infiltration of water into acid-forming material can be slowed by covering the material with low-permeability material, such as clay, and covering that layer with a vegetated layer to stabilize it. Effective reclamation and revegetation can eliminate a large proportion of the AMD from a given site.
- **Isolating from below.** Interactions between water and acid-forming materials can be further minimized by separating the waste material from impermeable bedrock below with conductive materials. Water may then flow beneath the spoil and be conducted away from it rapidly, so the water table does not rise into the spoil.
- **Surface water management.** Rock-lined ditches or grouted channels can be used to convey surface water off site before it can percolate into acid-forming material. Limestone is often used in such channels to neutralize acidity, as with oxic limestone channels (OLCs), discussed below.

4.1.2 Passive acid mine drainage treatment

- **Reducing and Alkalinity Producing Systems (25 g acidity/m^2).** In these systems, also known as “successive alkalinity producing systems” and “vertical flow ponds,” water encounters two or more treatment cells in series. First, water passes through organic material to deplete dissolved oxygen. Several helpful reactions take place in the anoxic environment. First, bacteria reduce sulfate in an alkalinity producing reaction. Second, ferric iron, which comes into contact with pyrite, should reoxidize the sulfur and turn to ferrous iron. In a second cell, the anoxic solution comes into contact with limestone. H^+ acidity is neutralized through contact with the limestone. Additional alkalinity dissolves into the water as well. Iron does not armor the limestone because it is the ferrous form. Water then runs through an aeration and settling pond, in which ferrous iron oxidizes and then precipitates out of solution as ferric hydroxide. The acidity released in this process is neutralized by the alkalinity that has accumulated in the solution.
- **Sulfate-reducing bioreactors (40 g acidity/m^2).** These systems also consist of organic matter and limestone, but in sulfate-reducing bioreactors, the materials are all mixed in a single cell. Some of the organic material included is of a coarser nature, such as sawdust or woodchips. Reactions in these systems are similar to those in Reducing and Alkalinity Producing Systems: compost eliminates oxygen, and drives the iron and sulfur to reduced forms. The coarser organic matter may serve to protect hydraulic conductivity and may retain metals as various organic complexes.
- **Manganese removal beds (to 2 mg/L).** Manganese may be removed from AMD either by active treatment (Section 4.1.3) or by manganese removal beds. In manganese removal beds, water is

passed over a wide limestone bed, and dissolved manganese oxidizes and precipitates from solution.

- **Oxic (or Open) limestone channels (30%).** Research to estimate the efficacy of OLCs is active. OLCs have the advantage that continually moving water may erode any armoring from limestone, and that water flow should remove precipitates from OLCs so that they do not interfere with acid neutralization. In practice, the efficacy of OLCs may suffer because they are too short, most limestone may be placed so as to react with water only at high flows, and fluctuating water levels enhance armoring. Recent research suggests that the acid neutralization that takes place in OLCs is actually greater than can be accounted for by limestone dissolution.
- **Limestone leachbeds (50%).** Limestone leachbeds are most effective when water has a pH of 3 or less, and when water retention times are short (~90 minutes). The low pH promotes rapid limestone dissolution, but the short retention time prevents armoring.
- **Steel slag leachbeds (addition of alkalinity).** Steel slag leachbeds are not exposed to AMD. Rather, circumneutral feed water passes through these leachbeds, and that water is then mixed with AMD to reduce its acidity drastically.
- **Compost wetlands (wide range).** Constructed wetlands can serve multiple functions in AMD treatment. Wide areas of exposure to the atmosphere allow metals in solution to oxidize. Slower waters allow precipitates to fall out of suspension. Anaerobic zones in sediments allow for sulfate reduction, which consumes acidity. Inclusion of limestone in the substrate provides an additional alkalinity source and helps maintain conditions that support sulfate reduction.
- **Grouting (50%).** Setting up grout walls or curtains in deep mines has great potential to solve AMD problems. Ideally, such barriers may serve to keep water from entering mines and interacting with acid-forming materials. They must be constructed carefully so as not to build water pressures near a weak point and to avoid blowouts. Also, fractures in bedrock always allow some water into mines, even if flows are eliminated. A grouting project at Winding Ridge, near Friendsville, MD, decreased acidity by 50% (MPPRP, 2000).

4.1.3 Active acid mine drainage treatment

- **Treating (100+%).** A variety of active treatment methods exist for AMD. One of a number of alkaline chemicals can be mixed with the polluted water. The mixture may then be aerated and is finally passed through ponds allowing metal hydroxides to settle out as sludge.

4.2 Fecal coliform

The Fayette County Commission has adopted the *Comprehensive Wastewater Management Plan for Fayette County* (LAI, 2005a). This plan was developed to address wastewater management issues and improve overall water quality. The control measures include:

- replacing onsite systems and repairing leach fields,
- installing community cluster systems,
- upgrading underground injection control permitted systems,
- upgrading and replacing package plants,
- improving the treatment and collection systems of municipal and public service district wastewater treatment facilities,
- extending lines for municipal and public service district systems, and
- installing controls for sanitary sewer overflows and combined sewer overflows (LAI, 2005b).

Some or all of these control measures may be used in Wolf Creek. Control measures used will depend on the needs of watershed communities and residents as the plan is implemented.

The Fayette County Commission has also adopted the *Wolf Creek Watershed: Stormwater Management & Flood Hazard Mitigation Plan* (Parsons Brinkerhoff, 2004). Implementation of this plan should reduce the amount of fecal coliform bacteria entering Wolf Creek from storm water runoff.

Some bacteria problems may be caused by agriculture, and a number of best management practices can be used to reduce these bacteria discharges. An assessment of agricultural pollution sources and nonpoint source management measures will be completed after the 2007 TMDL, as described in Section 7.2.

4.3 Biological impairment

The pollution sources listed in Section 3.3.1 are likely causes of biological impairment in the Wolf Creek watershed. However, before choosing specific nonpoint source management measures, WVDEP will perform a stressor identification process to determine the cause(s) of impairment. Data collected prior to TMDL development is used to establish a link between biological impairments and the possible source(s) of pollution. In past TMDLs, WVDEP has used the following list of candidate causes to help guide the stressor identification process:

- "Metals contamination (including metals contributed through soil erosion) causes toxicity.
- Acidity (low pH) causes toxicity.
- High sulfates and increased ionic strength cause toxicity.
- Increased total suspended solids…/erosion and altered hydrology cause sedimentation and other habitat alterations.
- Altered hydrology causes higher water temperature, resulting in direct impacts.
- Altered hydrology, nutrient enrichment, and increased biochemical oxygen demand...cause reduced dissolved oxygen…
- Algal growth causes food supply shift.
- High levels of ammonia cause toxicity (including increased toxicity due to algal growth).
- Chemical spills cause toxicity." (WVDEP, 2005b)

Once the stressors have been identified, they will be linked back to specific sources. Nonpoint source management measures will then be chosen to ensure that water quality standards are met.

As explained in Section 3.3.2, future threats to the biological integrity of Wolf Creek also exist. If it is discovered that other pollution sources or future development is impairing Wolf Creek, this plan will be updated to address those sources.

The *Wolf Creek Watershed: Stormwater Management & Flood Hazard Mitigation Plan* will serve as one tool for reducing storm water's biological impacts in the Wolf Creek watershed (Parsons Brinkerhoff, 2004). Reclamation methods outlined in this plan, and others, could be used to address the known and expected future sources of biological impairment. Reclamation options include:

- reclamation of the Summerlee site,
- adoption of storm water and wastewater management ordinances by the Fayette County Commission,
- issuance and enforcement of storm water permits,
- stream bank stabilization,
- trash clean-ups,
- installation of storm water best management practices,
- promoting the use of low impact development for future growth,
- educating the public and contractors about the benefits of proper storm water management and low impact development,

- working with local land and business owners to encourage good housekeeping on their properties, and
- restoring wetlands.

5. LOAD REDUCTIONS AND COSTS

Since the TMDL will not be completed for the Wolf Creek watershed until 2007, load reduction goals are unknown at this time.

5.1 Acid mine drainage

The only confirmed source of AMD in the Wolf Creek watershed is the Summerlee Refuse Pile; therefore, this site is the focus of the AMD section of this plan. As shown in Table 8, WVDEP measured loads from the site eleven times from 1996 through 2002. On average, the Summerlee site discharges more than 18 thousand pounds per year (lb/year) of aluminum, 43 thousand lb/year of iron, and 4 thousand lb/year of manganese.

Table 7: Loads from the Summerlee site

	Loads (lb/year)		
Date	**Aluminum**	**Iron**	**Manganese**
5/13/1996	24,475	69,669	7,388
6/5/1996	51,635	126,393	14,153
7/9/1996	7,802	30,165	2,898
8/8/1996	6,038	22,837	2,677
9/4/1996	2,471	8,634	1,047
10/1/1996	2,932	9,186	1,073
1/6/1997	8,312	26,140	3,326
5/1/1997	22,318	61,760	5,572
3/15/2001	6,173	1,591	1,178
9/27/2001	174	123	47
6/21/2002	74,274	124,473	9,725
Average	**18,782**	**43,725**	**4,462**

Source: WVDEP (2005c). Loads are averages of sums of loads measured at sites SRP-500 and SRP-600. Water from these two sites combine and then run off the site.

At the Summerlee site, WVDEP reclaimed 63 acres, extinguished surface burning, removed waste, and eliminated dangerous impoundments. The site still discharges large loads of AMD. The AMD treatment consultant WOPEC has proposed a five-phase plan for addressing these loads (Hilton, 2005). Building treatment in phases allows the performance of earlier phases to be evaluated before later phases are finalized. The plan includes the following steps:

1. Modification of channels through which AMD in the site drains to promote oxygenation of the water and oxidation of dissolved iron, mostly in the ferrous form,
2. Construction of a leachbed or sulfate reducing bioreactor to neutralize particular AMD seeps on the site,
3. Modification of an existing wetland to increase its ability to retain metals and add alkalinity,
4. Development of a source of unacidified water to dilute the AMD and promote the generation of additional alkalinity in wetlands and in a bioreactor, and
5. Implementation of additional plans based on observations of the performance of earlier phases (Hilton, 2005).

The design for Phase 1, currently in review by WVDEP, has been modified. Because much of the area is underlain by the refuse pile, less area than previously expected is available for increasing the length of OLCs. The water will instead be passed through large limestone leachbeds. It is expected that after picking up alkalinity in the leachbeds, a large proportion of metals will drop out of solution in existing open channels downstream from the leachbeds. At this time, it is not possible to calculate exact load reductions. The cost of Phase 1 is estimated at $250 thousand (Wood, 2006).

The evaluation period following construction of Phase 1 is expected to last at least two years. It is not possible to estimate the fraction of the pollution load that Phase 1 will eliminate (Wood, 2006). Following evaluation of Phase 1, it will be possible to predict load reductions from Phases 2 and 3 more precisely.

5.2 Fecal coliform

Until WVDEP completes the Wolf Creek watershed TMDL, projected load reductions and costs cannot be determined for fecal coliform bacteria sources. In addition, limited information regarding the exact number of homes hooked up to inadequate wastewater treatment systems makes predicting loads and associated costs from individual sources difficult. The *Comprehensive Wastewater Management Plan for Fayette County* does, however, outline general goals and estimated costs for wastewater management improvement for Fayette County (LAI, 2005b). As this plan is implemented and more accurate load reduction costs become available, this Watershed Based Plan can be updated to include this information.

5.3 Biological impairment

Until WVDEP completes the Wolf Creek watershed TMDL, projected load reductions and costs cannot be determined. At this time, limited data make it impossible to determine to what extent each suspected pollution source is impairing the biological integrity of Wolf Creek.

6. TECHNICAL AND FINANCIAL ASSISTANCE

A combination of federal and state agencies, academic institutions, watershed organizations, consultants, and citizens will be involved in providing technical and financial assistance for Wolf Creek watershed projects.

Detailed technical and financial resources are provided for AMD and fecal coliform bacteria pollution. Before the same level of detail can be provided for biological impairments, further research is needed to more accurately identify the scope of the problems and the specific nonpoint sources of pollution. As a starting point, a limited list of possible technical and financial assistance providers is outlined in Section 6.3.

6.1 Acid mine drainage

6.1.1 Technical assistance

Technical assistance is needed for the following tasks related to AMD:

- collecting data at AMD sources in preparation for the design of remediation projects;
- creating conceptual designs of remediation projects;
- creating detailed engineering designs of remediation projects;
- performing project management, including putting projects out for bid, managing projects, tracking their progress, and providing ongoing project operation and maintenance; and
- monitoring instream and source water quality following the installation of remediation projects to document their effectiveness.

6.1.1.1 Plateau Action Network

PAN’s mission is to work within the community to promote responsible economic development and sustainable environmental management. PAN will locate and apply for funding, partner with agencies to implement AMD reclamation projects, collect data to determine the effectiveness of reclamation projects, monitor impaired streams, assist with ongoing project operation and maintenance plans, and inform the local community and watershed stakeholders about reclamation efforts and water quality achievements.

6.1.1.2 West Virginia Department of Environmental Protection

Two WVDEP divisions will provide technical assistance. The Division of Water and Waste Management provides technical assistance for the use of best management practices, educates the public and land users on nonpoint source issues, enforces water quality laws that affect nonpoint sources, and restores impaired watersheds through its Nonpoint Source Program (WVDEP, 2006d).

WVDEP’s Office of Abandoned Mine Lands and Reclamation (OAMLR) directs technical resources to watersheds to address AMLs. Within OAMLR, the Stream Restoration Group (SRG) conducts extensive source monitoring of AMLs—as well as instream monitoring—before remediation systems are designed.

6.1.1.3 Office of Surface Mining, Reclamation and Enforcement

In the past, the Office of Surface Mining, Reclamation and Enforcement (OSM) has provided assistance with Watershed Cooperative Agreement Program grants and helped place summer interns and AmeriCorps*Volunteers In Service To America (VISTA) volunteers with PAN to assist with AMD-related projects. It is expected that OSM will play a similar role in the future in the Wolf Creek watershed.

6.1.1.4 Working on People's Environmental Concerns

WOPEC, a consulting company based in Lewisburg, West Virginia, is respected for its expertise in AMD treatment. Under contract with WVDEP, WOPEC has developed the conceptual designs for the Summerlee reclamation project. WOPEC may continue to provide assistance as the reclamation project proceeds.

6.1.1.5 Research Environmental & Industrial Consultants, Inc.

Research Environmental & Industrial Consultants, Inc. (REIC Labs), an environmental consulting, monitoring and testing company from Beaver, West Virginia, has assisted with preconstruction sampling and water quality testing for the Summerlee AML project. This monitoring is being funded by the Wolf Creek Environmental Trust. PAN expects to send all water samples collected at the Summerlee site to REIC Labs throughout the completion of this project.

6.1.2 Funding sources

Many funding sources are available for nonpoint source AMD remediation on AMLs and for water quality monitoring, including:

- Section 319 funds,
- the AML Trust Fund,
- the 10% AMD Set-Aside Fund,
- Watershed Cooperative Agreement Program grants,
- Wolf Creek Environmental Trust,
- mitigation fees,
- United States Army Corps of Engineers (USACE) Section 206 funds,
- NRCS Public Law 566 funds,
- Stream Partners Program grants, and
- local government contributions.

These funding sources are described in turn below.

6.1.2.1 Section 319 funds

Clean Water Act Section 319 funds may be provided by USEPA to WVDEP to be used for reclamation of nonpoint source AMD sources. This Watershed Based Plan is being developed so that these funds can be allocated to the Wolf Creek watershed. WVDEP's Nonpoint Source Program sets priorities and administers the state Section 319 program (WVDEP, 2006d).

6.1.2.2 The Abandoned Mine Land Trust Fund

Before 1977, when the Surface Mining Control and Reclamation Act was enacted, coal mines generally did not manage acid-producing material to prevent AMD or treat the AMD that was produced. These "pre-law" mines continue to be significant AMD sources and are treated as nonpoint sources under the Clean Water Act.

To reclaim these AMLs, the Act established the AML Trust Fund. This fund, supported by a per-ton tax on mined coal, has been allocated to coal mining states for remediation projects, according to a formula that takes states' current coal production into account. Authorization for this tax expired and has been temporarily extended, and if a permanent reauthorization is not secured, this very important source of funding for AMD remediation may be lost.[1]

For many reasons, the AML Trust Fund has failed to address AMD at a rapid pace:

- The priorities for disbursed monies place health and safety hazards ahead of water quality issues.
- Even though OSM allows states to assign water quality problems a priority equal to that of potential health and safety problems, WVDEP has been slow to change its priorities accordingly.
- Only part of the AML Trust Fund's income is disbursed each year, so that less money is available for remediation than the legislation initially envisioned.
- Some of the money that is disbursed from interest generated by the fund pays for health benefits for former miners.
- At least half of the AML fees collected in each state are allocated back to the state of origin, and are not available for AML reclamation in other states; therefore, much of the AML monies are earmarked for states with few AML problems.
- Some of the money allocated to West Virginia from the AML Trust Fund is used for water-line extensions, because deep mines are responsible for the failure of a number of private wells.
- Funds that are sent back to West Virginia are spent on agency staff salaries in addition to on-the-ground remediation.

Still, WVDEP has funded many AMD remediation projects on AMLs. But these projects are typically not designed to meet stringent water quality goals. The agency typically uses a small number of cost-effective techniques, such as OLCs, and chooses the layout for these measures based on how much land is available (for example, the distance between a mine portal and the boundary of properties for which the agency has right-of-entry agreements).

Unless significantly more money were allocated to West Virginia's AML program and these augmented funds were spent on water quality problems, the AML Trust Fund is not likely to be adequate to solve the AMD problems at the Summerlee site. And if the fund is not reauthorized, this important source of funding may disappear completely. OAMLR administers West Virginia's use of AML Trust Fund grants.

6.1.2.3 10% AMD Set-Aside Fund

The 10% AMD Set-Aside Program allows states to reserve up to 10% of their annual AML Trust Fund allocations as an endowment for use on water quality projects. These funds are critically important, because while regular AML Trust Fund allocations can only be spent on capital costs, 10% AMD Set-Aside Fund allocations can be spent on operations and maintenance.

As of March 14, 2005, $14.7 million remains in the West Virginia Set-Aside Fund (Darnell, 2005). The agency typically only spends the interest; therefore, the amount available for AMD projects varies with interest rates. In fiscal year 2001 the fund had the highest amount of interest available: $760 thousand. As of fiscal year 2003 the interest available has fallen to $211 thousand, and in subsequent years interest has fallen even further (Darnell, 2005). Long term commitments have been made to fund operations and maintenance on many AML projects across the state. If WVDEP continues to add money to this fund and if interest rates increase, funds may be available for operations and maintenance at the Summerlee site.

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[1] Reauthorization of the AML Trust Fund, which expired on September 30, 2004, is still not settled. At the time that this Plan is being written, the fund has been temporarily reauthorized through September 2007 under law H.R. 4939, the Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006. An OSM rule published in September 2004 also reauthorizes a much smaller per-ton tax. It is still not clear what shape a final reauthorization might take.

6.1.2.4 Watershed Cooperative Agreement Program
Grants specifically for AMD remediation projects on AMLs are available through OSM's Watershed Cooperative Agreement Program. This program is part of the Appalachian Clean Streams Initiative. Grants of up to $100 thousand are awarded to not-for-profit organizations that have developed cooperative agreements with other entities to reclaim AML sites. (OSM, 2006b). A match is required to receive these grants and is typically met with money from the AML Trust Fund and/or the 319 program.

6.1.2.5 Wolf Creek Environmental Trust
PAN's intervention in an ongoing AMD environmental suit resulted in a $375 thousand settlement. PAN and WVDEP then established a public/private environmental trust fund, only the second in state history. Since then, PAN has worked with OSM, OAMLR, and others to design and implement an AMD treatment system at the Summerlee site. The fund principle as of June 2006 reached $425 thousand (Ehrnschwender, 2006). While the primary purpose of the trust is to address the ongoing costs associated with reclaiming the Summerlee site, the money may also be used to address additional water quality and/or recreational projects at or near Wolf Creek, even if outside the watershed boundary (Wolf Creek Environmental Trust, 2002).

6.1.2.6 Mitigation fees
The West Virginia Division of Highways will soon be installing an interchange in Oak Hill to separate US 19 and Lochgelly Road and WV 16 (Kimley-Horn, 2005b). Construction will result in the removal of wetlands and impact perennial and intermittent stream channels in the Wolf Creek watershed. In order to receive its Section 404 permit, the agency is required to pay mitigation fees to compensate for impacts on waters of the state. The total fees generated by this project amount to $456,400 (Bennett, 2006). Final decisions on how and where the money will be spent will be determined by the project Mitigation Review Team (Bennett, 2006). These funds might be available to help implement nonpoint source measures identified in this plan.

6.1.2.7 United States Army Corps of Engineers Section 206 funds
USACE has funded an AMD ecosystem restoration study in the lower Cheat River watershed in northern West Virginia (USACE, 1997) and is planning to fund remediation work in one of the tributaries. The success of this project will help determine whether or not similar funds could be pursued for future AML reclamation projects in the Wolf Creek watershed.

6.1.2.8 Natural Resources Conservation Service Public Law 566 funds
Although they have not been active in AMD remediation in the Wolf Creek, NRCS is funding AMD remediation in the Deckers Creek watershed in West Virginia though a Public Law-566 watershed restoration project. NRCS engineers have experience developing conceptual designs and detailed engineering designs for AMD remediation projects.

6.1.2.9 Stream Partners Program
This program offers grants of up to $5 thousand to watershed organizations in West Virginia. Grants can be used for range of projects including small watershed assessments and water quality monitoring, public education, stream restoration, and organizational development. This grant has regularly provided funding for PAN projects in the past. Stream Partners grants will be pursued in the future to compliment nonpoint source research, education, and reclamation projects in the watershed.

6.1.2.10 Local governments

Fayette County will likely provide in-kind support for all Wolf Creek projects, and will likely take ownership of any property in the watershed that may be acquired by PAN in the future.

6.2 Fecal coliform

6.2.1 Technical assistance

Technical assistance is needed for the following tasks related to fecal coliform bacteria:

- collecting data at bacteria sources in preparation for the design and implementation of remediation projects;
- creating conceptual designs of remediation projects;
- creating detailed engineering designs of remediation projects;
- performing project management, including putting projects out for bid, managing projects, and tracking their progress,
- monitoring instream and source water quality following the installation of remediation projects to document their effectiveness, and
- managing decentralized onsite systems after installation.

As shown in Table 9, many people and organizations are represented in the Wastewater Management Plan Project Advisory Committee. This Committee developed the *Comprehensive Wastewater Management Plan for Fayette County*. It is expected that these people and organizations will be available for technical assistance for bacteria reclamation projects in the Wolf Creek watershed, whether or not these projects are specifically outlined in the management plan.

Table 8: Wastewater Management Plan Project Advisory Committee

Member	Organization
Dave Pollard	Fayette County
Al Gannon	Public Service Districts
Elbert Morton	WVDEP
Ken Toney	Fayette County Transition Team
Doug Proctor	West Virginia Professional River Outfitters
Mark Ehrnschwender	Fayette County Water Quality Coalition
Randy Boyd	PAN
Jesse Purvis	National Park Service
Pio Lombardo	Lombardo Associates
Edward Shutt	Stafford Consultants
General public members	

Source: LAI (2006).

6.2.2 Funding sources

Several funding sources are available for nonpoint source fecal coliform remediation and for water quality monitoring, including:

- National Park Service,
- Wolf Creek Environmental Trust,
- Section 319 funds,
- local governments, and
- additional sources.

6.2.2.1 National Park Service

The National Park Service will continue to fund instream bacteria monitoring to determine water quality changes resulting from the implementation of the Wastewater Management Plan and this Watershed Based Plan.

6.2.2.2 Wolf Creek Environmental Trust

While the Wolf Creek Environmental Trust was implemented primarily to address the ongoing costs associated with reclaiming the Summerlee site, the money may also be used to address additional water quality and recreational projects at or near Wolf Creek (Wolf Creek Environmental Trust, 2002). Money from the Trust may be available for projects addressing fecal coliform bacteria impairment.

6.2.2.3 Section 319 funds

Clean Water Act Section 319 funds may be available for reclamation of nonpoint sources of fecal coliform bacteria. This Watershed Based Plan is being developed so that these funds can be allocated to the Wolf Creek watershed. WVDEP's Nonpoint Source Program will determine whether or not funds will be allocated to Wolf Creek for projects addressing fecal coliform bacteria pollution (WVDEP, 2006d).

6.2.2.4 Local governments

Fayette County government will provide in-kind support for water improvement projects occurring in the watershed. The County government is supportive of and has adopted the *Comprehensive Wastewater Management Plan for Fayette County* (LAI, 2005a). The County is also likely to support and enforce ordinances related to wastewater management.

6.2.2.5 Additional sources

As the *Comprehensive Wastewater Management Plan for Fayette County* is being implemented, a number of funding source may be pursued to install and repair onsite and centralized wastewater treatment systems including:

- State Revolving Loan funds,
- Housing and Urban Development Small Cities Block Grants,
- Appalachian Regional Commission funds,
- special appropriations from the United States Congress,
- United States Department of Agriculture Rural Utility Service funds,
- funds from a private purveyor of wastewater treatment services interested in an operations and maintenance contract on the system, and
- a local bond issue using tax increment financing or industrial development bonds (LAI, 2005a).

6.3 Biological impairment

Until the exact causes of biological impairment are determined, an exhaustive list of potential technical and financial assistance providers cannot be completed. This section includes a list of a few technical assistance providers and funding sources already playing a role in the watershed, and which are potentially suitable for addressing biological impairment pollution sources in the future.

6.3.1 Parsons Brinckerhoff

Parsons Brinkerhoff has been one of the key players in developing the *Wolf Creek Watershed: Stormwater Management & Flood Hazard Mitigation Plan* (Parsons Brinckerhoff, 2004). As this plan is implemented, Parsons may be available for additional technical assistance for projects designed to improve the biological integrity of Wolf Creek. They have also been involved with the development of Wolf Creek Park, a low impact development designed to reduce storm water runoff onsite.

6.3.2 Wolf Creek Environmental Trust

The Wolf Creek Environmental Trust funds water quality and recreational projects at or near Wolf Creek (Wolf Creek Environmental Trust, 2002). Therefore, this money may be available for projects addressing biological impairment pollution sources.

6.3.3 Local governments

Fayette County government will provide in-kind support for water improvement projects occurring in the watershed. The County is also likely to support and enforce ordinances related to storm water management that have the potential for reducing biological impairment in Wolf Creek.

6.3.4 Private developers

As the Wolf Creek watershed develops, private developers will play a key role in determining the biological impacts that will result from their actions. Partnerships with developers will likely be important for maintaining and improving the biological health of the creek.

6.3.5 St. Peter & Paul Elementary

In the near future, PAN will train students in the science classes at St. Peter & Paul Elementary to collect instream water quality samples in Wolf Creek to document ongoing water quality changes related to the Wolf Creek Park project. Wolf Creek Park is an innovative residential and business development designed to reduce storm water runoff impacts from development.

7. IMPLEMENTATION SCHEDULE, MILESTONES AND MEASURABLE GOALS

7.1 Acid mine drainage

7.1.1 Remediate the Summerlee site

Implementation of this plan will require installation of a treatment system at the Summerlee site. This process is currently underway with the design for Phase 1 awaiting approval. Phase 1 construction is expected in 2007. Upon completion of Phase 1, water quality will be evaluated for at least two years to determine the best steps for completing Phases 2 and 3. Phase 2 construction is expected in 2010 at the earliest. It is not possible at this time to predict a timeline for the completion of the remaining phases.

7.1.2 Confirm whether acid mine drainage is released from the Fayette Station (NPS) Slide and Lochgelly (Fredericks) Impoundment sites

PAN, WVDEP, and other partners will confirm whether the two sites with possible AMD—the Fayette Station (NPS) Slide and Lochgelly (Fredericks) Impoundment sites—do, in fact, discharge AMD. The investigation will begin in 2006, through discussions among PAN, WVDEP, and other experts. If there is any uncertainty whether these sites discharge AMD, a monitoring program will be instituted with the goal of confirming whether AMD is discharging by the end of 2007. If AMD is detected, this plan will be updated so that Section 319 funds can be secured to remediate the sites by 2010.

7.1.3 Conduct monitoring to evaluate progress

After installation, monitoring at the Summerlee site and in the receiving stream will be conducted to track improvements over time. Monthly monitoring of AMD-related parameters will be done at the immediate receiving stream (Unnamed tributary to Wolf Creek, RM 8.7) and in Wolf Creek from the headwaters to the mouth, at appropriate intervals. Monitoring will continue until monthly data for an entire year shows that water quality standards are being met for all AMD-related parameters. Because a schedule for all phases of the Summerlee project cannot be predicted at this time, it is not known when monitoring will show that standards are met.

Substantial improvement, however, should be found by 2010. If standards are not met by this time, this plan will be revised based on new information so that all necessary remediation work is accomplished so that Wolf Creek and its AMD-impaired tributaries eventually meet water quality standards.

7.2 Fecal coliform

WVDEP will release the Wolf Creek fecal coliform TMDL in 2007. Milestones and measurable goals for the implementation of the fecal coliform TMDL cannot be laid out with certainty at this time.

The approved *Comprehensive Wastewater Management Plan for Fayette County* may serve as a starting point for setting milestones and measurable goals for fecal coliform pollution from wastewater. A detailed assessment of agricultural pollution sources and nonpoint source management measures will also be conducted to develop milestones and measurable goals for fecal coliform pollution from agriculture. As the wastewater plan is implemented and as the agricultural assessment is written and implemented, this Watershed Based Plan should be updated to reflect any specific goals laid out for Wolf Creek.

7.3 Biological impairment

As discussed in Section 4.3, WVDEP will perform a stressor identification process to determine the cause(s) of biological impairments before releasing biological TMDL in 2007. The results of the stressor identification process and the TMDL will be crucial for establishing an implementation schedule, milestones, and measurable goals.

The milestones that can be listed at this time include:

- perform stressor identification by early 2007, and
- release final biological TMDL by the end of 2007.

Milestones and measurable goals for the implementation of the TMDL cannot be laid out with certainty at this time.

8. MONITORING

Instream monitoring is important to gage the recovery of streams after remediation projects are installed, and is also crucial to support partners as they engage in periodic strategic planning of reclamation priorities.

8.1 Quality Assurance Project Plans

Quality Assurance Project Plans name objectives for sampling and outline procedures for documenting that the quality of the observations are sufficient to answer the appropriate questions. Monitoring associated with this Watershed Based Plan will have the following objectives:

- To determine pollutant loads to design remediation projects at AMLs,
- To verify that loads of nonpoint source pollutants have been reduced following implementation of the measures outlined in this plan, and
- To verify that streams are no longer impaired by nonpoint source pollutants.

The most intractable sources of variation are likely to be changes over time. The most important quality assurance measure will be to sample many times throughout a range of hydrologic conditions. Additional standard quality assurance methods such as analysis of duplicates, fields blanks, and samples with known concentrations will be included in Quality Assurance Project Plans as well.

8.2 Instream monitoring

Several agencies and organizations are now monitoring the Wolf Creek watershed, and will continue to do so in the future.

8.2.1 Watershed Assessment Program.

According to WVDEP's five-year watershed management framework cycle, the agency performs in-depth monitoring of the state's watersheds every five years. When the next round of monitoring takes place in Wolf Creek, this data will be helpful to show whether streams are improving or declining in quality. In addition to 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.

8.2.2 Plateau Action Network

PAN has been conducting semi-annual instream monitoring to document water quality changes in Wolf Creek and will continue to do so in the future. This monitoring is funded by the Wolf Creek Environmental Trust.

8.2.3 National Park Service

The National Park Service conducted tributary monitoring to determine baseline bacteria levels in Wolf Creek prior to the implementation of the *Comprehensive Wastewater Management Plan for Fayette County.* The National Park Service plans to continue this monitoring so long as funding exists.

8.2.4 St. Peter & Paul Elementary

Students at St. Peter & Paul Elementary will collect water quality samples in Wolf Creek to document ongoing water quality changes associated with Wolf Creek Park, an innovative development designed to reduce storm water impacts on Wolf Creek. Samples will be collected semi-annually.

8.2.5 Wolf Creek Advisory Committee

Over the next year, PAN will develop an advisory committee to help steer the work being completed in the watershed. Once formed, the committee will conduct quarterly monitoring throughout the watershed.

8.3 Source monitoring

8.3.1 Stream Restoration Group

SRG collects source data when WVDEP is designing a remediation project. It is anticipated that SRG will continue to play this valuable role in the future if other AMD sources are identified.

8.3.2 Working on People's Environmental Concerns

WOPEC has conducted source monitoring for the Summerlee site in the past, and if appropriate may perform additional monitoring in the future.

8.3.3 Plateau Action Network

PAN will assist with source monitoring related to the Summerlee AML project, internship projects, and other water quality improvement projects for the pollution sources outlined in this plan. Funding for this monitoring is provided by the Wolf Creek Environmental Trust.

8.3.4 West Virginia Division of Highways

If mitigation fees from the Loghelly Interchange project are spent in the Wolf Creek watershed, the Division of Highways will conduct post-construction instream monitoring to determine the impact of their water quality improvement projects.

9. OUTREACH AND EDUCATION

Most outreach and education for this Watershed Based Plan will be performed by PAN. The Wolf Creek Advisory Committee will also play a role.

9.1 Plateau Action Network

9.1.1 Organization

PAN has been performing outreach and education on water quality issues since its founding in 1997. PAN will continue with their outreach and education initiatives and will integrate information about nonpoint source remediation projects into these efforts.

9.1.2 Newsletters

PAN newsletters are distributed to about 300 members every quarter. Newsletters will continue to update readers about planned nonpoint source remediation projects and about remediation priorities.

9.1.3 Public education

PAN is actively involved in educating local students about the Wolf Creek watershed. Members of the organization participate in fourth grade environmental education classes at Fayetteville Elementary. PAN is also a site for Service Learning volunteers from Fayetteville High School. Through this program, students volunteer with PAN for a semester for one-and-a-half hours a day, five days a week. PAN is also looking into starting a geographic information system–based education program with Marshall University and Fayetteville Middle School.

9.1.4 Web site

PAN maintains a Web site, www.plateauactionnetwork.org, with information about projects and priorities.

9.2 West Virginia Department of Environmental Protection

Prior to initiating its regular five-year monitoring effort in 2009, WVDEP will hold a public meeting in the watershed to gather suggestions for monitoring locations. WVDEP will include information at this meeting on the status of plans for remediating nonpoint source pollution in the watershed.

9.3 Wolf Creek Advisory Committee

One of the main tasks of PAN's current VISTA is to develop the Wolf Creek Advisory Committee. Once developed, it is expected that this committee will support education and outreach efforts as well as publish a newsletter on a quarterly basis.

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