SECTION 3

3. WATER RESOURCES

Buffalo Creek is the largest tributary on the west side of the Allegheny River between French Creek and the Ohio River. Located within the Ohio River Basin (USGS Cataloging Unit 05), and considered to be a part of the Lower Allegheny River Subbasin (USGS Cataloging Unit 05010009), Buffalo Creek is unique among the major tributaries in this area in that it has maintained relatively good water quality through the rise and decline of industry in western Pennsylvania (Buffalo Creek is recognized in the Pennsylvania State Water Plan as follows: Ohio Basin, Subbasin 18 Allegheny River, Watershed F Buffalo Creek). It bears an additional distinction of being one of the only free-flowing major Allegheny tributaries

Buffalo Creek arises in Butler County north of the borough of Chicora. The mainstem extends 34.4 miles to the Allegheny River at Freeport. The 171 square mile watershed contains at least 341 miles of perennial and intermittent streams. These exhibit a dendritic drainage pattern. Dendritic systems evolve in areas containing homogenous bedrock layers with vast areas of equal weathering potential, thus leading to a directionally random pattern of tributaries. These typically resemble a tree and branch (or dendritic) pattern. The Buffalo Creek mainstem is a 5th order stream as defined by Strahler (1964).

Most of the precipitation in the watershed falls as rain in the spring and early summer months, however, there is no distinct dry period or significant water deficit incurred during the year. All months receive some precipitation as either rain or snow. The USGS maintains a gauging station on Buffalo Creek in Kepples, Butler County. Between 1941 and 2005, this station recorded an average daily discharge of 195 cubic feet per second (cfs) (Figure 3-1). The highest average daily discharge was 341 cfs in 2004, and the lowest was 121 cfs in 1999. The maximum discharge recorded during this period was 16,700 cfs on September 17, 2004. The lowest recorded discharge was 1,880 cfs on August 15, 1941 (Figure 3-2).

Figure 3-1
MEAN DISCHARGE

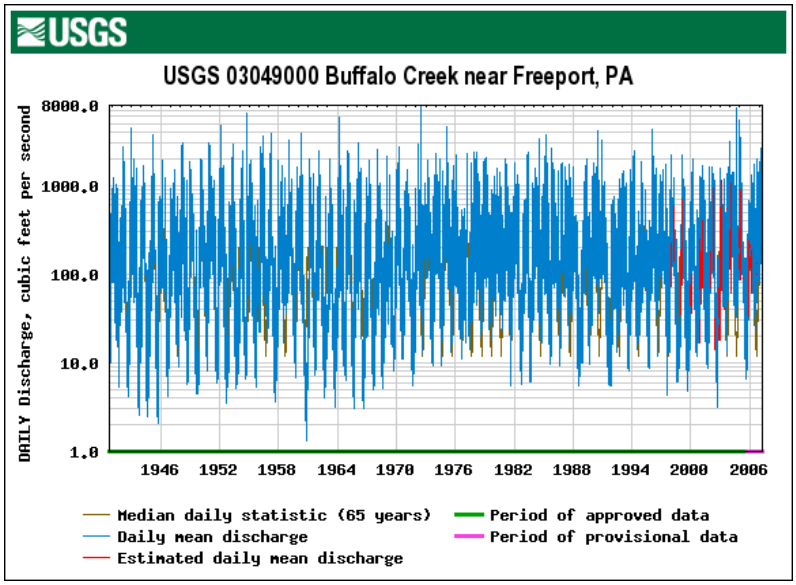
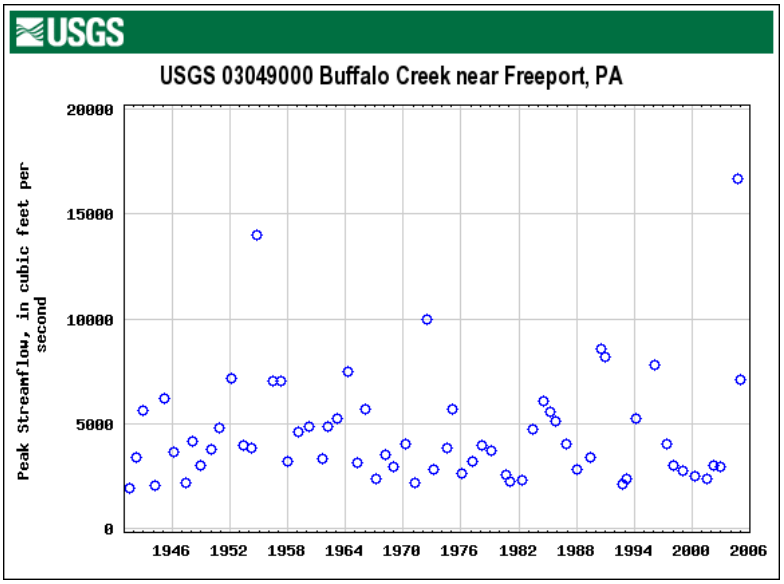


Figure 3-2
PEAK DISCHARGE



3.1 SUBWATERSHEDS

The Buffalo Creek Watershed is composed of a number of smaller subwatersheds. For descriptive and planning purposes, seven major subwatersheds have been identified as described in Table 3-1 and shown on Figure 3-3.

Table 3-1
SUBWATERSHEDS

Subwatershed	Drainage Area (Sq. Mi.)	Percent of Buffalo Creek Watershed	County
Upper Buffalo Creek	25.5	15	Armstrong, Butler
Central Buffalo Creek	35.8	21	Armstrong, Butler
Patterson Creek	21.8	12.7	Armstrong
Little Buffalo Run	14.5	9	Armstrong, Butler
Rough Run	18.0	10	Armstrong, Butler
Little Buffalo Creek	26.4	15	Butler
Lower Buffalo Creek	28.6	17	Armstrong, Butler

Source: GAI 2007.

The Upper Buffalo Creek subwatershed includes the Buffalo Creek headwaters as well as approximately 8.2 miles of the main stem. The main stem originates in the northwestern corner of the watershed near the drainage divide with Conoquenessing Creek. The topography in this subwatershed is rolling and typified by broad rounded hilltops. The main stem of Buffalo Creek is 8.2 miles long through this subwatershed and has an average slope of 35 feet per mile. The major tributary in this section is Buffalo Run, which is approximately 6.6 miles long. The Borough of Chicora is located in the upper portion of the watershed. This area was part of one of the worlds first oil-producing boom areas and the subbasin landscape was heavily affected

N

Chicora

1023

68

268

UPPER BUFFALO CREEK

PATTERSON CREEK

Fenelton

LITTLE BUFFALO RUN

422

CENTRAL BUFFALO CREEK

Worthington

BUTLER COUNTY

ARMSTRONG COUNTY

ROUGH RUN

LITTLE BUFFALO CREEK

BUFFALO CREEK

28

Saxonburg

228

LITTLE BUFFALO CREEK

LOWER BUFFALO CREEK

Sarver

228

356

28

Freeport

128

ALLEGHENY COUNTY

LEGEND

SUBWATERSHED BOUNDARY

MAJOR TOWNS

MAJOR STREAMS

MAJOR ROADS

0 10,000 20,000 Feet

FIGURE 3-3
STREAMS
BUFFALO CREEK WATERSHED

Audubon Society OF WESTERN PENNSYLVANIA

AUDUBON SOCIETY OF
WESTERN PENNSYLVANIA

gai consultants

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CHECKED: AJB APPROVED: GTR

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by this activity for several decades. Limited oil production still occurs, but coal (via strip mining), is now the major resource extraction industry.

The Patterson Creek subwatershed is located entirely in Armstrong County. Patterson Creek drains the extreme northeastern portion of the Buffalo Creek Watershed. The creek has a length of 7.6 miles, originating south of Frogtown in Sugarcreek Township and entering Buffalo Creek near Craigsville. Patterson Creek has an average slope of 47 feet per mile. Its major named tributary is Long Run. The watershed includes a mix of forest and farmland uses; there are no concentrated population centers. Extensive strip mining for coal has occurred in portions of the watershed.

The Little Buffalo Run subwatershed is located almost entirely within Butler County. The stream originates in rolling uplands in Clearfield Township and flows 6.0 miles north and east to join with Buffalo Creek near Fennelton. The average slope of Little Buffalo Run is 38 feet per mile. An unnamed tributary of 4.6 miles in length drains the northern portion of the watershed in Donegal Township. Much of the watershed is forested, with the village of Fennelton being the only concentrated population center. The area north of S.R. 0422 is within the oil field area and was heavily influenced by this industry in the late 19th century.

The Central Buffalo Creek subwatershed includes the mainstem and tributaries between the mouth of Little Buffalo Run and the mouth of Rough Run. Within this watershed the topography becomes more rugged, and varies from rolling uplands to the entrenched valley of the main stem of Buffalo Creek. Beginning at Blaine Bridge (a.k.a. Anthony's Bridge), the stream enters an increasingly deep gorge from which it does not emerge until the Allegheny River is reached. The main stem is 15.3 miles long through the subwatershed and has an average slope of 11.4 feet per mile. The major tributary in this section is Marrowbone Run, which is approximately 4.8 miles long. Population centers include the Borough of Worthington and the villages of Craigsville, and Shadyside Village. The southern limit of the subwatershed coincides with the southernmost exposure of the Vanport limestone along Buffalo Creek. North of this limit there are extensive outcroppings of limestone at stream level. Much of the watershed is forested, although the most intensive and extensive agricultural landscape in the basin occurs in the vicinity of Worthington. Extensive coal and limestone mining (both strip and deep mines) occur in the northern portion of the subwatershed.

The Rough Run subwatershed drains portions of Clearfield, Summit and Winfield Townships in Butler County and a small portion of North Buffalo Township in Armstrong County. Rough Run is 7.7 miles long and has an average slope of 55 feet per mile. Major named tributaries include the North Branch of Rough Run and Sarver Run. Topography in the drainage is highly variable, ranging from broad rolling uplands in the west to the deeply entrenched valley of Rough Run in the east. The uplands are generally devoted to agriculture and the valleys and slopes are forested. There are no population centers in the watershed. However, the now vanished village of West Winfield had a population of several thousand in the 1920s. Resource extraction activities at West Winfield began in 1847 with the Winfield iron furnace, and subsequently included limestone mining, cement production, a clay pipe refractory, and mushroom farming. The lower portions of the Rough Run valley bear ample evidence of these activities through the remains of abandoned industrial sites.

Little Buffalo Creek is the major Buffalo Creek tributary and is located entirely in Butler County. The creek has a length of 9.4 miles, originating south of Great Belt in Jefferson Township and entering Buffalo Creek at Winfield Junction. Little Buffalo Creek has an average slope of 54 feet per mile. Its major named tributary is Sarver Run. The topography of the

subwatershed is generally typified by broad rolling uplands. However, the valley of Little Buffalo Creek becomes increasingly entrenched as it proceeds southeastward. Downstream of Sandy Lick in Buffalo Township, the valley becomes a gorge, with slopes dropping precipitously for 200 feet from the level uplands to the narrow valley floor. The uplands are generally devoted to agriculture, but much of the Little Buffalo valley is forested. Major population and commercial centers include Saxonburg, Marwood, Cabot, and Sarver (including much of Buffalo Township). The S.R. 0028 and S.R. 0356 corridors through the watershed are presently experiencing rapid residential and commercial development. The Little Buffalo Creek valley historically was the location of the only railroad line connecting Butler to the Allegheny Valley. A number of early industries developed along this line including quarries, mines, and oil shipping terminals.

The Lower Buffalo Creek subwatershed extends from the mouth of Rough Run to the Allegheny River and includes 10.9 miles of the mainstem. Throughout this section Buffalo Creek is confined within a canyon that plunges up to 300 feet from the adjacent uplands. This is the section described by W.E. Clyde Todd as "…*a mere gorge, its bottom usually quite narrow, and the neighboring slopes steep and rugged, sometimes rising as precipitous sandstone cliffs, rendering the scenery along the creek among the most wild and picturesque in western Pennsylvania".* Major named tributaries include Pine Run, Cornplanter Run, and Sipes Run. Sandstone cliffs and outcroppings are common along the gorge slopes. Population centers in this section include Boggsville, Slate Lick, Shuster Heights, and Freeport. The S.R. 0028/ S.R. 0356 corridor is presently experiencing rapid residential development. The valleys of Buffalo Creek and its tributaries are largely forested, and substantial areas of adjacent upland are heavily forested as well.

3.2 WETLANDS

Wetlands are defined by the Commonwealth of Pennsylvania as, "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions...." (25 Pennsylvania Code Chapter 105). These include those communities commonly referred to as swamps and marshes. Wetlands are regulated by the PaDEP (under 25 Pennsylvania Code Chapter 105) and by the U.S. Army Corps of Engineers (under Section 404 of the Clean Water Act).

Due to topographic conditions, wetlands are not extensive within the Pittsburgh Plateaus Province. Within the Buffalo Creek Watershed natural wetlands are largely restricted to floodplains of streams and relatively level headwater areas. Wetland areas within the watershed were identified from the U.S. Fish and Wildlife Service's National Wetland Inventory (NWI) mapping. Table 3-2 summarizes wetland occurrence by subwatershed. It is important to note that NWI mapping is based on remote sensing technology, and thus typically underestimates wetland occurrence.

Larger wetland communities within the watershed include the Hickey Bottom wetlands in the Upper Buffalo watershed, the Fennelton wetlands in the Little Buffalo Run watershed, the Long Run wetlands in the Rough Run watershed, the Little Buffalo Creek headwaters wetlands in the Little Buffalo Creek watershed, and the Horigan wetlands in the Lower Buffalo Creek watershed. Forested and scrub-shrub wetland habitat is also commonly scattered throughout the Little Buffalo Run and Little Buffalo Creek valleys.

Table 3-2
WETLAND SUMMARY

Subwatershed	Wetland Acres				
	Palustrine Forested	Palustrine Scrub-Shrub	Palustrine Emergent	Palustrine Unconsol. Bottom	Total
Upper Buffalo Creek	-	1.2	9.4	28.1	38.7
Patterson Creek	-	5.7	1.5	19.3	26.5
Little Buffalo Run	-	4.2	4.4	20.7	29.3
Central Buffalo Creek	10.2	2.4	6.6	40.2	59.5
Rough Run	-	-	0.7	14.0	14.7
Little Buffalo Creek	-	5.5	0.6	54.0	60.1
Lower Buffalo Creek	1.0	-	-	17.3	18.3
Totals	11.2	19.1	23.2	193.6	247.1

Source: NWI mapping data 2007.

3.3 FLOODPLAINS

In western Pennsylvania, flooding is typically the result of abnormally high rainfall. However, rapid snow melts and ice dams also create problems in some areas. In the Buffalo Creek watershed, flood damage is typically related to the former rather than latter causes. Within the watershed, major storm events such as Hurricanes Agnes (1972) and Ivan (2004) have caused the most widespread damage. However, sudden thunderstorms as well as prolonged rain events over localized areas can have devastating effects on small watersheds as well, particularly in urban areas with extensive impervious surfaces and inadequate stormwater control.

According to the Federal Emergency Management Agency (FEMA), 10 million households in the United States are located in areas of significant flood risk. Nearly all floodplain areas are susceptible to flooding, even if there are no historically recorded floods. In Pennsylvania, of the approximately 40,000 miles of major and minor perennial streams, about 15,000 miles are considered to be flood prone areas (Shultz 1999).

Floodplains are mapped in communities participating in the National Flood Program. All of the communities within the Buffalo Creek Watershed participate in this program. These communities are required to map flood prone areas and to implement ordinances to minimize the potential for flood damage, including the restriction of development in floodplains. Figure 3-4 shows FEMA-mapped floodplains in the watershed. Flood prone area maps require periodic updating to address changing hydraulic conditions and development patterns. As shown in Table 3-3, the current flood maps for many municipalities in the watershed are 20 or more years old.

3.4 LAKES AND PONDS

There are no natural lakes in the Buffalo Creek watershed, with the exception of a small oxbow pond along Buffalo Creek between the towns of Worthington and Craigsville. In addition, there are no reservoirs or other man-made bodies of water of sufficient size to warrant the use of the term lake. As noted previously, Buffalo Creek is one of the few major Allegheny River tributaries that is not impounded by a flood control or water supply reservoir. A single small dam approximately 36 inches high located on Buffalo Creek at Shadyside Village, Armstrong

Table 3-3
FLOOD MAPPING STATUS

Municipality	National Flood Program Participant	Date of Most Recent Flood Map
Allegheny County		
Harrison Township	Yes	5/15/03
Armstrong County		
Bradys Bend Township	Yes	07/03/86
East Franklin Township	Yes	04/05/88
Freeport Borough	Yes	08/23/00
North Buffalo Township	Yes	11/01/86
South Buffalo Township	Yes	08/23/00
Sugarcreek Township	Yes	10/15/85
West Franklin Township	Yes	05/01/85
Worthington Borough	Yes	05/01/85
Butler County		
Buffalo Township	Yes	07/05/01
Chicora Borough	Yes	08/10/79
Clearfield Township	Yes	04/17/85
Clinton Township	Yes	12/11/81
Concord Township	Yes	05/01/85
Donegal Township	Yes	02/15/85
Fairview Township	Yes	09/11/86
Jefferson Township	Yes	02/15/85
Oakland Township	Yes	04/17/85
Saxonburg Borough	Yes	04/17/85
Summit Township	Yes	02/15/85
Winfield Township	Yes	05/01/86

Source: FEMA 2007.

County is currently the only water control structure on the creek. This dam provides a pool for withdrawal of water for Creekside Mushrooms. The effect of this dam or movement and dispersal of organisms in the creek is unknown.

Small farm ponds are numerous throughout the watershed. These have primarily been constructed to provide water for livestock or for recreational purposes. There are approximately 193.6 acres of palustrine unconsolidated bottom wetlands shown on NWI mapping for the watershed. The vast majority of these are farm ponds.

3.5 WATER QUALITY

Water quality in the Buffalo Creek watershed has historically been generally recognized to be better than most streams in the Lower Allegheny River drainage. In 1982, the *State Water Plan for Subbasin 18: Lower Allegheny River* noted that while water quality in the headwaters of Buffalo Creek was depressed by abandoned mine drainage, the remainder of the watershed had good to excellent water quality.

The PaDEP identifies use classifications for waters of the Commonwealth under 25 Pa. Code §93.1.

N

Chicora

Fenelton

Worthington

Saxonburg

Sarver

Freeport

1023

68

268

422

228

356

28

128

BUTLER COUNTY

ARMSTRONG COUNTY

LITTLE BUFFALO CREEK

BUFFALO CREEK

ALLEGHENY COUNTY

LEGEND

- BUFFALO CREEK WATERSHED BOUNDARY
- MAJOR TOWNS
- MAJOR STREAMS
- MAJOR ROADS
- 100- YEAR FLOODPLAIN

0 10,000 20,000 Feet

FIGURE 3-4
FLOODPLAINS
BUFFALO CREEK WATERSHED

Audubon Society OF WESTERN PENNSYLVANIA

gai consultants

DRAWN BY: AML
CHECKED: AJB

DATE: 07/10/2007
APPROVED: GTR

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Water quality standards have been developed for all surface waters of the state. These standards, which are designed to safeguard surface water quality, consist of both use designations and the criteria necessary to protect those uses. All waters are protected for a designated aquatic life use as well as a number of water supply and recreational uses. Use designations are identified according to aquatic life use codes. These include Warm Water Fishes (WWF), Trout Stocking (TSF), Cold Water Fishes (CWF), and Migratory Fishes (MF). In addition to these base designations, streams with excellent water quality may be designated as either High Quality Waters (HQ) or Exceptional Value Waters (EV). For permitting purposes, water quality in an HQ stream can be lowered only if a discharge is the result of necessary social or economic development, the water quality criteria are met, and all existing uses of the stream are protected. EV waters are to be protected at their existing quality; water quality cannot be lowered.

As shown in Table 3-4, most of the Buffalo Creek Watershed has been designated as High Quality waters. Only the portion of the watershed downstream of the mouth of Little Buffalo Creek does not carry an HQ designation.

Table 3-4
PaDEP WATER QUALITY DESIGNATIONS

Stream	Zone	County	Water Uses Protected	Exceptions to Specific Criteria
Buffalo Creek	Basin, Source to Little Buffalo Run	Butler	HQ-CWF	None
Buffalo Creek	Basin, Little Buffalo Run to Little Buffalo Creek	Butler	HQ-TSF	None
Buffalo Creek	Basin, Little Buffalo Creek to Mouth	Armstrong	TSF	None
Little Buffalo Creek	Basin	Butler	HQ-TSF	None

Notes:

HQ = High Quality Waters: streams or watersheds with excellent water quality containing environmental features requiring species protection.

CWF = Cold Water Fisheries: Aquatic conditions maintained to sustain cold water fish species (i.e. *Salmonidae* family) and their naturally associated flora and fauna.

TSF = Trout Stocking: Aquatic conditions sustain the maintenance and propagation of indigenous warm water fish and their associated flora and fauna in addition to maintaining suitable conditions for trout stocking from February 15 to July 31.

Source: Pennsylvania Code Chapter 93 Water Quality Standards.

The PaDEP has an ongoing program to assess water quality and identify those that are not attaining designated and existing uses as "impaired." Water quality standards are comprised of the uses (including antidegradation) that waters can support and goals established to protect those uses. Uses include, among other things, aquatic life, human health, and recreation, while the goals are numerical or narrative water quality criteria that express the in-stream levels of substances that must be achieved to support the uses. The PaDEP is currently using an integrated format for Clean Water Act Section 305(b) reporting and Section 303(d) listing. The 303(d) list includes the reason for impairment, which may be one or more point sources (like industrial or sewage discharges), or non-point sources (like abandoned mine lands or agricultural runoff).

As a result of listing, either the state or USEPA must develop a Total Maximum Daily Load (TMDL) for each listed waterbody. A TMDL identifies allowable pollutant loads from both point and non-point sources that will prevent violation of water quality standards. A TMDL also includes a margin of safety to ensure protection of the water.

The most recent 305(b) and 303(d) report is the 2006 Pennsylvania Integrated Water Quality Monitoring and Assessment Report (PaDEP 2006). In this report, water quality status is summarized using a five-part categorization of waters according to their use attainment status. These categories represent varying levels of attainment, ranging from Category 1, where all designated water uses are met, to Category 5, where impairment requires a TMDL to correct. Each waterbody segment is placed in one of these categories. Different segments of the same stream may appear if status changes downstream. The listing categories include:

- Category 1: Waters attaining all designated uses.
- Category 2: Waters where some, but not all, designated uses are met. Attainment status of the remaining designated uses is unknown because data are insufficient to categorize a water body consistent with the state's listing methodology.
- Category 3: Waters for which there are insufficient or no data and information to determine, consistent with the State's listing methodology, if designated uses are met.
- Category 4: Waters impaired for one or more designated use but not needing a TMDL.
- Category 5: Waters impaired for one or more designated uses by any pollutant. Category 5 constitutes the Section 303(d) list that EPA will approve or disapprove under the CWA. Where more than one pollutant is causing the impairment, the water remains in Category 5 until all pollutants are addressed in a completed/EPA-approved TMDL or a delisting factor is satisfied.

Within the Buffalo Creek watershed, there are no streams or stream segments listed in Category 1 (waters attaining all designated uses).

Category 2 listings (waters where some, but not all, designated uses are met) include:

- 3 miles of Buffalo Creek;
- 73 unnamed tributaries of Buffalo Creek totaling 78.7 miles;
- 4.5 miles of Buffalo Run and 8 unnamed tributaries totaling 8.0 miles;
- 1.5 miles of Cornplanter Run and 5 unnamed tributaries totaling 5.3 miles;
- 4.5 miles of Little Buffalo Creek and 8 unnamed tributaries totaling 10.8 miles;
- 1.9 miles of Little Buffalo Run and 24 unnamed tributaries totaling 20.8 miles;
- 1.9 miles of Long Run and 4 unnamed tributaries totaling 3.1 miles;

- 1.6 miles of Marrowbone Run and 2 unnamed tributaries totaling 1.0 mile;
- 0.5 mile of Patterson Creek and 24 unnamed tributaries totaling 33 miles;
- 2 unnamed tributaries to Pine Run totaling 1.2 miles;
- 1.5 miles of Rough Run and 18 unnamed tributaries totaling 16.3 miles;
- 5.9 miles of Sarver Run and 5 unnamed tributaries totaling 5.5 miles;
- 1.7 miles of Sipes Run and 0.8 mile of an unnamed tributary; and
- 1.2 miles of Yutes Run.

These streams are listed in Appendix C.

There are no streams or stream segments listed in Category 3 (waters for which there are insufficient or no data if designated uses are met).

One unnamed tributary to Buffalo Creek (UNT 42793 totaling 0.95 miles) is listed under Category 4b (alternative control measures are expected to adequately restore the impaired designated use against pollutants).

Several streams are listed as Category 4c (the stream impairment is not caused by a pollutant, but another factor). These include:

- 1.43 miles of an unnamed tributary to Buffalo Creek;
- 0.39 mile of Little Buffalo Creek and 7 unnamed tributaries totaling 5.85 miles;
- 0.86 mile of an unnamed tributary to Little Buffalo Run;
- 0.71 mile of an unnamed tributary to Pine Run; and
- 1.26 miles of 2 unnamed tributaries to Rough Run.

These streams are listed in Appendix C.

Eighty-three stream segments are listed as Category 5 (requiring a TMDL) as identified in Table 3-5. Predominant causes of degradation are siltation, nutrients, and metals. The primary sources listed for siltation and nutrients is agriculture, with abandoned mine drainage the source of metals contamination.

Based on these data, the entire watershed is degraded to some extent (i.e. there are no Category 1 streams in the watershed). The degradation of tributaries to varying degrees and by various causes may likely have a cumulative effect that may vary temporally and spatially within the mainstem. Unfortunately, there are no long-term chemical or biological monitoring data available to assess these effects over time. With the exception of PaDEP's Section 305 and 303 efforts, there are no comprehensive monitoring efforts in the watershed to examine water

quality and its effects. Thus, the overall effect of this degradation on the health of the aquatic ecosystem is not known. There is anectodal evidence to suggest that ecosystem degradation has continued to occur over the past several decades. Bier (personal communication 2008) notes that mussel populations have declined over this period, and that current population levels are indicative of degradation. Other aquatic and riparian species have noticeably declined during this period as well. For example, the Queen Snake (*Regina septemvittata*) is a riparian species that feeds almost exclusively on crayfish. Formerly abundant along Buffalo and Little Buffalo Creeks during the 1970s and 1980s, it is now rarely encountered. Populations of this species have also been noted to be in decline throughout much of its range although the reason has yet to be determined (Hulse *et al*. 2001). It is now listed as an endangered species in such varied locations as New Jersey and Wisconsin. Speculation concerning reasons for the decline has largely focused on water quality impairment having an adverse effect on the crayfish populations on which the species depends.

SIDEBAR:

Controlling Streambank Erosion and Creating Fish Habitat

Through the cooperative efforts of the Arrowhead Chapter of Trout Unlimited, PFBC, Buffalo Valley Sportsmen's Club, Armstrong County Conservancy, Snyder Associated Companies, Coors Brewing Company and the Armstrong Conservation District, a number of stream enhancement initiatives to address severe streambank erosion problems and to create fish habitat have been implemented in the upper portions of the watershed.

For example, in the delayed harvest fishing area near Nichola, numerous deflectors and mud sills have been installed on Buffalo Creek at a cost of approaching $500,000. This area is annually stocked by the Arrowhead Chapter of Trout Unlimited who rear 3,000 to 4,000 fingerlings a year in their Co-op Trout Nursery. The fingerlings are provided by the Pennsylvania Fish and Boat Commission. These efforts have been funded through both federal and state grants.

Also completed was the South Scenic Drive Project in South Buffalo Township designed to reduce road bank erosion along Buffalo Creek. This project included the construction of 14 rock veins, rock channels and culverts. This project was overseen by the Armstrong Conservation District and was funded by the Pennsylvania Department of Environmental Protection Growing Greener Program.

The *Western Armstrong Watershed Assessment Final Report* prepared by the Armstrong Conservation District in 2006 included monitoring and assessment of the Buffalo Creek Watershed to identify non-point source pollution. These investigations identified agriculture as the primary source of impairment to water quality within the Armstrong County portions of the watershed. Impairments due to abandoned mine drainage were concluded to be generally minimal within the main stem, although several tributaries are heavily impacted. Table 3-6 lists sites of impairment concerns identified during this investigation.

Based upon the available water quality data and anecdotal observations of aquatic life impacts, it appears abandoned mine drainage (AMD) may be of greater concern than initially estimated. AMD typically arises from abandoned deep mines. Pennsylvania has the greatest and most widespread abandoned mine drainage problem in the Appalachian coalfields (of which the watershed is a part). About 2,300 miles of streams in the state are polluted by AMD (Miller 1995). Although coal mining has occurred extensively in the watershed, little AMD degradation is apparent. This is likely attributable to several factors. First, the vast majority of mining in the watershed is conducted by strip mining methods, thus eliminating the potential for substantial AMD discharge. Secondly, extensive deposits of limestone occur in the upper watershed, which coincides with the area of greatest mining activity. The presence of limestone, and its respective alkaline properties in the soils and streambeds, assists in buffering of acid drainage, minimizing the most obvious effects from discharges that do occur.

The net effect of these circumstances would be to neutralize acidic discharges, thereby maintaining normal pH levels and precluding the formation of iron and other metal precipitates that readily identify a stream as AMD impaired. Instead, metals would remain dissolved and substrates and the water column would appear unaffected. However, within the immediate discharge area or through cumulative downstream effects, elevated metal concentrations could have substantial adverse effects on aquatic life with little or no obvious visible indicators.

AMD clearly has substantial negative impacts on some tributaries and portions of the main stem as demonstrated by PaDEP and Armstrong Conservation District data. The potential for a more widespread cumulative effect that is masked by natural pH buffering within the watershed warrants further investigation.

3.6 WATER USE

Residents and businesses in the majority of the watershed rely on private wells to supply potable water needs. Ten community suppliers provide water to limited areas of high population density as identified in Table 3-7.

Buffalo Creek near Buffalo Mills

Little Buffalo Creek

Table 3-5
CATEGORY 5 STREAMS - POLLUTANTS REQUIRING A TMDL

Stream	Assessment ID	Source	Cause	Total Miles
Buffalo Creek	6771	AMD	Metals	1.88
Buffalo Creek	6804	On-site Wastewater	Nutrients	2.35
		Urban Runoff/ Storm Sewers	Siltation	
Buffalo Creek	6852	Municipal Point Source	Nutrients	0.26
Buffalo Creek	7350	Natural Sources	Siltation	1.44
		On-site Wastewater	Excessive Algal Growth	
Buffalo Creek	7355	Natural Sources	Siltation	3.45
		On-site Wastewater	Excessive Algal Growth	
Buffalo Creek	7357	Natural Sources	Siltation	2.70
UNT 42558 Buffalo Creek	7419	Erosion From Derelict Land	Siltation	0.79
UNT 42559 Buffalo Creek	7418	Erosion From Derelict Land	Siltation	0.61
UNT 42560 Buffalo Creek	7419	Erosion From Derelict Land	Siltation	0.75
UNT 42599 Buffalo Creek	11698	Agriculture	Nutrients	1.43
			Siltation	
UNT 42605 Buffalo Creek	11698	Agriculture	Nutrients	0.49
			Siltation	
UNT 42606 Buffalo Creek	7375	Natural Sources	Siltation	0.60
UNT 42678 Buffalo Creek	7354	Crop Related Agriculture	Siltation	0.71
UNT 42679 Buffalo Creek	7354	Crop Related Agriculture	Siltation	0.49
UNT 42680 Buffalo Creek	7352	Crop Related Agriculture	Siltation	1.60
		Grazing Related Agriculture		
UNT 42681 Buffalo Creek	7352	Crop Related Agriculture	Siltation	0.85
		Grazing Related Agriculture		
UNT 42682 Buffalo Creek	7352	Crop Related Agriculture	Siltation	1.29
		Grazing Related Agriculture		
UNT 42685 Buffalo Creek	7453	Abandoned Mine Drainage	Metals	3.12
UNT 42686 Buffalo Creek	7349	Abandoned Mine Drainage	Siltation	0.52
UNT 42687 Buffalo Creek	7348	Abandoned Mine Drainage	Siltation	0.75
UNT 42688 Buffalo Creek	7344	Bank Modifications	Siltation	1.45
	7345	On-site Wastewater	Unknown Toxicity	1.32
UNT 42689 Buffalo Creek	7345	On-site Wastewater	Unknown Toxicity	0.48
UNT 42690 Buffalo Creek	7345	On-site Wastewater	Unknown Toxicity	0.46
UNT 42691 Buffalo Creek	7345	On-site Wastewater	Unknown Toxicity	1.42

Table 3-5 (Continued)

Stream	Assessment ID	Source	Cause	Total Miles
UNT 42692 Buffalo Creek	7344	Bank Modifications	Siltation	1.16
UNT 42693 Buffalo Creek	7344	Bank Modifications	Siltation	0.90
UNT 42694 Buffalo Creek	7343	Abandoned Mine Drainage	Siltation	1.69
UNT 42789 Buffalo Creek	6776	Abandoned Mine Drainage	Metals	3.32
UNT 42794 Buffalo Creek	6776	Abandoned Mine Drainage	Metals	0.56
UNT 42796 Buffalo Creek	6804	On-site Wastewater	Nutrients	0.55
		Urban Runoff/Storm Sewers	Siltation	
UNT 42797 Buffalo Creek	6737	On-site Wastewater	Nutrients	0.92
UNT 42798 Buffalo Creek	6737	On-site Wastewater	Nutrients	0.91
UNT 42809 Buffalo Creek	6771	Abandoned Mine Drainage	Metals	0.34
UNT 42810 Buffalo Creek	6771	Abandoned Mine Drainage	Metals	0.61
UNT 42811 Buffalo Creek	6771	Abandoned Mine Drainage	Metals	0.32
UNT 42812 Buffalo Creek	6771	Abandoned Mine Drainage	Metals	1.88
UNT 42813 Buffalo Creek	6771	Abandoned Mine Drainage	Metals	0.27
Buffalo Run	6814	On-site Wastewater	Nutrients	1.50
Little Buffalo Creek	7060	Agriculture	Nutrients	1.81
	7061	Agriculture	Nutrients	0.39
		On-site Wastewater		
	7296	On-site Wastewater	Nutrients	3.29
UNT 42566 Little Buffalo Creek	7167	Urban Runoff/Storm Sewers	Nutrients	1.42
			Siltation	
UNT 42567 Little Buffalo Creek	7167	Urban Runoff/Storm Sewers	Nutrients	0.62
			Siltation	
UNT 42568 Little Buffalo Creek	7167	Urban Runoff/Storm Sewers	Nutrients	0.57
			Siltation	
UNT 42569 Little Buffalo Creek	7167	Agriculture	Nutrients	0.50
			Siltation	
UNT 42570 Little Buffalo Creek	7126	Agriculture	Nutrients	1.58
			Siltation	
UNT 42582 Little Buffalo Creek	11692	Agriculture	Nutrients	1.68
			Siltation	
UNT 42583 Little Buffalo Creek	11693	Agriculture	Nutrients	1.31
			Siltation	

Table 3-5 (Continued)

Stream	Assessment ID	Source	Cause	Total Miles
UNT 42584 Little Buffalo Creek	11693	Agriculture	Nutrients	0.67
			Siltation	
UNT 42585 Little Buffalo Creek	11692	Agriculture	Nutrients	0.53
			Siltation	
UNT 42586 Little Buffalo Creek	7095	Agriculture	Nutrients	0.85
			Siltation	
UNT 42587 Little Buffalo Creek	7081	Agriculture	Nutrients	0.61
			Siltation	
UNT 42589 Little Buffalo Creek	7061	Agriculture	Nutrients	1.32
			Siltation	
UNT 42590 Little Buffalo Creek	7061	Agriculture	Nutrients	0.57
			Siltation	
UNT 42591 Little Buffalo Creek	7060	Agriculture	Nutrients	0.56
			Siltation	
UNT 42592 Little Buffalo Creek	7060	Agriculture	Nutrients	0.69
			Siltation	
UNT 42593 Little Buffalo Creek	7060	Agriculture	Nutrients	0.57
			Siltation	
Little Buffalo Run	7000	Natural Sources	Nutrients	0.77
			Siltation	
UNT 42749 Little Buffalo Run	6924	Abandoned Mine Drainage	Metals	0.56
		Petroleum Activities		
UNT 42756 Little Buffalo Run	7000	Upstream Impoundment	Siltation	0.86
UNT 42766 Little Buffalo Run	7000	Natural Sources	Nutrients	0.77
			Siltation	
Marrowbone Run	7426	Abandoned Mine Drainage	Siltation	0.28
UNT 42674 Marrowbone Run	7426	Abandoned Mine Drainage	Siltation	2.21
UNT 42675 Marrowbone Run	7426	Abandoned Mine Drainage	Siltation	0.39
Patterson Creek	7324	Crop Related Agriculture	Siltation	0.91
	7325	Crop Related Agriculture	Siltation	1.34
		Grazing Related Agriculture		
	7327	Crop Related Agriculture	Siltation	0.09
		Grazing Related Agriculture		
UNT 42723 Patterson Creek	7324	Crop Related Agriculture	Siltation	0.94

Table 3-5 (Continued)

Stream	Assessment ID	Source	Cause	Total Miles
UNT 42724 Patterson Creek	7324	Crop Related Agriculture	Siltation	0.65
UNT 42725 Patterson Creek	7324	Crop Related Agriculture	Siltation	0.50
UNT 42726 Patterson Creek	7324	Crop Related Agriculture	Siltation	1.11
Pine Run	7362	Natural Sources	Siltation	0.83
	7366	Bank Modifications	Siltation	2.04
	7373	Natural Sources	Siltation	1.84
UNT 42608 Pine Run	7374	Natural Sources	Siltation	0.80
UNT 42609 Pine Run	7374	Natural Sources	Siltation	0.57
UNT 42610 Pine Run	7370	Bank Modifications	Siltation	1.09
	7372	Bank Modifications		0.85
UNT 42613 Pine Run	7370	Bank Modifications	Siltation	0.35
UNT 42614 Pine Run	7370	Bank Modifications	Siltation	0.36
UNT 42615 Pine Run	7367	Natural Sources	Siltation	0.66
	7369			1.19
UNT 42616 Pine Run	7369	Natural Sources	Siltation	0.79
UNT 42617 Pine Run	7369	Natural Sources	Siltation	0.26
UNT 42619 Pine Run	7366	Bank Modifications	Siltation	0.24
UNT 42620 Pine Run	7364	Natural Sources	Siltation	1.29
UNT 42621 Pine Run	7363	Natural Sources	Siltation	0.64
UNT 42659 Rough Run	7031	Other	Nutrients	1.48
			Siltation	
UNT 42631 Sipes Run	7360	Crop Related Agriculture	Siltation	0.61
UNT 42632 Sipes Run	7360	Crop Related Agriculture	Siltation	0.43

Source: PADEP 2007

Table 3-6
MAJOR IMPAIRMENT CONCERNS
IDENTIFIED IN WESTERN ARMSTRONG WATERSHED ASSESSMENT

Site	Location	Coordinates	Type	Description	Degree of Impact
Butler Pike Discharge	Freeport Borough	N40° 40' 36.1" W79° 41' 32.9"	Mine Drainage	Old underground mine discharge	Volume of discharge is high quality; low impact is negligible
Mickeys Mill Discharge	Freeport Borough	N40° 40' 45.7" W79° 41' 15.7"	Mine Drainage	Old underground mine discharge	Volume of discharge is high quality; low impact is negligible
Unnamed Tributary	Buffalo Township	N40° 41' 2.9" W79° 41' 34.9"	Sediment	A large fill area in Buffalo Township is eroding and depositing sediment in unnamed trib and Buffalo Creek	Severe
Boney Pile	South Buffalo Township	N40° 41' 24.0" W79° 41' 3.9"	Abandoned Mine	Coal waste from underground mine	Low impact
Kepple Mine	Buffalo Township	N40° 42' 54.1" W79° 41' 51.2"	Mine Drainage	Old underground Coal mine complex	Water quality of this discharge was not tested – volume is low – no impact is discernable in Buffalo Creek
Buffalo Township Sewer Plant	Buffalo Township	N40° 42' 20.6" W79° 41' 43.3"	Permitted Discharge	New sewage treatment plant	Added nutrient to Buffalo Creek; no discernable impairment; expect possible algae increase
S. Buffalo, Buffalo, and North Buffalo Townships	Upland within Watershed		Urban Impairment	Residential/urbanization Increased development Related to Rt 28	At present low to moderate; main concern is for future impacts
Pine Run; Slate Lick Industrial Park; Northpointe	South Buffalo Township	N40° 45' 15.0" W79° 38' 34.4"	Urban Impairment	Site of intensive urbanization	Low to moderate at present
Boggsville	Main Stem	N40° 45' 0.3" W79° 40' 20.9"	Stream Hydrology	Streambank erosion site	Severe
Boggsville	Main Stem	N40° 45' 51.9" W79° 40' 10.7"	Stream Hydrology	Streambank erosion site	Severe
Boggsville	Main Stem	N40° 46' 21.0" W79° 40' 35.8"	Stream Hydrology	Streambank erosion site	Severe
Boggsville	Main Stem	N40° 45' 46.8" W79° 40' 6.4"	Stream Hydrology	Streambank erosion site	Severe
Boggsville	Main Stem	N40° 46' 24.8" W79° 40' 42.5"	Stream Hydrology	Streambank erosion site	Severe
Craigsville	Main Stem	N40° 50' 53.5" W79° 38' 19.7"	Stream Hydrology	Streambank erosion site	Severe
Craigsville	Main Stem	N40° 51' 24.6" W79° 39' 9.5"	Stream Hydrology	Streambank erosion site	Severe
Craigsville	Main Stem	N40° 51' 32.0" W79° 39' 19.5"	Stream Hydrology	Streambank erosion site	Severe
Craigsville	Main Stem	N40° 51' 33.1" W79° 39' 38.7"	Stream Hydrology	Streambank erosion site	Severe
Logan Clay Products Mine	Main Stem	N40° 50' 54.4" W79° 38' 39.3"	Mine Drainage	Surface Mine Discharge	No Discernable impact on Buffalo Creek
Marrowbone Run Mining	North Buffalo Township	N40° 47' 41.5" W79° 38' 34.0"	Mine Drainage	Discharge of alkaline; iron from strip mines	Discharge has severely impacted Marrowbone Run. No impacts on Buffalo Creek due to assimilation
Millen Hollow Road Shady Side Village	West Franklin Township	N40° 49' 38.0" W79° 39' 29.1"	Mine Drainage	Two discharges from underground limestone mines; alkaline iron	Discharges are direct to Buffalo Creek; impacts are not evident

Table 3-6 (Continued)

Site	Location	Coordinates	Type	Description	Degree of Impact
Worthington	West Franklin Township	N40° 50' 25.1" W79° 38' 44.6"	Mine Drainage	Seepage from rock strata between Vanport Limestone & Clarion Coal road cut	No discernable impact on Buffalo Creek
Nichola Mine Discharge	West Franklin Township	N40° 51' 22.6" W79° 40' 17.7"	Mine Drainage	Discharge from an old underground mine in Clarion Coal seam; estimated discharge	Quality is xxx; no discernable impact on Buffalo Creek except visual impact in immediate zone of inflow.
Various strip mine operation in Vanport Limestone	West Franklin Township		Surface Mine Runoff	Active strip mines with permits	The concern is that these operations be reclaimed properly
Agriculture	Entire watershed		Agricultural	Agricultural runoff nutrients, pesticides and sediment are contributing to impairment of Buffalo Creek	Agricultural activities are the number one source of impairment on Buffalo Creek
Claypoole Run	Worthington Borough		Sewage, Also stream Hydrology	Mass sewage discharge from Worthington Borough Stream bank erosion	Sever impairment but a treatment collection and plant are in process.
Patterson Creek	West Franklin Township	N 40°- 54'-02" W 79°-38'-37"	Mine Drainage	Remedial work needed on old passive discharge wetlands	Preventative measure
Patterson Creek	West Franklin Township	N 40°-54'-04" W 79°-38'-38"	Stream Hydrology	Streambank erosion site	Severe

Source: Armstrong Conservation District 2006.

Table 3-7
PUBLIC WATER SUPPLY SYSTEMS

System Name	Type	Distribution Areas	Source	Population Served
Municipal Authority of Buffalo Township	Community	Buffalo Township, Freeport Borough	Allegheny River	5,849
South Buffalo Township Municipal Authority	Community	South Buffalo Township	Allegheny River (Municipal Authority of Buffalo Township)	825
Harrison Township Water Authority	Community	Harrison Township	Allegheny River	10,934
Saxonburg Area Authority	Community	Saxonburg Borough	Well	2,270
Chicora Borough Water Department	Community	Chicora Borough	Well	950
Kittanning Suburban Joint Water Authority	Community	North Buffalo Township, East Franklin Township	Allegheny River	6,000
Worthington West Franklin Joint Municipal Authority	Community	Worthington Borough, West Franklin Township	Well	1,500
Fair Winds Manor	Private	Fair Winds Manor	Well	160
E.J. Gulic Mobile Home Court	Private	E.J. Gulic Mobile Home Court	Well	78
Pine Haven Boarding Home	Private	Pine Haven Boarding Home	Well	90

SIDEBAR:

A Success Story – Improving Water Quality.

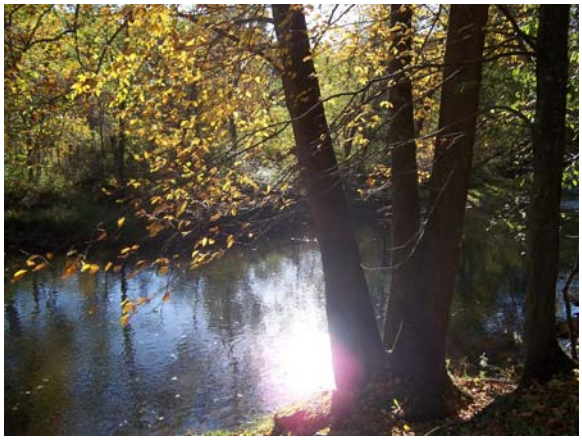
Creekside Mushrooms, Inc. produces mushrooms in a former limestone mine near Worthington. In fact, Creekside is the world's largest underground mushroom farm, employing more than 500 people to produce the well-known Moonlight® Brand Mushrooms.

Mushrooms are grown in a compost medium containing manure, straw, and mulch. Raw materials are stockpiled, mixed, and seasoned above ground prior to use in growing a mushroom crop. Following use in the mine, the compost is recycled by spreading it on the ground surface and allowing it to decompose for a period of three years. At the completion of this period, the mulch produced in this process is reused in producing a new batch of growing medium.

The storage and seasoning of the raw materials as well as the decomposition of the spent mulch occurred over many acres of farmland on the hills above the central watershed's most popular trout fishing areas. These activities were exposed to rainwater, resulting in runoff with excessive nutrient loads leaving the farm facilities and entering local streams. By working with the Armstrong Conservation District through the 1990s, Creekside was able to develop an integrated nutrient management plan to prevent the nutrient-laded runoff from leaving the site. This has included the implementation of a variety of Best Management Practices (BMPs) at the farm, including providing covered facilities for the storage of raw materials, and a system of grass-lined diversion channels to prevent runoff from leaving the site by discharging it as sheet flow across grass infiltration areas and grass-lined ponds.

3.7 SEWERAGE SERVICE

Act 537 requires that all municipalities develop and implement comprehensive official plans that provide for the resolution of existing sewage disposal problems, provide for the future sewage disposal needs of new land development and provide for the future sewage disposal needs of the municipality. As shown in Table 3-8, the majority of these plans are 20 years old or more. The Armstrong County Sewage Enforcement Agency, The Butler County Sewage Association and the Allegheny County Health Department Water Pollution Control Section are responsible for Act 537 enforcement within their respective counties.



Buffalo Creek near Beatty Mill

Table 3-8
ACT 537 PLAN STATUS

Municipality	Act 537 Plan Date
Allegheny County	
Harrison Township	12/01/1970
Armstrong County	
Brady's Bend Township	06/01/1980
East Franklin Township	04/03/2001
Freeport Borough	06/01/1980
North Buffalo Township	06/01/1980
South Buffalo Township	06/01/1980
Sugarcreek Township	06/01/1980
West Franklin Township	06/01/1980
Worthington Borough	03/12/2002
Butler County	
Buffalo Township	03/15/1971
Chicora Borough	07/14/1994
Clearfield Township	11/01/1972
Clinton Township	03/08/1971
Concord Township	03/06/1971
Donegal Township	07/14/1994
Fairview Township	07/14/1994
Jefferson Township	04/12/1971
Oakland Township	04/05/1971
Saxonburg Borough	08/24/2004
Summit Township	12/01/1972
Winfield Township	04/30/1971

As with water supplies, most residents within the watershed rely on private, on-lot septic systems for sewerage discharge. Six community systems serve higher population areas within the watershed as listed in Table 3-9.

Table 3-9
COMMUNITY SEWERAGE SYSTEMS

System Name	Type	Service Areas	Discharge	Population Served
Municipal Authority of Buffalo Township	Community	Buffalo Township	Buffalo Creek	4,700
Upper Allegheny Joint Sanitary Authority	Community	Harrison Township	Allegheny River	11,000
Saxonburg Area Authority	Community	Saxonburg Borough	Thorn Creek	1,200
Chicora Borough Sewer Authority	Community	Chicora Borough	Buffalo Creek	912
Freeport Borough Sewer Authority	Community	Freeport Borough	Allegheny River	800
Worthington West Franklin Joint Municipal Authority	Community	Worthington Borough, West Franklin Township	Buffalo Creek	1500

3.8 STORMWATER MANAGEMENT

Changing the soil cover by installing impervious surfaces (such as pavement), removing vegetation, and changing the contour of the land and the way water drains across it can all accelerate stormwater runoff. Impacts from accelerated runoff can be avoided by minimizing changes to the landscape and implementing stormwater management practices that replicate pre-development conditions.

Pennsylvania's Storm Water Management Act (Act 167) was enacted in 1978 in response to the impacts of accelerated stormwater runoff resulting from land development. It requires counties to prepare and adopt watershed-based stormwater management plans. It also requires municipalities to adopt and implement ordinances to regulate development consistent with these plans.

Watershed-based Stormwater Management Plans provide municipalities with a framework to control stormwater runoff from new development in a watershed. These include standards for managing the quantity and quality of stormwater runoff, including current and future development plans. The goal is to control the post-development stormwater runoff rate, volume and quality, to replicate pre-development conditions. This will thereby prevent additional downstream flooding and to protect water resources and their uses. Following adoption of the Stormwater Management Plan by the county and approval by PaDEP, anyone engaged in construction activities in the watershed is required to implement stormwater management measures consistent with the plan. In addition, each municipality in the watershed covered by the plan must adopt ordinances consistent with the plan. These include zoning, subdivision and development, building code, erosion and sedimentation and post-construction stormwater management requirements

There is currently no Act 167 Plan in effect or under development for the overall Buffalo Creek Watershed (PaDEP 2007). A number of municipalities are in the process of implementing ordinances based on Pennsylvania's model stormwater ordinance.

SIDEBAR:

Dirt and Gravel Roads Program

Numerous past and present projects within the watershed have focused on minimizing sediment and pollutant inputs into tributaries and streams. The Pennsylvania Dirt and Gravel Road Pollution Prevention Program provides funding to minimize runoff pollution and sediment from unpaved and out-of-condition roadways through environmentally driven redesign and maintenance. Funding is allocated to County Conservation Districts to be distributed amongst municipal agencies. Projects are designed to be long-term solutions to locally identified problems.

Stormwater Programs

Buffalo Township recently has been designated as an MS4 community. The MS4 Stormwater Program (MS4 – Municipal Separate Storm Sewer System) consists of six elements implemented to reduce the discharge of pollution and contaminants into local water bodies. The six program elements involve (1) education and outreach, (2) public involvement, (3) illicit discharge elimination, (4) construction runoff control, (5) development runoff control, and (6) municipal pollution prevention. This program is part of the U.S. EPA Office of Wastewater Management's National Pollutant Discharge Elimination System (NPDES) stormwater program.

Worthington

Beaver Dam - West Winfield

Stocking the DHALO at Nichola