# Raccoon Creek Watershed Abandoned Mine Drainage (AMD) Survey and Preliminary Restoration Plan EPA Section 104(b)(3) Document

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Washington County Watershed Alliance, Inc.
Washington County Conservation District
Pennsylvania Department of Environmental Protection,
Greensburg District Mining Office
Burgettstown School District (High School)

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it was through their participation in the public process,
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## Executive Summary

Abandoned mine lands in Pennsylvania present a significant liability to public health and contribute to environmental degradation. These scars are a result of Pennsylvania's 200-year industrial history that was characterized by fossil fuel and mineral extraction. The Commonwealth's industrial legacy has left more than 250,000 acres of abandoned surface mines and an estimated 2,300 miles of streams polluted with abandoned mine drainage (AMD). This report catalogues the AMD conditions within the entire 184 square miles of the Raccoon Creek watershed that is located in southwestern Pennsylvania (Refer to Figures 1 and 2). AMD not only impairs water quality, it affects the health and condition of aquatic habitat as well. Contemporary planning and restoration efforts now conducted using a holistic approach, acknowledging that the environment, the economy and society are directly linked. The restoration of the Raccoon Creek watershed's water quality from AMD degradation will provide not only an improved physical environment but will also create opportunity for economic development within the watershed. The combination of these two benefits will significantly improve the quality of life for the local residents of the communities within the watershed, as well as contribute to regional improvement for the Pittsburgh metropolitan area.

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# I. INTRODUCTION

## A. Purpose

The purpose of this report is to complete an abandoned mine drainage (AMD) survey and preliminary restoration plan for the Raccoon Creek watershed. There has been an increasing focus on utilizing a watershed-based approach to remediating the streams of Pennsylvania. According to the Report of the Pennsylvania 21$^{st}$ Century Environment Commission (1998), the Commonwealth's goal is to remediate all streams impacted by AMD by the year 2025. To accomplish this goal, the Commission has made three recommendations:

1. To develop a watershed-based approach to solving AMD problems;
2. To prevent potential AMD problems in future mining activities; and
3. To identify, catalog, categorize and prioritize existing AMD locations in the development of a comprehensive strategic plan (p. 48).

In accordance with these recommendations, the Washington County Conservation District (WCCD) coordinated this plan. Mr. Gary Stokum, of the WCCD, was instrumental in forming the Washington County Watershed Alliance, Inc. (WCWA) and the Raccoon Creek Watershed Association (RCWA). These local organizations, along with the Pennsylvania Department of Environmental Protection (PADEP), and Skelly and Loy, Inc., have proceeded with development of a preliminary restoration plan in an effort to identify and remediate AMD pollution within the watershed.

The objectives of this report are:

1. To identify, categorize and prioritize the most significant AMD discharge locations within the Raccoon Creek watershed; and
2. To propose the most appropriate remediation strategies economically and physically feasible.

The proposed results expected from the adoption of this plan are:

1. To significantly restore and protect the water quality of Raccoon Creek from past, present and future AMD pollution;
2. To create opportunity for economic development;
3. To reduce local government costs;
4. To enhance the quality of life for residents within the watershed;
5. To provide environmental and socio-economic improvements for the Pittsburgh region; and

6. To create a heightened awareness among the general public, local government officials, agencies and the business community of watershed values, problems and solutions.

The Raccoon Creek watershed is known to have at least 175 to 200 AMD discharges. Many of these sites are minor AMD discharges and are insignificant when weighed economically as feasible for remediation. This plan identifies seven (7) primary AMD sites and seventeen (17) secondary AMD sites (Refer to Figure 3) within the watershed. Remediation of these seven sites would significantly improve the overall water quality of the watershed. One of these sites, the Langeloth Borehole (L2), has been addressed and the implementation of a passive treatment system is 90% complete at this time. However, all parties have agreed that continued monitoring of this site is necessary, and that it should be included within this report as a major source of AMD.

To monitor the water quality of Raccoon Creek and its tributaries, twelve (12) stream sampling points have been established (Refer to Figure 3). The primary AMD sites were selected by Mr. John Davidson, PADEP, based upon historical data collection, his extensive knowledge of the Raccoon Creek watershed, and the large amount of historical and current water quality data for these locations. Additional water quality data and flow estimations were then provided by PADEP for incorporation into this plan. These sampling points, in addition to the primary AMD sites, have been monitored for twelve (12) months or more in order to make a contemporary assessment of the overall water quality of the watershed (Refer to Appendix A, B, and C).

Funding for this report has been supplied by a United States Environmental Protection Agency (USEPA) Section 104 grant provided by the Pennsylvania Department of Environmental Protection (PADEP). In order to compete for implementation funds for future land and water quality improvement projects, an updated assessment must be completed in the format required by the PADEP. The intent of this report is to provide the necessary assessment. Following the completion and adoption of this preliminary plan, the proposed remediation projects suggested herein will be eligible for funding from various state and federal programs (Refer to Appendix D).

## B. Location and Characteristics of the Raccoon Creek Watershed

The Raccoon Creek watershed is located in western Allegheny, southern Beaver, and northern Washington Counties, Pennsylvania (Refer to Figure 1). The Raccoon Creek watershed encompasses an area that is approximately 477 $km^2$ (184 $mi^2$). The length of Raccoon Creek within this area is approximately 74 km (46 mi.). Raccoon Creek's headwaters are located in Hickory, PA. Sub-basins of Raccoon Creek include (Refer to Figure 2):

- Bigger Run
- Brush Run
- Burgetts Fork
- Little Service Creek
- Little Traverse Creek
- Potato Garden Run

- Chamberlain Run
- Cherry Run
- Dilloe Run
- Frames Run
- Fishpot Run
- Gums Run
- Little Raccoon Run
- Raredon Run
- Service Creek
- St. Patrick Run
- Trampmill Run
- Traverse Creek
- Lower Raccoon Creek
- Upper Raccoon Creek

As Raccoon Creek flows downstream (north), it meanders through mostly rural areas (i.e., small villages, agricultural land, wood lots, and previously strip-mined areas) until it discharges into the Ohio River near Josephtown in Beaver County. The watershed/study area lies within the following municipalities (Refer to Figure 3):

- **Allegheny County:** Findlay and North Fayette;

- **Beaver County:** Aliquippa, Center, Greene, Hanover, Hopewell, Independence, Potter, and Raccoon; and

- **Washington County:** Burgettstown, Cross Creek, Hanover, Mt. Pleasant, Robinson, and Smith.

The mean annual precipitation in the watershed is between 914 to 1,016 mm (36 to 40 in)(USDOI, 1984). The Pennsylvania Water Quality Standards (Chapter 93) classifies the main steam of Raccoon Creek as a Warm Water Fishery (PA Code, 1994). Approved trout waters in the Raccoon Creek watershed include Raccoon Lake and Traverse Creek (PFBC, 2000). Raccoon Creek is considered a navigable waterway by the U.S. Army Corps of Engineers and their jurisdiction extends 1.8 miles upstream from its confluence with the Ohio River (USACOE, 1981).

C. Previous Investigations

Raccoon Creek has been the focus of numerous state and federal agency assessments and reports concerning water quality within the watershed. These include:

1. "Sources of Coal Mining Drainage Pollution of Raccoon Creek Watershed, Pennsylvania" (USDOI, 1968):

   This study is a detailed mine drainage source investigation that located and quantified all coal mine drainage discharges and attempted to establish a county-wide network of stream sampling water quality locations for long-term monitoring. The study indicates that Raccoon Creek is degraded from the Cherry Valley area to its mouth (approximately 40 miles). It is also noted that another 30 to 40 miles of tributary streams are impacted. These streams are impacted by approximately 200 mining related sites that caused water quality to be characterized as acidic, highly mineralized, devoid of normal aquatic life, and unsuitable for many legitimate water uses. It is noted that with the exception of Potato Garden Run, tributaries to Raccoon Creek polluted by mine drainage are restricted to Washington County. Finally, twenty-eight principal mine drainage sources were found to contribute 87 percent of the acidity discharged to streams at the time of the study (USDOI, 1968).

2. Within the watershed, a total of eighteen Pennsylvania Operation Scarlift Reports were filed. Of the eighteen, two reports were reviewed in preparation of this plan (Project SL 130-2 & 130-7). The criteria used in choosing these two reports are that they directly relate to the purpose of this plan and that they are comprehensive to the watershed. A complete listing of the eighteen reports are listed in Appendix E.

"Operation Scarlift Report (Project SL 130-2)", Giorgione and Ackenheil, 1972:

The 1972 Scarlift Report (SL 130-2) was performed as a by-product of Mr. James F. Hillman's gift of the land to the Commonwealth of Pennsylvania. With the knowledge of the AMD problems that existed in the area from the USDOI 1968 study and as part of the planning process for Hillman State Park, it was decided that a Scarlift Report would be completed for the park area. All sites were sampled for chemical parameters only. This report stated that Brush Run drains approximately 85% of the total park area.

"Operation Scarlift Report (Project SL 130-7)", Gooding and Dougherty, 1976:

The 1976 Scarlift Report (SL 130-7) sampled for chemical parameters only. This report states that four tributaries are responsible for the majority of water quality degradation in the Upper Raccoon Creek basin. These basins are:

- Potato Garden Run
- Little Raccoon Run, and
- Two unnamed tributaries (from the Joffre, PA basin and PA State Gamelands areas [SR-36]).

Three other sub-basins are marginally degraded by mine drainage:

- Dilloe Run
- Burgetts Fork, and
- Unnamed tributary to St. Patrick Run [SR-37].

The SL 130-7 study indicates sites JB1 and JB2 (Stream Reach Abatement Priority Index #4) and site H3 (Stream Reach Abatement Priority Index #18) are located in the priority areas. These areas have been recommended to have surface reclamation (Gooding and Dougherty, 1976). The SL 130-7 report also found 115 AMD sources contributing 24 tons per day of net acidity to the SL 130-7 study area. However, the USDOI 1968 study for the same study area found 28 mine drainage sources, contributing 71 tons per day of net acidity. When the 1968 and 1976 studies are compared, even though more AMD discharge locations had been found in 1976, net acidic discharges to the watershed was reported at 47 tons per day less. The improvements to water quality are most likely due to a combination of natural and anthropogenic improvements.

3. "Water Quality of Raccoon Creek- Washington/Beaver Counties" (PADER, February 1980):

   This study was prompted by water quality improvement as observed in the Water Quality Network data (USDOI, 1968 study recommendation) and the lack of information concerning many of the tributaries to Raccoon Creek. All sites were sampled for chemical and biological parameters (benthic macro-invertebrate and fish populations). The area is impacted by historic and abandoned mine sites (both surface and underground mines), mainly in the Washington County portion of the watershed. In the 1980 PADER study, it was noted that Raccoon Creek's water quality is marginal for most of its length. However, many of its tributaries are of good to excellent water quality. At the time, recent data showed significant improvement in water quality. It was also noted that most of its degradation was due to abandoned mine workings in the Allegheny and Washington County portions of the watershed. The 1980 PADER study states that Raccoon Creek still suffers from severe AMD pollution; however, improvement to water quality and macro-invertebrate/fish populations were observed at a number of sampling station locations. The watershed, at that time, was described as a "biological wasteland."

4. "Raccoon Creek Watershed Survey" (PADER, November 1983):

   The 1983 PADER study was performed to document further improving trends in water quality to Raccoon Creek in Smith, Robinson, and Hanover Townships in Washington County. This study involved chemical and biological parameters (benthic macro-invertebrate and fish populations). It found that water quality conditions were improving when compared to Scarlift data collected in 1976. Significant increases in alkalinity versus acidity were observed, especially at the stations located at Little Raccoon Run and Potato Garden Run. These two large tributaries are adding net alkalinity to Raccoon Creek instead of high acidities (PADER, 1983). Finally, the 1983 study states that overall improvements are apparent, but localized AMD sources continue to pose a serious problem.

5. "Raccoon Creek (820D) Management Report, Sections 01 & 02" (Pennsylvania Fish and Boat Commission [PFBC], 1989):

   In 1989 the PFBC collected chemical water quality data in Raccoon Creek, along with limited biological data at three sites. Section 01 (Headwaters to T-821 bridge) was characterized by one sampling location that was suitable for an aquatic community. Species were indicative of a warm water stream community with pollution intolerant species present.

Section 02 (T-821 bridge to mouth) was characterized by four sampling locations. Habitat in Section 02 was good for aquatic life production. However, chemical parameters indicated impact from AMD. It is noted that the AMD has created a pollution block that may prevent fish migration above or below Section 02 under normal to low flow conditions. Species were indicative of a warm water stream community with pollution tolerant species present (PFBC, 1989).

6. "PFBC Cost/Benefit Information Letter" (PFBC, 2000)

The PFBC provided a cost/benefit analysis of Raccoon Creek involving the potential remediation of AMD. According to the PFBC information, when the proposed remediation work is completed, an additional 75 miles of warmwater/coolwater stream fishing would be created. This would produce an estimated stream reach of 213.4 acres. PFBC estimates for these water types are 370 angler trips per year, per acre. When compiled, total angler trips per year potential is 78,958. Knowing that the estimated value of an angler trip in Pennsylvania is $31.04 (1996 dollars), this means that this proposed AMD remediation would yield an estimated $2,454,804 annually to the communities within the watershed (PFBC, 2000).

It is known from these studies, and on going water quality sampling, that the water quality of the main stem of Raccoon Creek is degraded due to AMD in approximately 40 miles of stream. Additionally, another 30 to 40 miles of tributaries to Raccoon Creek are also impacted by AMD. The review of these documents support the present finding that most of these streams are acidic, highly mineralized (Fe, Al and Mn), lack normal aquatic life, and are unsuitable for most water uses. Most of the effected streams in this watershed are located in the headwater areas of Raccoon Creek in Washington County (Refer to Appendix A and Figures 3 and 4).

D. The Value of Watershed Restoration

The Raccoon Creek watershed offers extensive open and green space for its inhabitants, for the City of Pittsburgh and for the region. Unlike adjacent watersheds, such as Chartiers Creek to the east, Raccoon Creek has yet to experience significant urban sprawl and development from Pittsburgh. This means that the Raccoon Creek watershed has the potential to become a regional recreation destination. The restoration of the water quality degraded by AMD in Raccoon Creek will also provide local landowners and government officials more decision making options in regards to local issues such as 'smart growth', which is encouraged in Pennsylvania's *Growing Greener* program. In other words, a cleaner physical environment empowers the local communities in deciding the direction of their planning efforts, whether it is to encourage outside investment into their community, or to place restrictions on development in effort to resist urban and suburban sprawl.

Across the entire Commonwealth, fishing and boating activities accumulate in estimated earnings of more than $2.5 billion per year. Pennsylvania's physical beauty is not only an environmental treasure, it is also an economic draw that should be protected. Much of the Raccoon Creek watershed is particularly suited for potential outdoor recreational uses if the needed AMD remediation were to take place. In fact, the PFBC, Division of Fisheries Management (PFBC, 1989) identifies AMD as the critical factor to water quality improvements in the Raccoon Creek watershed and continue to state that improved water quality would provide a valuable recreational warm water stream fishery.

## II. GEOLOGY

### A. Factors Affecting Mine Drainage

Past anthropologic (man-made) activities in the watershed have caused a variety of negative impacts to the environment. The major type of non-point source (NPS) pollution to water quality is AMD. AMD results when water and pyrite (iron sulfide) are exposed to oxygen. Metals (Iron- Fe, Aluminum- Al, and Manganese- Mn) that are in solution in underground minepools, precipitate out of solution when the AMD discharges into a stream, pond, or other surface feature. These precipitates are in the form of oxides and hydroxides. AMD can have varying levels of pH, acidity, and alkalinity, depending on how much interaction the discharge has had with carbonate rocks (USDA, 1995).

Past mining activity (underground [deep] mines, surface [strip] mines, and coal refuse piles) have had the greatest negative impact to the watershed(s) water quality. Mining activity has been present in the area for over 200 years. The deep mines have expansive underground tunnel networks that are now flooded (minepools), thus permitting groundwater to be impacted by pyrite. This degraded water can move from one watershed to another via this underground tunnel network and then be discharged to receiving streams in a completely different watershed than the one from which the water initiated. Surface mines and coal refuse piles also have a negative impact on water quality because surface-mined coal and pyrite is exposed to the atmosphere, which then permits any associated water to react chemically with oxygen in the atmosphere.

### B. Physiography

The Raccoon Creek watershed is located entirely within the Pittsburgh Low Plateau Section-Prototypical Area of the Appalachian Plateaus Province. The Appalachian Plateaus Province occupies more than 26,000 $mi^2$, almost 60% of the area of the state. Of that 26,000 $mi^2$, the Pittsburgh Low Plateau Section-Prototypical Area occupies approximately 6,500 $mi^2$. The Prototypical Area of the Pittsburgh Low Plateau Section forms the largest unit of the Appalachian Plateaus Province in Pennsylvania.

The study area has a general relief pattern of a broad, dissected upland underlain by essentially horizontal sedimentary rocks. The present surface consists of broad, rounded ridges and intervening valleys.

## C. Stratigraphy

The Raccoon Creek watershed is located within two different portions of the stratigraphic sequence. The southern portion of the watershed is sporadically located in the Pennsylvanian-Permian Transition and Permian System. The northern and predominate portion of the watershed is located within the Pennsylvanian System.

The Pennsylvanian-Permian Transition and Permian System is identical to the Dunkard Group. The Dunkard Group extends from the base of the Waynesburg coal bed to the present topographical surface. The Dunkard Group is divided into the Waynesburg, Washington, and Greene Formations, in ascending order. The boundary between the Waynesburg and Washington Formations is at the base of the Washington coal bed, and the boundary between the Washington and Greene Formations is at the top of the Upper Washington limestone bed. The exact placement of the Pennsylvanian-Permian boundary is a complex and controversial problem. Conventionally, it is placed at the bottom of the Waynesburg coal bed. The bedrock strata exposed over various portions of the Pennsylvanian System are members of the Monongahela and Conemaugh groups. The total stratigraphic thickness exposed of the Dunkard, Monongahela, and Conemaugh groups is on the order of 800 feet. All of the strata are sedimentary in origin. The formations within the Dunkard, Monongahela, and Conemaugh groups are comprised principally of shales and sandstones but also contain prominent limestone and coal horizons. The area of outcrop of the Monongahela Group is more extensive than that of any other group in the Raccoon Creek study area. The Pittsburgh coal seam is the lowest bed in the Monongahela Group and rests unconformably on the Conemaugh Group. Below the Pittsburgh Coal is about 2 ft. of dark to light gray brecciated limestone. The Pittsburgh coal seam is approximately 5 to 6 ft. thick, with some thickening and thinning in various areas. The upper part of the Pittsburgh Coal consists of alternating bands of black carbonaceous shales and boney coal 6 in. to 2 ft. in thickness for about 7 to 8 ft. above the main seam (Refer to Appendix F and Plate 1). Iron sulfide minerals (pyrite and marcasite) are generally associated with the coal and the black carbonaceous shales and sandstone overlying the coal bed. These minerals, upon oxidation, represent the principal source of acid from coal mining related activities.

Iron sulfide minerals are also found in the main coal seam as horizontal shaly partings and as concretions known as sulfur balls. The iron sulfide minerals in these partings are generally in the form of flaky crystals and the concretions occur as black to brassy spheres in various sizes. The sulfur balls, in the Pittsburgh Coal, are irregular in distribution and their composition is largely pyritic. These sulfur balls are one of the sources of acid in the main coal seam (PADCNR, 1999).

## D. Structure

Raccoon Creek watershed is contained within the physiographic province known as the Appalachian Plateaus. This province is characterized by essentially flat-lying strata whose regularity is broken by low broad folds. The regional dip of the stratified rocks exposed in the watershed is to the southeast. Two structural folds modify the local geology. The West Middletown syncline is the fold that most predominately affects the local geology of the Raccoon Creek study area. The northern axis of the syncline crosses Raccoon Creek near Bavington, PA. The closure of the syncline just to the northeast results in a basin-like structure within the main watershed area. This condition is evident by noting the circular pattern formed by the Pittsburgh Coal structural contours. The Cross Creek syncline, which trends east-west across the Cherry Valley sub-watershed, intersects the West Middletown syncline west of the Cherry Valley sub-watershed. The structure contour of the coal also indicates that a certain amount of AMD that enters the Raccoon Creek watershed results from surface water sources that originate outside the topographic boundaries of the basin (PADCNR, 1999).

## III. MINING

### A. History

The Raccoon Creek watershed is located in portions of three counties in southwestern Pennsylvania (Allegheny, Beaver, and Washington). However, the majority of the coal mining activity in the watershed has taken place in Washington County (Refer to Figures 4, 5, and 6). This study, therefore, primarily focuses on the Washington County portion of the watershed.

Coal mining in the watershed began in the late eighteenth century. The earliest mine (coal) known to exist in Washington County is depicted on a map of the City of Washington (then Bassettown), dated 1781. After this date, other outcrop mines were opened near Coal Center and Canonsburg. Due to the relative ease of access and the quality of the coal, Washington County soon had numerous small mines operating. These mines operated for home heating and the powering of small, localized industrial activity. After 1820, the need for coal was increased for home heating purposes. By 1840, the early Pittsburgh industrial complex became another consumer of the region's abundant coal resources. Soon, railroads and locks and dams were constructed, which facilitated the transportation of coal to the Pittsburgh market and further spurred increased mining/production of Washington County coal (circa 1880 Washington County delivered 700,000 tons of coal to market). From 1880 to 1923 there were annual increases in the amount of coal produced, and by 1923 the highest amount of coal produced was recorded (24.5 million tons). Decreases in coal production occurred after 1923 until the 1960's when large steel companies created a certain amount of industry stability. Large steel companies owned seven of the nine major mines at this time and 14.1 million tons of coal were produced in 1966 in Washington County. Only one year later (1967), however, coal production in the Raccoon Creek watershed was estimated to be less than 100,000 tons (USDOI, 1968).

According to the 1968 United States Department of the Interior study, recoverable coal reserves are estimated at 2.1 million tons in the Washington, Waynesburg, Redstone, Pittsburgh, and Upper Freeport seams in Washington County. This study also states that the only significant coal reserves that remain in the Raccoon Creek watershed are in the Washington County portion of the Pittsburgh coal seam.

### B. Current Mining

The primary source of coal in Washington County is from the Pittsburgh coal seam. Despite the fact that coal production has decreased from 1923 to present, Washington County ranks number two among Pennsylvania counties in coal production, producing 9,613,000 tons of coal in 1999. There are currently eleven permitted mining operations in the Raccoon Creek watershed, four of them active and seven of them inactive operations. The active operations consist of two surface (strip) mines, and five refuse disposal, reprocessing, and coal preparation facilities. There are no underground (deep) mines currently active within the watershed. Approximately 20,000 to 25,000 tons (18,000 to 23,000 tonnes) of coal was produced in the Raccoon Creek watershed in 1999 (Davidson, 2000).

After a period of decline of coal production in Raccoon Creek watershed, coal production is on the increase. PADEP personnel have indicated that some of the seven inactive permits may become active in the near future (2000-2001). With this renewed mining activity, it is expected that coal production in 2000 will increase to approximately 200,000 tons (181,436 tonnes) in Raccoon Creek watershed (Davidson, 2000). Besides these active mining operations, the watershed contains a large amount of coal refuse from abandoned and/or historic mining/waste sites. These areas remain as a legacy to previous mining activities and are a source of many water quality/environmental problems in the watershed. The re-mining and processing of these refuse sites provides both economic and environmental benefits to the community and the watershed (Refer to Figure 4).

# IV. WATER QUALITY EVALUATIONS

## A. SUMMARY

### 1. General Discussion

In Pennsylvania, approximately 2,425 miles of streams do not achieve water quality standards due to drainage from past coal mining (PADEP, 1999). Raccoon Creek and its tributaries are a component of this larger statewide picture concerning AMD, and this plan is a tool to assist in reducing the number of AMD impacted stream miles.

Raccoon Creek flows through its watershed in a northwestern direction from Hickory in Washington County to the Ohio River near Josephtown in Beaver County (Refer to Figures 1 and 2). The City of Pittsburgh is 30 miles upstream on the Ohio River from Raccoon Creek. The length of Raccoon Creek is approximately 74 km (46 mi) and the size of the watershed is approximately 477 $km^2$ (184 $mi^2$). The annual mean discharge (water years 1942 to 1999) of Raccoon Creek is 5.5 cu m/s (192 cfs) (Refer to Appendix F and Plate 2, USDOI 2000). Additionally, three reservoirs are located in the watershed: Raccoon Creek Lake, Cherry Run, and Silver Creek (PADER, 1980). The Raccoon Creek watershed is bordered to the north by the Ohio River, to the northeast by the Elkhorn Run, Flaugherty Run, and Montour Run watersheds, to the east by the Chartiers Creek watershed, and to the south and west by Cross Creek, Harmon Creek, Kings Creek, Mill Creek, and Tomlinson Run watersheds.

Since the 1980 study, water quality and aquatic life continues to be impacted; mainly in the Raccoon Creek and Burgetts Fork portions of the watershed. As one moves downstream, water quality and aquatic life generally improve. Since the 1980 PADER study, mine reclamation activities have improved water quality in portions of the watershed (Potato Garden Run, Little Raccoon Run and St. Patrick Run) and assisted in restoring benthic macro-invertebrate and fish populations to previously impacted streams (PADER, February 1980).

### 2. 2000 Data Findings

For this study, the following review discusses upstream sample locations and then progresses to downstream sample locations. A discussion of each sampling point and a comparison of results to historical water quality data from previous studies follows. The water quality samples in downstream order were obtained at the following stream sampling sites: SL1, SL2, SL3, SL4, SL5, SL6, SL7, SL8, R1, SL9, SL10, and SL11 (Refer to Appendices A, B, C, and G and Figure 3).

Sites SL1 through SL3 are headwater sites on Raccoon Creek and Burgetts Fork. Water quality at these sites is characterized by net-alkaline water and low-metal concentrations. When 2000 data is compared to the 1974 and 1983 water quality data from similar sampling sites, SL1 has remained relatively constant with a average pH ranging between 7.2 - 7.7 and average Total Iron ranging between 0.3 - 1.4 mg/L. SL2 has also remained relatively constant with average pH of 7.8 and average Total Iron ranging between 0.5 - 2.1 mg/L. SL3 was not previously sampled in other studies, however, its average pH was 7.3 and its average Total Iron was 2.2 mg/L.

Sample sites SL4 through SL6 are located in the Burgetts Fork sub-basin and exhibit decreased water quality from upstream sampling locations. Water quality at these sites is characterized by net-alkaline water and increasing metal concentrations (mostly iron). SL4 has improved since the 1983 study. It had not been sampled in the 1974 study. In 1983, SL4 had an average pH of 3.2 and an average Total Iron of 47.3 mg/L. During this investigation, SL4 was observed to improve with an average pH of 6.4 and average Total Iron of 40.7 mg/L. SL5 has also improved since the 1983 study. It had not been sampled in the 1974 study. In 1983, SL5 had an average pH of 4.3 and an average Total Iron of 5.8 mg/L. During this investigation, SL5 was observed to improve with an average pH of 5.7 and average Total Iron of 3.0 mg/L. SL6 has also improved since the 1983 study. It had not been sampled in the 1974 study. In 1983, SL6 had an average pH of 5.4 and an average Total Iron of 0.3 mg/L. During this investigation, SL6 was observed to improve with an average pH of 6.7 and average Total Iron of 0.3 mg/L.

Sample site SL7 is located in the Upper Raccoon Creek sub-basin downstream of the confluence of Burgetts Fork and Raccoon Creek. Water quality at this site is characterized by net-alkaline water and low-metal concentrations. SL7 had not been sampled in the 1974 or 1983 studies. During this investigation, SL7 was observed to have an average pH of 7.1 and average Total Iron of 2.9 mg/L. Though metal concentrations are low at this location, SL7 does exhibit the degradation that sample site SL8 characterizes in the Joffre area.

Sample site SL8 is located on an unnamed tributary to Raccoon Creek near the Village of Joffre. Water quality at this site is erratic. During this investigation, SL8 was observed to have an average pH of 4.5 and average Total Iron of 2.8 mg/L. SL8 had not been sampled in the 1974 or 1983 studies. As was discussed above, SL8 is a source of further degradation to downstream areas. Additionally, as the 1976 Scarlift Report (SL 130-7) discussed, this unnamed tributary (in the Joffre area) is one of the four tributaries responsible for water quality degradation (Gooding and Dougherty, 1976).

Sample site R1 is located at an unnamed tributary to Raccoon Creek along U.S. Route 22 near the Village of Bavington. Water quality at this site is characterized by net-alkaline water and low-metal concentrations. When compared to the 1974 and 1983 water quality data from a similar sampling site, R1 has remained relatively constant with a average pH ranging between 6.7 - 7.4 and average Total Iron ranging between 0.3 - 1.7 mg/L.

Sample site SL9 is located near the confluence of the Little Raccoon Run and Upper Raccoon Creek sub-basins. Water quality at this site is characterized by net-alkaline water and low-metal concentrations. SL9 has improved since the 1974 study. In 1974, SL9 had an average pH of 3.0 and an average Total Iron of 102 mg/L. During this investigation, SL9 was observed to improve with an average pH of 7.1 and average Total Iron of 0.3 mg/L. Since the 1976 Scarlift Report (SL 130-7) significant improvement has occurred in the Little Raccoon Creek sub-basin (as was also observed in the 1983 investigation) to Raccoon Creek. As was noted, Little Raccoon Creek was one of the four tributaries responsible for the majority of water quality degradation (Gooding and Dougherty, 1976).

Sample site SL10 is located on Raccoon Creek at Murdocksville. Water quality at this site is characterized by net-alkaline water and low-metal concentrations. During this investigation, SL10 was observed to have an average pH of 7.3 and average Total Iron of 1.1 mg/L. SL10 had not been sampled in the 1974 or 1983 studies.

Sample site SL11 is located on Potato Garden Run nearing the confluence with Raccoon Creek. Water quality at this site is characterized by net-alkaline water and low-metal concentrations. During this investigation, SL11 was observed to improve with an average pH of 7.3 and average Total Iron of 0.4 mg/L. SL11 had been sampled in the 1974 or 1983 studies. SL11 has improved since the 1974 study. In 1974, SL11 had an average pH of 2.9 and an average Total Iron of 70.9 mg/L. Additionally, as the 1976 Scarlift Report (SL 130-7) discussed, Potato Garden Run is one of the four tributaries responsible for water quality degradation (Gooding and Dougherty, 1976).

As is observed in Figures 3 and 4, the municipalities that contain the most significant AMD pollution are Burgettstown, Findlay, Hanover (Washington County), Robinson, and Smith. Burgettstown has an estimated population of 1,634 persons (PSDC, 1997) and is the largest community by population in Raccoon Creek watershed. Thus, Burgettstown has more people impacted by AMD in the watershed.

3. Comparison of 1974 Data versus 2000 Data Findings

A comparison of water quality data (1974 Scarlift Data [Gooding and Dougherty, 1976] versus 1999/2000 Data) was performed for this investigation (USDA, 2000). Current data was available for fifty-one of the seventy-one Scarlift sampling points. This comparison indicates that of the fifty-one sample locations, twenty-nine sites are adding increased amounts alkalinity (loadings) to the watershed (4,784 tons per year) versus the 1974 quantities, one is adding increased acidity (loadings) to the watershed (8 tons per year) versus the 1974 quantities, four are adding increased iron (loadings) to the watershed (15 tons per year) versus the 1974 quantities, and five are adding increased sulfates (loadings) to the watershed (80 tons per year) versus the 1974 data. Impacts to the watershed continue from the Upper Raccoon Creek (Joffre area) sub-basin

(SR2, SR3, SR5, and SR10) in terms of iron and sulfate loadings. For this comparison, the majority of the improvements to water quality from 1974 to the present have occurred in the Little Raccoon Run and Potato Garden Run sub-basins. In Little Raccoon Run, though some negative increases have occurred to a few sampling locations (SR22, SR23, SR30, SR40, and SR47) in terms of acidity, iron, and sulfate loadings, these increases have been negated by more substantial improvements in alkalinity loadings at other sampling locations (SR21, SR25, SR26, SR27, SR28, SR32, SR33, SR 42, SR43, SR45, SR46, and SR47). In the Potato Garden Run sub-basin, an increase in the alkalinity loadings has occurred here (SR34, SR55, SR57, SR58, SR61, SR65, and SR66) since 1974 (Refer to Appendix G). From this comparison, it can be seen that the Raccoon Creek watershed has made improvements to its overall water quality. Degradation in areas still exist, however, remediation projects to reduce the major discharge problems in the Burgetts Fork, Upper Raccoon Creek, and Potato Garden Run sub-basins are detailed in Section V, Proposed Remediation Design. When completed, these treatment systems will further improve conditions.

4. RCWA Biological Data Findings

Additional biological samples have been collected by the RCWA, in partnership with Burgettstown High School. Students and RCWA members completed a benthic macro-invertebrate study in fall 1999 and spring 2000 (RCWA, 1999/2000). Five stream reach locations were sampled. Generally the biological samples confirm the condition of the watershed's streams. The study also showed the same trend in the streams' biological conditions as was shown in earlier studies (Refer to Appendix H).

B. PRIMARY AMD SITES

The seven primary AMD discharge sites in the Raccoon Creek watershed are L2, P6, P7, E1, JB1, JB2, and H3 (Refer to Appendices A through C and Figure 3): The sites were selected as the primary AMD sites by Mr. John Davidson, PADEP, based upon historical data collection, his extensive knowledge of the Raccoon Creek watershed, and the large amount of historical and current water quality data for these locations. Additional water quality data and flow estimations were then provided by PADEP for incorporation into this plan. SL 130-7 ranks the stream reach areas to make improvements to water quality. Three of the present (2000) plan's seven primary AMD sites are located in the 1976 Scarlift study area. Of the primary AMD sites, sites JB1 and JB2 (Stream Reach Abatement Priority Index #4) and site H3 (Stream Reach Abatement Priority Index #18) are located in the priority areas. These areas have been recommended to have surface reclamation (Gooding and Dougherty, 1976). The primary AMD sites are characterized below and prioritized for remediation in Section V, Proposed Remediation Design.

1. Langeloth Borehole (L2)

The Langeloth Borehole project is under construction and is approximately 90% complete. This project is a partnership between the RCWA, WCWA, WCCD, WPCAMR, and PADEP. Funding was provided by both WPCAMR ($42,106.00) and PADEP ($19,600.00). The L2 site is located along Balogna Industrial Road west of State Route 18, 1/4 mile west of the Village of Slovan in Smith Township, Washington County. The treatment system design consists of an aerobic wetland or simple pond/wetland system, which provides detention, aeration, and storage for iron sludge.

2. East Plum Run (P6)

The East Plum Run site is located behind the structure located at 37 Plum Run Avenue in Burgettstown. The estimated flow rate is 19 gallons per minute (gpm). The discharge is characterized as a low-flow, net-acid, metal-laden discharge. Aluminum is present in the discharge at a concentration measured at 6 milligrams per Liter (mg/L). This limits the method of passive treatment and design of the system. Iron is also present in the discharge at a measured concentration of 31 mg/L. One and a third tons per year of iron and 1/4 ton per year of aluminum is introduced to the watershed via this discharge point.

3. West Plum Run (P7)

The West Plum Run site is located 50 feet upstream from P6 along Plum Run Avenue. The estimated flow rate is 247 gpm. The discharge is characterized as a high-flow, slightly net-acid, metal-laden discharge. Aluminum is present in the discharge at an average concentration of less than 0.5 mg/L. Iron is also present in the discharge at an average concentration of 73 mg/L. Over 39 tons per year of iron and approximately 1/4 ton per year of aluminum is introduced to the watershed via this discharge point.

4. Erie Mine (E1)

The Erie Mine site is located along Burgetts Fork below Ballfield Road and next to Hill Stadium in Burgettstown. Flow rates vary from under 30 gpm to 250 gpm. The estimated flow rate is 113 gpm. The discharge is characterized as a moderate-flow, net-alkaline, iron-laden discharge. Although a small amount of aluminum is also present, iron is the main contaminant of concern and is present at an average concentration measured at 73 mg/L. Over 18 tons per year of iron is introduced to the watershed via this discharge point.

5. Joffre Borehole (JB1)

This Joffre Borehole site is located adjacent at the end of Bonnymeade Drive along State Route 4015 in the Village of Bonnymeade, Smith Township. The estimated flow rate is 980 gpm. The discharge is characterized as a high-flow, net-acid, metal-laden discharge. Aluminum is present in the discharge at an average concentration measured at 6 mg/L. This limits the method of passive treatment and design of the system. Iron is also present in the discharge at an average concentration measured at 43 mg/L. Ninety-two tons per year of iron and 13 tons per year of aluminum are introduced to the watershed via this discharge point.

JB1 is an artesian discharge located about 20 feet above the base of the Pittsburgh coal seam. The SL 130-7 Report stated that the JB1 discharge drained a large mine pool with an elevation estimated at or near 1,000 feet. According to the Pittsburgh and Eastern Coal Company Mine No. 2 Map (scale 1" = 400') dated 1925, JB1 emerges from an open slope entry into the No. 2 Mine. The map also indicates a haulage-way to the north, underneath Raccoon Creek, connecting the No. 2 Mine with the No. 3 Mine of the Pittsburgh and Eastern Coal Company. This haulage-way may serve as a link for a supply of water into the mine pool (Gooding and Dougherty, 1976). Currently, on the western side of Raccoon Creek downstream from the JB1 site, there is a refuse disposal site in operation (PennBalt, Inc. – Mine Permit #63871301, Mine #1 Refuse Disposal Site).

6. Joffre Borehole (JB2)

PADEP's Bureau of Abandoned Mine Reclamation, Ebensburg District Office, in conjunction with the RCWA, has designed the JB2 project to treat this major source of AMD. The project was awarded two EPA Section 319 grants for $80,000 & $142,800 from the PADEP.

The JB2 site is located along the east side of State Route 4015 between the villages of Cherry Valley and Hickton in Smith Township, Washington County. The discharge currently passes under the roadway through a 36-inch diameter culvert. Using water chemistry and flow data provided by Mr. John Davidson of the PADEP, Greensburg District Mining Office, a vertical flow (also known as a successive alkalinity producing system [SAPS]) passive treatment system was designed. The treatment system consists of a sedimentation pond, a vertical flow wetland, and a second sedimentation pond.

The estimated flow rate is 94 gpm. The discharge is characterized as a moderate-flow, net-acid, metal-laden discharge. Aluminum is present in the discharge at an average concentration measured at 12 mg/L. This limits the method of passive treatment and design of the system. Iron is also present in the discharge at an average concentration measured at 65 mg/L. Over thirteen tons per year of iron and 2.5 tons per year of aluminum are introduced to the watershed via this discharge point.

JB2 is a combination strip mine and deep mine discharge emerging from the base of strip mine spoils at the original outcrop. The source is situated near the location of an old drift to the Armide No. 1 Mine. The drift entry was strip mined in the mid 1960's (Gooding and Dougherty, 1976). Currently, on the western side of Raccoon Creek across from the JB2 site, there is a refuse disposal site in operation (PennBalt, Inc. – Mine Permit #63871301, Mine #1 Refuse Disposal Site).

7. Hamilton (H3)

The Pennsylvania Turnpike Commission (PTC) and the U. S. Department of Interior, Office of Surface Mining (OSM), in conjunction with the RCWA, is in the planning stages to treat this major source of AMD in the watershed. The PTC is providing $100,000.00 (stream and wetland mitigation funds for the Southern Beltway project) and the OSM is providing $80,000.00 (Appalachian Clean Streams Initiative Program) for this project.

The H3 site is located along the east side of State Route 3089 between U.S. Route 30 and State Route 3071 in Findlay Township, Allegheny County. The treatment system being designed by PADEP, Bureau of Abandoned Mine Reclamation consists of an aerobic wetland and successive alkalinity producing system (PADEP, 2000).

Flow rates vary from under 11 gpm to 148 gpm. The estimated flow rate is 75 gpm. The discharge is characterized as a moderate-flow, net-alkaline, iron-laden discharge. Iron is present in the discharge at an average concentration measured at 45 mg/L. Over seven tons per year of iron is introduced to the watershed via this discharge point.

## C. SECONDARY AMD SITES

Numerous secondary AMD discharge sites exist in the watershed and should be considered important sources of water quality degradation. Mr. John Davidson of PADEP, Greensburg District Mining Office provided water quality data on the secondary AMD sites as a guide for potential future remediation activities, once the primary AMD sites are remediated. The following seventeen secondary AMD sites have been grouped into the following three categories so as to provide insight. These sites will need further detailed study in order to complete engineering/design remediation specifications (Refer to Figure 3):

- Net Acid with Metals: PG4, PG20, PG21, PG22, PG31, PG32, PG36, BR9, JB5, JB6, JB7, and JB25;
- Net Acid with No Metals: SP15 and SP16; and
- Net Alkaline with Iron: PG26, SR8, and SR68.

## V.  PROPOSED REMEDIATION DESIGN

The following proposed remedial actions for primary AMD sites involve the use of passive treatment technologies.  Passive treatment technologies are considered the most feasible option since maintenance costs associated with this type of treatment are typically lower in comparison to other systems.  These other systems are usually cost prohibitive for local conservation organizations.  Three of seven primary AMD sites (L2, JB2, and H3) are currently either under construction or are being prepared for construction activities.  Based on a prioritization of acidity and iron loadings per discharge, remediation of the remaining four primary AMD sites would be as follows:

1. JB1 (Acidity 24.91 tons/yr. + iron 91.63 tons/yr. = 116.54 tons/yr.);
2. P7 (Acidity 19.08 tons/yr. + iron 85.31 tons/yr. = 104.39 tons/yr.);
3. E1 (Acidity 3.07 tons/yr. + iron 18.07 tons/yr. = 21.14 tons/yr.); and
4. P6 (Acidity 17.58 tons/yr. + iron 1.86 tons/yr. = 19.44 tons/yr.).

Besides providing proposed remediation designs for the seven primary AMD sites as separate facilities, an eighth design for a combined or hybrid system for discharges P6, P7, and E1 has been prepared.

The following proposed remediation design cost estimations are based upon other projects of similar nature that have been completed by Skelly and Loy, Inc.  Certain assumptions were made in regard to the major bid items in order complete cost estimations for the primary AMD sites and involve a variety of site specific constraints (Refer to Appendix I and Figures 3 and 5).  *Some costs may vary and additional specific site information needed to more specifically estimate costs for recommended actions.  The cost estimate information is provided to assist readers in gauging the approximate cost of each proposed remediation action and in prioritizing activities.  The cost estimate information should not be inferred as the cost of completing each action.*

### A. Langeloth Borehole (L2)

The L2 project is approximately 90% complete, however all parties have agreed that continued monitoring of this site is necessary, and that it should be included within this report as a major source of AMD.  This project is a partnership between the RCWA, WCWA, WCCD, WPCAMR, PADEP, and the United State Department of Agriculture, Natural Resource Conservation Service (USDA, NRCS).  Engineering/Site Design was provided by USDA – NRCS and funding was provided by WPCAMR ($42,106.00) and PADEP ($19,600.00).  The L2 site is located along Balogna Industrial Road west of State Route 18, 1/4 mile west of the Village of Slovan in Smith Township, Washington County.  The treatment system design consists of an aerobic wetland or simple pond/wetland system, which provides detention, aeration, and storage for iron sludge.

B. East Plum Run (P6)

The recommended passive treatment system for this discharge is a vertical flow wetland (also known as a successive alkalinity producing system [SAPS]) consisting of an alkaline-producing cell. The alkaline producing cell consists of a column of water above a compost layer which overlays a limestone layer. A flushing mechanism should also be included for removal of aluminum from the cell. Water discharging from the cell should be directed to an aerobic cell with a pond/wetland system for aeration, detention, and storage of metal sludges. Based upon the water quality data and general design criteria, approximately 800 tons of limestone may be required. The alkaline addition cell would be placed in an area of 1/3 to 2/3 acre. The discharge would be directed to a small pond/wetland system that may be placed in an area of less than one acre. It may be possible to place the treatment system on less than two acres, depending on topographic conditions and other constraints. As appropriate, emerging technologies should be considered such as passive flushing systems for aluminum and windmill or water-wheel power for aeration (Refer to Appendix J). A passive aluminum flushing system would involve the use of PVC piping with sanitary fittings and a valve. The outlet pipe from the SAPS, is sloped to allow enough velocity in the outlet pipe to siphon aluminum precipitate from the system. Periodically, this flushing maintenance activity may need to be performed in order to keep the system fully functional.

| MAJOR BID ITEMS | QUANTITY | UNIT | UNIT PRICE | COST |
|---|---|---|---|---|
| Clearing/Grubbing | 2 | Acre(s) | $500.00 | $1,000 |
| Pollution Control | 400 | Feet | $3.00 | $1,200.00 |
| Seeding | 2 | Acre(s) | $1,500.00 | $3,000.00 |
| Access | 1 | Job | $5,000.00 | $5,000.00 |
| Excavation & Fill Settling Basin | 1 | Each | $15,000.00 | $15,000.00 |
| Excavation & Fill Wetland | 1 | Each | $5,000.00 | $5,000.00 |
| Compost Wetland | 2,500 | Square Yards | $4.00 | $10,000.00 |
| Limestone Channel | 100 | Feet | $28.00 | $2,800.00 |
| Rockfill -SAP | 800 | Tons | $20.00 | $16,000.00 |
| Compost - SAP | 2,500 | Square yards | $4.00 | $10,000.00 |
| Pipe (6") - SAP | 400 | Feet | $8.00 | $3,200.00 |
| **Construction Sub-Total** | | | | **$72,200.00** |
| Construction Cost Contingencies | | 20 Percent | | $14,440.00 |
| Engineering = % of Construction | | 10 Percent | | $7,220.00 |
| Project Administration = % of Construction | | 8 Percent | | $5,776.00 |
| Mobilization/Demobilization % of Construction | | 10 Percent | | $7,220.00 |
| Land Rights | 2 | Acre(s) | $2,000.00 | $4,000.00 |
| **Total** | | | | **$110,856.00** |

C. West Plum Run (P7)

The recommended passive treatment system for this discharge is an Anoxic Limestone Drain (ALD). An ALD includes a buried bed of limestone for alkalinity production. A backup flushing mechanism may be included for removal of aluminum from the ALD. Water discharging from the ALD would be directed to an aerobic cell with a pond/wetland system for aeration, detention, and storage of metal sludges. This system would include at least two ponds for iron removal followed by a wetland. Based upon the water quality data and general design criteria, approximately 15,000 tons of limestone may be required. This limestone may be placed in an area of approximately two acres. The alkaline addition cell may be followed by two ponds and a wetland approximately 6 acres in size. The entire treatment system may take an area of approximately 10 acres. As appropriate, emerging technologies should be considered such as ALD flushing systems for aluminum and windmill or water-wheel power for supplemental aeration.

| MAJOR BID ITEMS | QUANTITY | UNIT | UNIT PRICE | COST |
|---|---|---|---|---|
| Clearing/Grubbing | 10 | Acre(s) | $500.00 | $5,000.00 |
| Pollution Control | 2,000 | Feet | $3.00 | $6,000.00 |
| Seeding | 10 | Acre(s) | $1,500.00 | $15,000.00 |
| Access | 1 | Job | $5,000.00 | $5,000.00 |
| Excavation & Fill Settling Basin | 2 | Each | $30,000.00 | $60,000.00 |
| Excavation & Fill Wetland | 1 | Each | $10,000.00 | $10,000.00 |
| Compost Wetland | 28,000 | Square Yards | $4.00 | $112,000.00 |
| Limestone Channel | 2,000 | Feet | $28.00 | $56,000.00 |
| Rockfill -ALD | 15,000 | Tons | $20.00 | $300,000.00 |
| Pipe (6") - ALD | 800 | Feet | $8.00 | $6,400.00 |
| **Construction Sub-Total** | | | | **$575,400.00** |
| Construction Cost Contingencies | | 20 Percent | | $115,080.00 |
| Engineering = % of Construction | | 10 Percent | | $57,540.00 |
| Project Administration = % of Construction | | 8 Percent | | $46,032.00 |
| Mobilization/Demobilization % of Construction | | 10 Percent | | $57,540.00 |
| Land Rights | 10 | Acre(s) | $2,000.00 | $20,000.00 |
| **Total** | | | | **$851,592.00** |

D. Erie Mine (E1)

The recommended passive treatment system for this discharge is an aerobic wetland or a simple pond/wetland system to provide detention, aeration, and storage of iron sludge. Given adequate space to provide retention time, the iron will precipitate. Based on typical sizing criteria for maximum flow rates, a treatment area of approximately three acres would be required, possibly consisting of two ponds and a wetland. Typical design criteria should be coupled with space limitations to optimize design. As appropriate, emerging technologies should be considered such as windmill or water-wheel power for aeration.

| MAJOR BID ITEMS | QUANTITY | UNIT | UNIT PRICE | COST |
|---|---|---|---|---|
| Clearing/Grubbing | 3 | Acre(s) | $500.00 | $1,500.00 |
| Pollution Control | 600 | Feet | $3.00 | $1,800.00 |
| Seeding | 3 | Acre(s) | $1,500.00 | $4,500.00 |
| Access | 1 | Job | $5,000.00 | $5,000.00 |
| Excavation & Fill Settling Basin | 2 | Each | $15,000.00 | $30,000.00 |
| Excavation & Fill Wetland | 1 | Each | $5,000.00 | $5,000.00 |
| Compost Wetland | 14,000 | Square Yards | $4.00 | $56,000.00 |
| Limestone Channel | 300 | Feet | $28.00 | $8,400.00 |
| **Construction Sub-Total** | | | | **$112,200.00** |
| Construction Cost Contingencies | | 20 Percent | | $22,440.00 |
| Engineering = % of Construction | | 10 Percent | | $11,220.00 |
| Project Administration = % of Construction | | 8 Percent | | $8,976.00 |
| Mobilization/Demobilization % of Construction | | 10 Percent | | $11,220.00 |
| Land Rights | 3 | Acre(s) | $2,000.00 | $6,000.00 |
| **Total** | | | | **$172,056.00** |

E. East Plum Run/West Plum Run/Erie Mine Hybrid

The recommended passive treatment system for these combined discharges would involve a hybrid passive treatment approach. Each discharge (P6, P7, and E1) has different water quality issues. However, the water quality and flow data suggest that combining these discharges may result in a net alkaline discharge which may eliminate or reduce the need for alkaline addition. Average alkalinity and acidity loading indicate that a net alkaline discharge would result. However, occasions did exist when a net acid load would result in a small percentage of the sample events.

The recommended passive treatment system approach for the combination of the Erie Mine (E1) and Plum Run (P6 and P7) discharges is a water transmission line for the Plum Run discharges and a simple pond/wetland system for the combined discharges to provide detention, aeration, and storage of the metal sludge. Given adequate space to provide retention time, the metals will precipitate and drop out. Based on typical sizing criteria for maximum flow rates, a treatment area of approximately fifteen acres would be required, possibly consisting of multiple ponds, wetlands, and aeration berms. Typical design criteria should be coupled with space limitations to optimize design.

The most difficult part for this hybrid system may be in the transmission of the water from the Plum Run discharges to the Erie Mine area. The water transmission line would bisect a neighborhood area and multiple properties. An easement or right-of-way must be negotiated for this purpose. In order to provide aeration and detention for the combined discharges, a location needs to be identified which contains approximately fifteen acres with gravity drainage below the Erie Mine. A possible location is found directly below the Erie Mine discharge. This location must be field verified utilizing surveying techniques as necessary to confirm the feasibility. If the location is suitable (barring other potential constraints), and land rights can be acquired, a hybrid treatment system could be constructed. Typical design criteria should be coupled with space limitations to optimize design. As appropriate, emerging technologies should be considered such as windmill or water-wheel power for aeration.

There are advantages to this remediation option. These include:

1) The treatment of the three discharges is accomplished at one location, therefore maintenance activities are minimized;
2) With one significant project, three of the four remaining seven primary AMD sites would be constructed. This would lead to significant improvements to water quality in the Burgetts Fork drainage area;
3) Construction of this option and its environmental benefits (as discussed in Section I) would yield improved economic benefits from fishing and other outdoor recreation;
4) Construction of this option would give local educators a unique passive system / laboratory that students could use to expand local science curriculums;
5) Improved aesthetics would potentially assist in fostering community

development activities that otherwise would not have occurred; and
6) Costs associated with alkaline limestone addition may be eliminated or significantly reduced.

However, there are disadvantages as well. These include:

1) Potential problems associated with transporting the Plum Run discharges to this location;
2) Attaining land rights, rights-of-way, and/or easements from numerous property owners;
3) Limited hydraulic head available for transmitting the Plum Run discharges to Erie Mine; and
4) The possibility that a net alkaline discharge would not occur at all times resulting in lower overall treatment efficiencies.

| MAJOR BID ITEMS | QUANTITY | UNIT | UNIT PRICE | COST |
|---|---|---|---|---|
| Clearing/Grubbing | 15 | Acre(s) | $500.00 | $7,500.00 |
| Pollution Control | 3,000 | Feet | $3.00 | $9,000.00 |
| Seeding | 15 | Acre(s) | $1,500.00 | $22,500.00 |
| Access | 1 | Job | $5,000.00 | $5,000.00 |
| Excavation & Fill Settling Basin | 6 | Acres | $30,000.00 | $180,000.00 |
| Excavation & Fill Wetland | 4 | Acres | $20,000.00 | $80,000.00 |
| Pipe (18”) Transport P6 and P7 | 6,000 | Feet | $30.00 | $180,000.00 |
| **Construction Sub-Total** | | | | **$484,000.00** |
| Construction Cost Contingencies | | 20 Percent | | $96,800.00 |
| Engineering = % of Construction | | 10 Percent | | $58,800.00 |
| Project Administration = % of Construction | | 8 Percent | | $46,400.00 |
| Mobilization/Demobilization % of Construction | | Lump Sum | | $20,000.00 |
| Land Rights | 15 | Acre(s) | $2,000.00 | $30,000.00 |
| **Total** | | | | **$736,000.00** |

F. Joffre Borehole (JB1)

The recommended passive treatment system for this discharge is a vertical flow wetland consisting of an alkaline-producing cell with a compost layer and limestone layer, a flushing mechanism for removal of aluminum from the cell, and an aerobic component with a pond/wetland system for aeration, detention, and storage of metal sludges. Recovery of aluminum will be considered as a potential asset to this project. Based upon the water quality data and general design criteria, up to 28,500 tons of limestone may be required. The total system area may require 12-15 acres. It may be possible to reduce the limestone tonnage based on bench scale testing to determine actual alkalinity production rates. This would also reduce the required treatment area size. The use of emerging technologies such as passive flushing systems for aluminum handling and windmill or water-wheel power for aeration should also be considered.

| **MAJOR BID ITEMS** | **QUANTITY** | **UNIT** | **UNIT PRICE** | **COST** |
|---|---|---|---|---|
| Clearing/Grubbing | 15 | Acre(s) | $500.00 | $7,500.00 |
| Pollution Control | 3,000 | Feet | $3.00 | $9,000.00 |
| Seeding | 15 | Acre(s) | $1,500.00 | $22,500.00 |
| Access | 1 | Job | $5,000.00 | $5,000.00 |
| Excavation & Fill Settling Basin | 1 | Each | $100,000.00 | $100,000.00 |
| Excavation & Fill Wetland | 1 | Each | $50,000.00 | $50,000.00 |
| Compost Wetland | 4,800 | Square Yards | $4.00 | $19,200.00 |
| Limestone Channel | 3,000 | Feet | $28.00 | $84,000.00 |
| Rockfill -SAP | 28,500 | Tons | $20.00 | $570,000.00 |
| Compost - SAP | 56,000 | Square Yards | $4.00 | $224,000.00 |
| Pipe (6") - SAP | 9,600 | Feet | $8.00 | $76,800.00 |
| **Construction Sub-Total** | | | | $1,168,000.00 |
| Construction Cost Contingencies | | 20 Percent | | $233,600.00 |
| Engineering = % of Construction | | 10 Percent | | $116,800.00 |
| Project Administration = % of Construction | | 8 Percent | | $93,440.00 |
| Mobilization/Demobilization % of Construction | | 10 Percent | | $116,800.00 |
| Land Rights | 15 | Acre(s) | $2,000.00 | $30,000.00 |
| **Total** | | | | **$1,758,640.00** |

G. Joffre Borehole (JB2)

Using water chemistry and flow data provided by Mr. John Davidson of the PADEP, Greensburg District Mining Office, a vertical flow (also known as a SAPS) passive treatment system has been designed by PADEP, Bureau of Abandoned Mine Reclamation. The treatment system consists of a sedimentation pond, a vertical flow wetland (SAPS), and a second sedimentation pond. The project was awarded two EPA Section 319 grants for $80,000 and $142,800 from the PADEP for a total project cost of $220,800 for construction. Construction for this project should begin in 2001.

H. Hamilton (H3)

The PADEP, Bureau of Abandoned Mine Reclamation has completed the engineering design for this AMD remediation project. The following project cost estimate was a part of the engineering design by PADEP (PADEP, 2000). The PTC is providing $100,000.00 and the OSM is providing $80,000.00 for construction of this project.

| **MAJOR BID ITEMS** | **QUANTITY** | **UNIT** | **UNIT PRICE** | **COST** |
|---|---|---|---|---|
| Clearing/Grubbing | Job | Job | Lump Sum | $1,000.00 |
| Implementation of E&S Plan | Job | Job | Lump Sum | $1,000.00 |
| Seeding | Job | Job | Lump Sum | $4,200.00 |
| Wetland Construction: | | | | |
| Pond 1 | 712 | Cubic Yards | $3.00 | $2,136.00 |
| SAPS Excavation | 34,500 | Cubic Yards | $3.00 | $103,500.00 |
| SAPS Limestone | 4,082 | Tons | $10.00 | $40,820.00 |
| 6 inch PVC Pipe | 705 | Linear Feet | $7.00 | $4,935.00 |
| 10 inch PVC Pipe | 150 | Linear Feet | $8.00 | $1,200.00 |
| Inline Level Control Structure | Job | Job | Lump Sum | $1,500.00 |
| Spent Mushroom Compost | 2,300 | Cubic Yards | $12.00 | $27,600.00 |
| Aerobic Wetland: | | | | |
| Spent Mushroom Compost | 210 | Cubic Yards | 12.00 | $2,520.00 |
| Wetland Planting | Job | Job | Lump Sum | $1,000.00 |
| Mobilization/Demobilization | Job | Job | | $5,000.00 |
| **Total** | | | | **$196,411.00** |

## VI. RECOMMENDATIONS

Raccoon Creek watershed has been impacted by AMD for many years. The numerous studies that have been completed to date have detailed the past and current water quality conditions that existed when each particular study was completed. The remediation of some discharges by re-mining/reclamation activities has resulted in water quality improvement. The primary sources of acidity and metals are sites L2, P6, P7, E1, JB1, JB2, and H3 (Refer to Figure 3). The remediation of these sites is critical to restoring Raccoon Creek's water quality and aquatic ecosystem.

Due to the recent efforts of the RCWA and their partnership, three on-going remediation activities are in differing states of completion (sites L2, JB2, and H3). These help the RCWA and its partnership towards their goal of restoring the Raccoon Creek watershed from degradation. These projects, along with the recently (1999) completed sewer project in the Burgettstown area, will make further watershed restoration improvements by addressing two significant NPS water quality issues.

Continued chemical and biological sampling of the watershed's AMD discharges and stream aquatic habitat will help gauge the effect remedial actions (current or future) will have on water quality.

The following recommendations are being made for the future remediation of AMD from the Raccoon Creek watershed:

- Complete PADEP Environmental Good Samaritan Act Forms for <u>all</u> AMD-related projects that are located on private property prior to commencing project activities (Refer to Appendix K);

- Continue on-going remediation projects (sites L2, JB2, and H3);

- Utilize the RCWA and other potential volunteers to assist with monitoring water quality and invertebrate community of Raccoon Creek and its tributaries;

- RCWA, local school districts, and other interested organizations continue to partner, and facilitate youth and adult environmental education (Refer to Figure 7);

- Partner with the PFBC to update the 1989 Raccoon Creek (and its tributaries) fish communities electrofishing evaluation;

- Continue planning proposed future remediation of the remaining four primary AMD discharge sites (P6, P7, E1, and JB1). These activities can include, but are not limited to, water sampling/analysis, flow calculations, land acquisition, funding acquisition, grant writing, and engineering/design of treatment system. Based on a prioritization of acidity and iron loadings per discharge location, remediation of the primary AMD sites would be as follows:

    1. JB1;

2. P7;
3. E1; and
4. P6;

- Remediate secondary AMD sites after primary AMD sites have been corrected;

- Utilize re-mining as a tool for reclamation of abandoned mine lands and associated AMD discharges;

- Utilize various state and federal funding programs (i.e., EPA Section 319, Title IV, Surface Mining Control and Reclamation Act [SMCRA], 10% Set Aside, OSM Emergency Reclamation, etc.) to remediate AMD sites. Submit grant applications to the Growing Greener program and submit additional grant applications to programs identified in Appendix D.

*The completion of this watershed plan will further assist by giving a higher ranking to all grant applications submitted by the partnership for making any and all future improvement projects to the Raccoon Creek watershed.*

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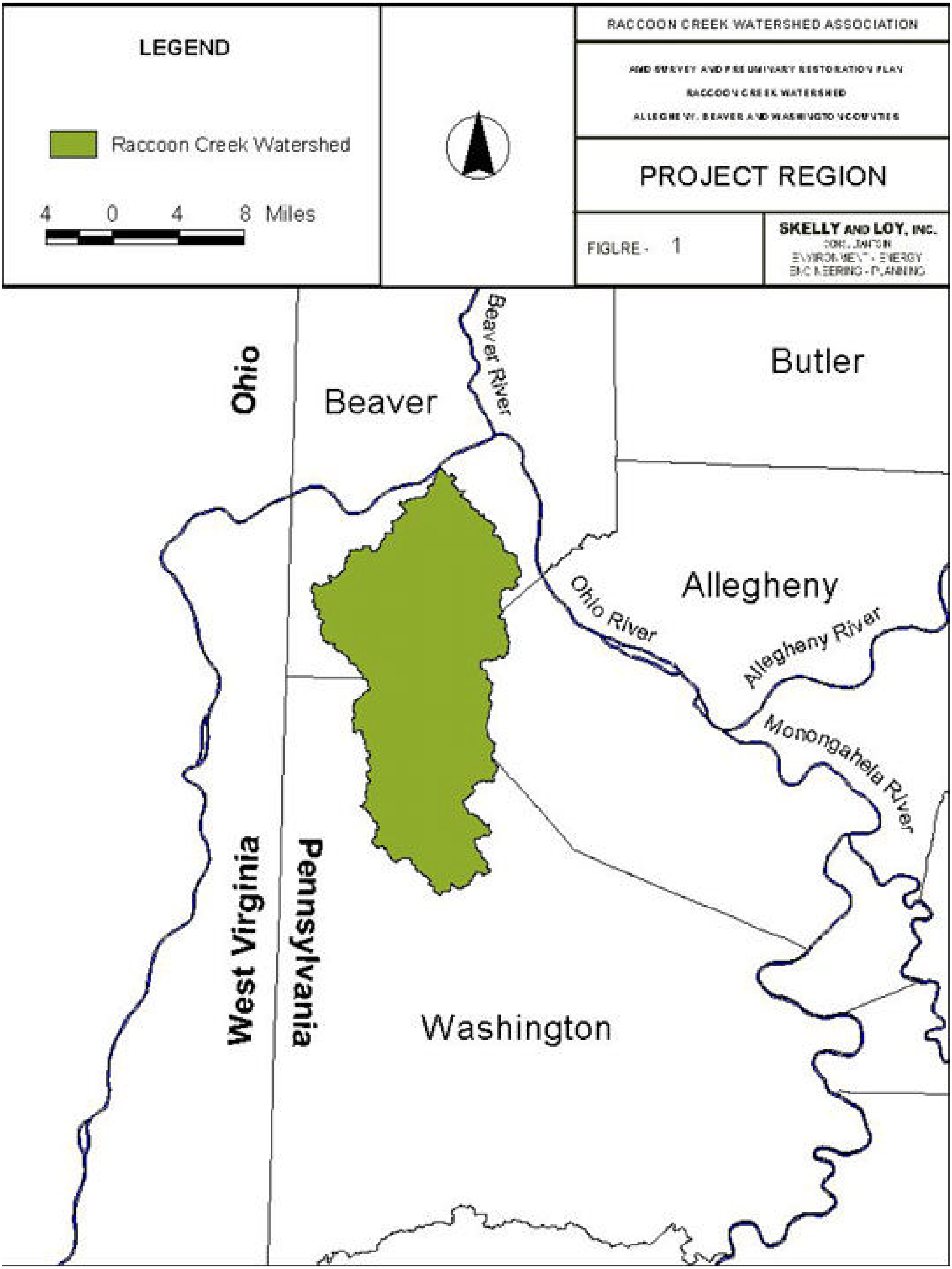
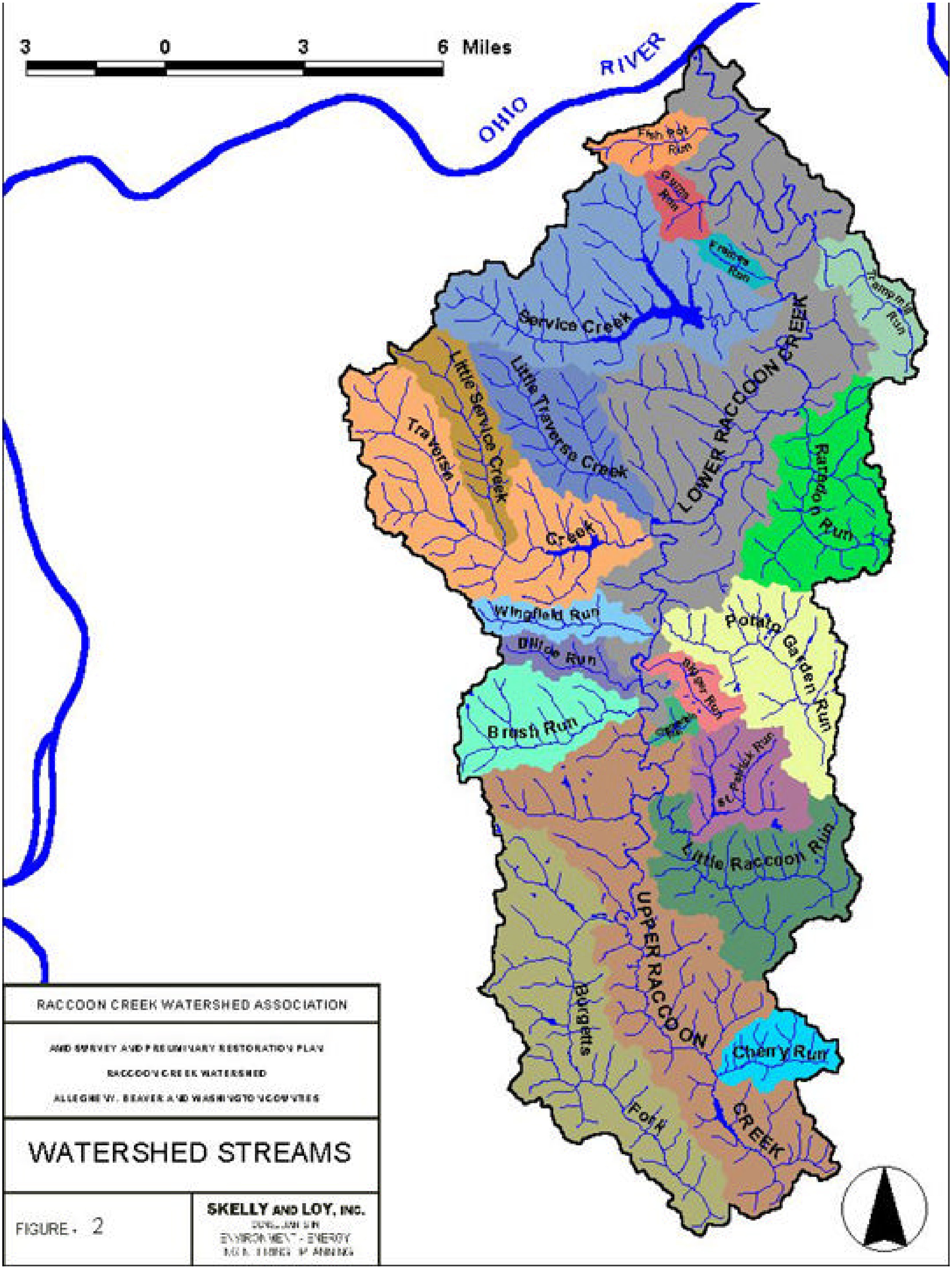
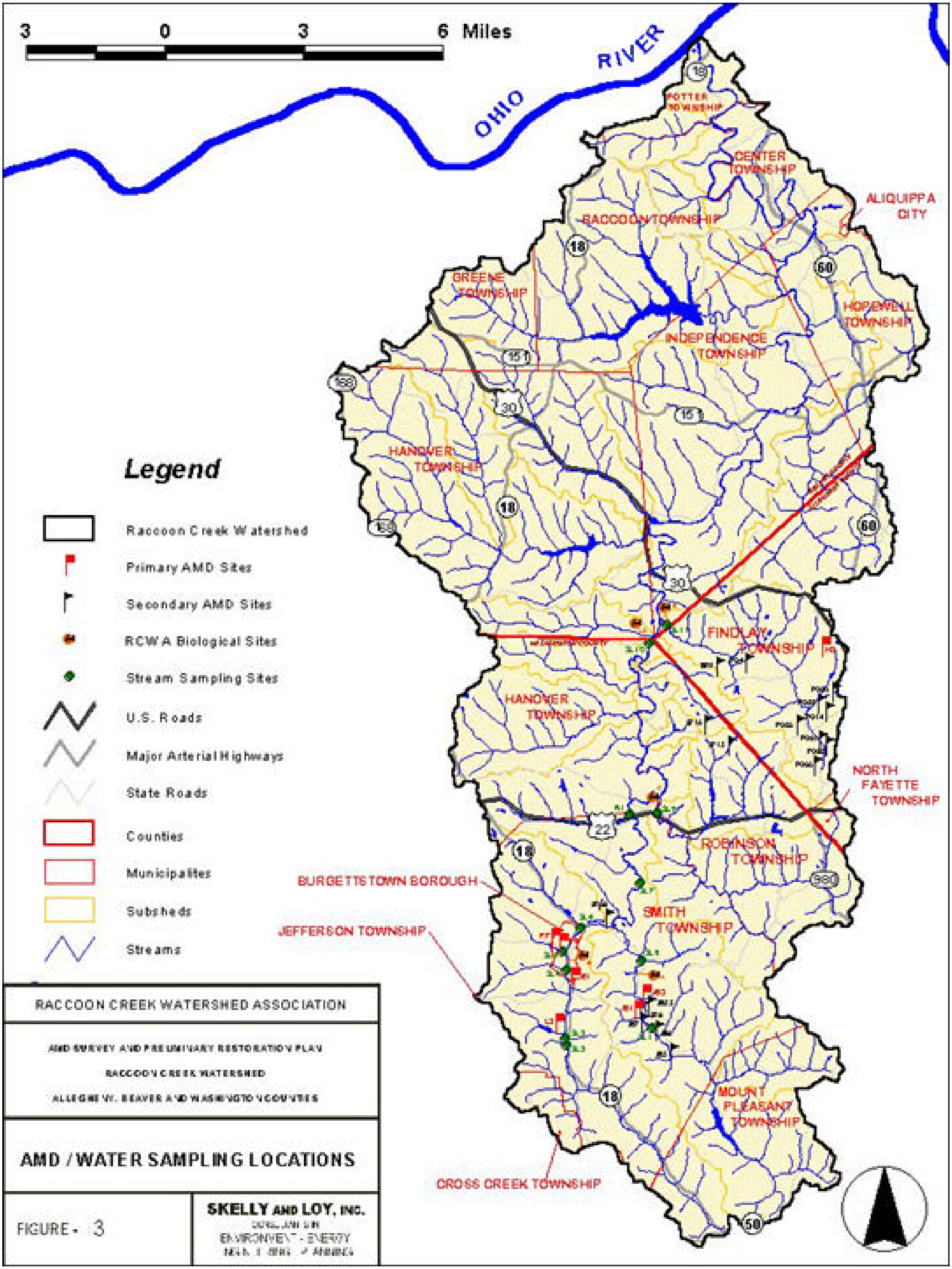
# FIGURES


LEGEND
Raccoon Creek Watershed
4 0 4 8 Miles
RACCOON CREEK WATERSHED ASSOCIATION
RACCOON CREEK WATERSHED
PROJECT REGION
FIGURE - 1
SKELLY AND LOY, INC.
Ohio
Beaver
Beaver River
Butler
Allegheny
Ohio River
Allegheny River
Monongahela River
West Virginia
Pennsylvania
Washington

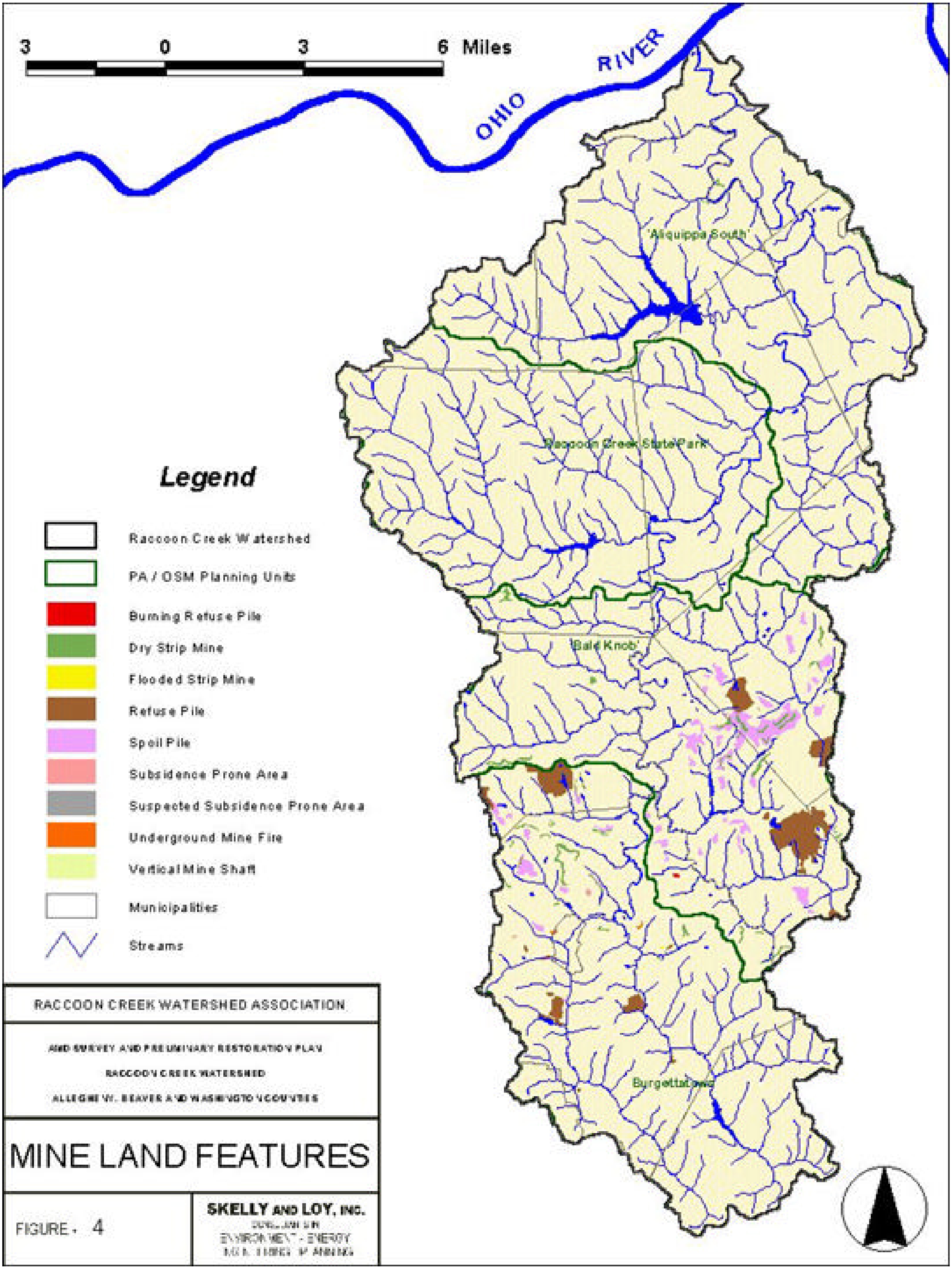



WATERSHED STREAMS

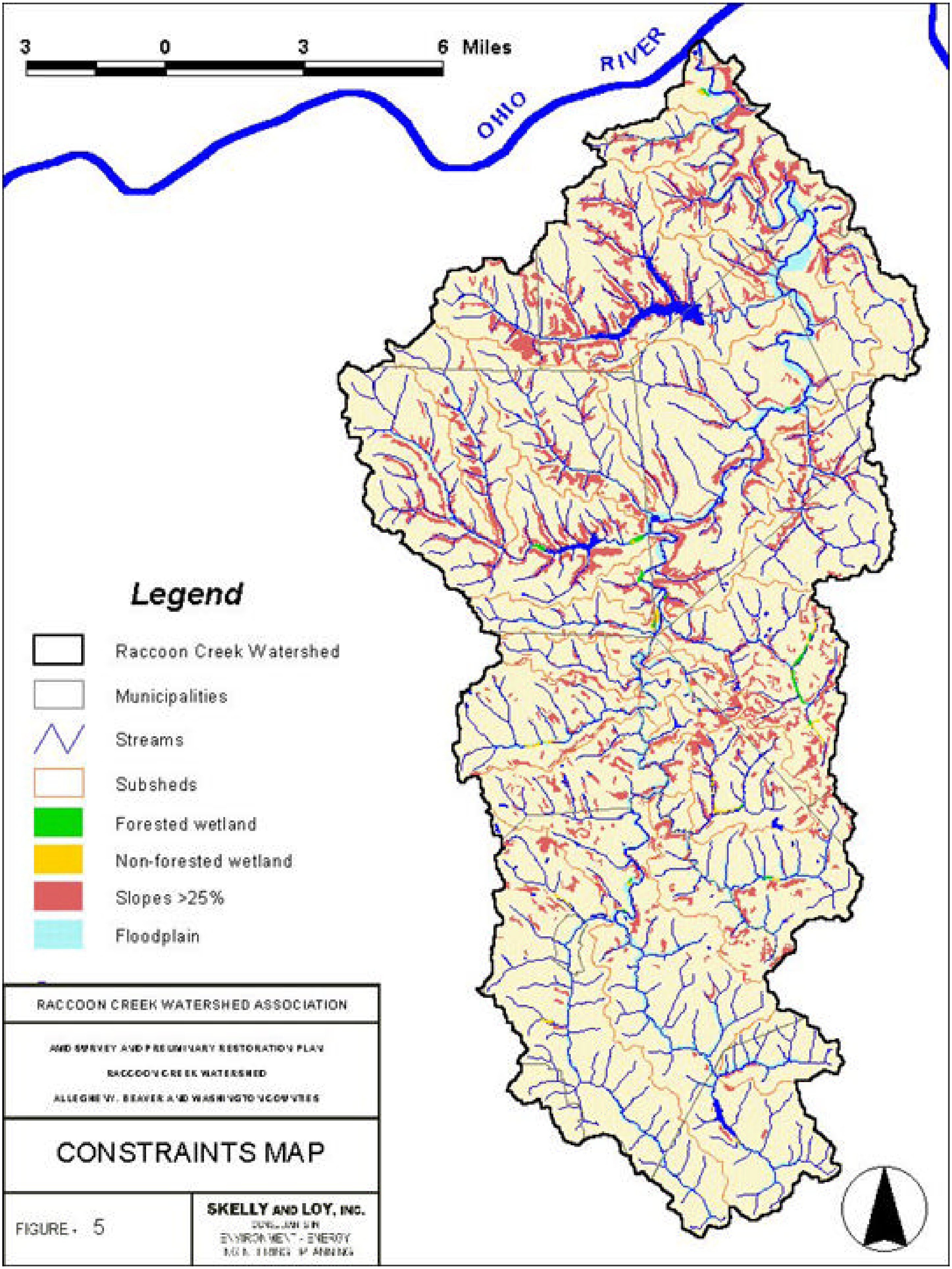
FIGURE - 2

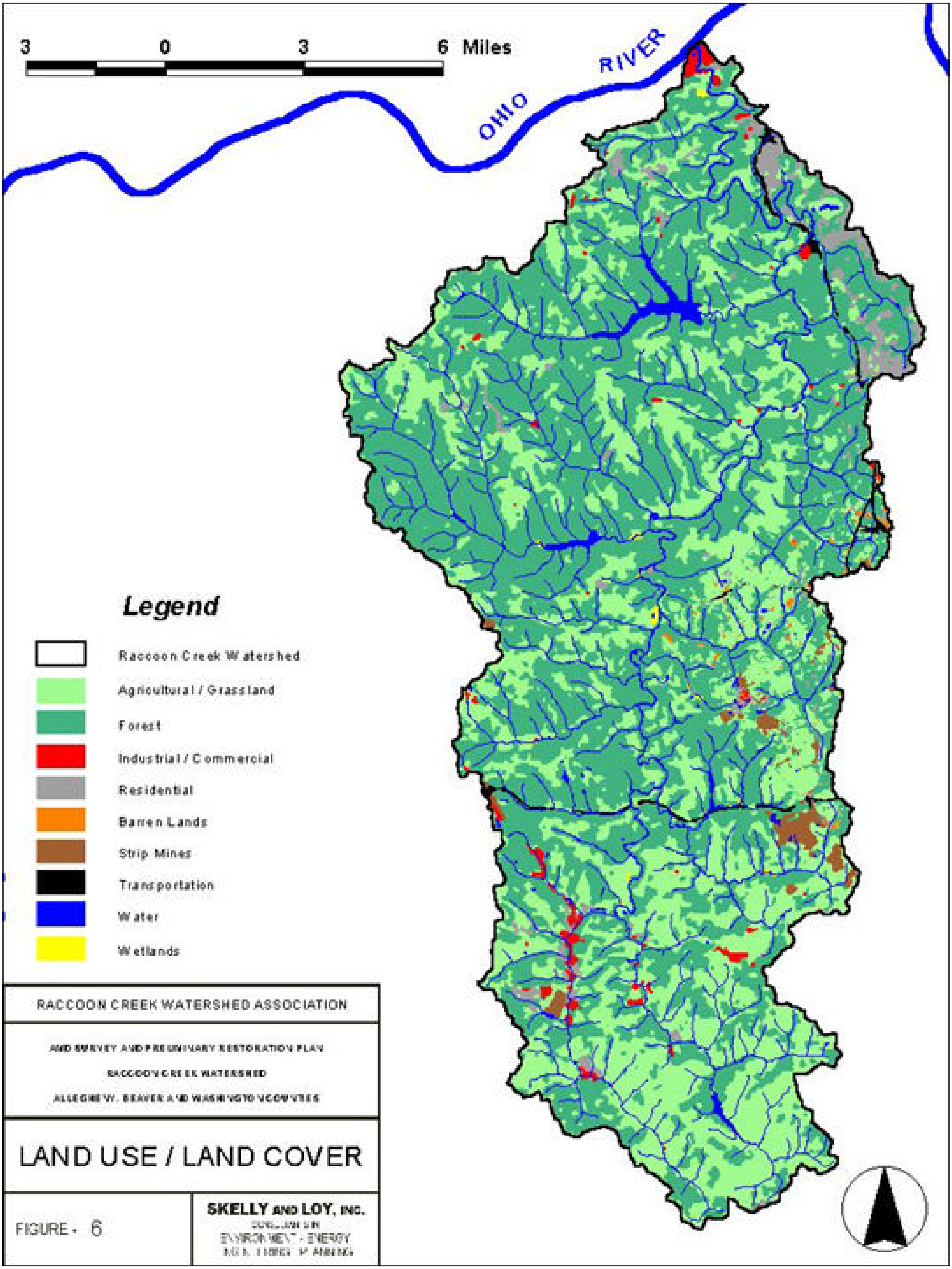


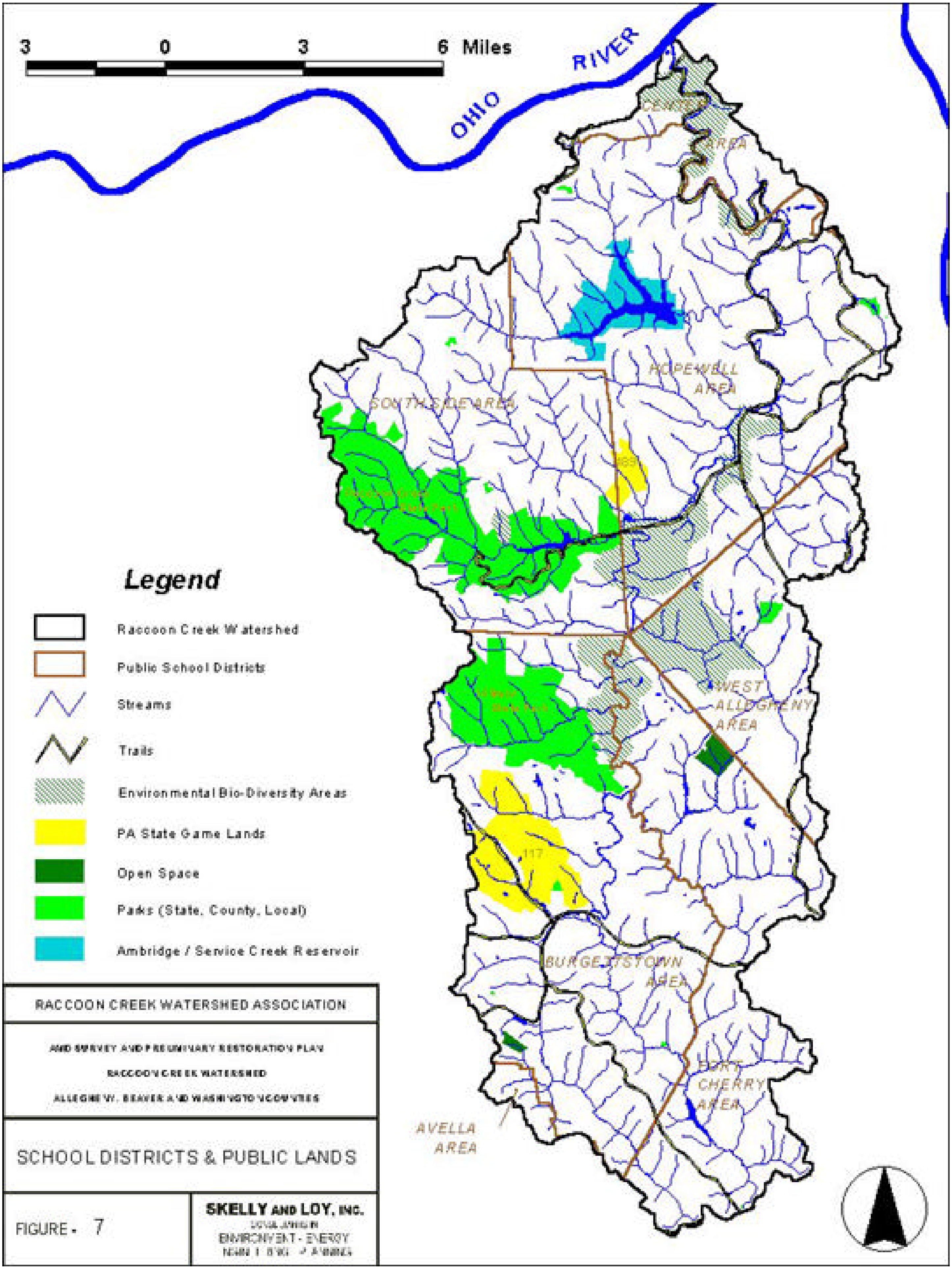
3 0 3 6 Miles
OHIO RIVER
POTTER TOWNSHIP
CENTER TOWNSHIP
ALIQUIPPA CITY
RACCOON TOWNSHIP
GREENE TOWNSHIP
HOPEWELL TOWNSHIP
INDEPENDENCE TOWNSHIP
HANOVER TOWNSHIP
FINDLAY TOWNSHIP
HANOVER TOWNSHIP
NORTH FAYETTE TOWNSHIP
ROBINSON TOWNSHIP
BURGETTSTOWN BOROUGH
JEFFERSON TOWNSHIP
SMITH TOWNSHIP
MOUNT PLEASANT TOWNSHIP
CROSS CREEK TOWNSHIP
Legend
Raccoon Creek Watershed
Primary AMD Sites
Secondary AMD Sites
RCWA Biological Sites
Stream Sampling Sites
U.S. Roads
Major Arterial Highways
State Roads
Counties
Municipalities
Subsheds
Streams
RACCOON CREEK WATERSHED ASSOCIATION
AMD SURVEY AND PRELIMINARY RESTORATION PLAN
RACCOON CREEK WATERSHED
ALLEGHENY, BEAVER AND WASHINGTON COUNTIES
AMD / WATER SAMPLING LOCATIONS
FIGURE - 3
SKELLY AND LOY, INC.



3 0 3 6 Miles
OHIO RIVER
'Aliquippa South'
Raccoon Creek State Park
'Bald Knob'
Burgettstown
Legend
Raccoon Creek Watershed
PA / OSM Planning Units
Burning Refuse Pile
Dry Strip Mine
Flooded Strip Mine
Refuse Pile
Spoil Pile
Subsidence Prone Area
Suspected Subsidence Prone Area
Underground Mine Fire
Vertical Mine Shaft
Municipalities
Streams
RACCOON CREEK WATERSHED ASSOCIATION
MINE LAND FEATURES
FIGURE - 4
SKELLY AND LOY, INC.


3 0 3 6 Miles
OHIO RIVER
Legend
Raccoon Creek Watershed
Municipalities
Streams
Subsheds
Forested wetland
Non-forested wetland
Slopes >25%
Floodplain
RACCOON CREEK WATERSHED ASSOCIATION
CONSTRAINTS MAP
FIGURE - 5
SKELLY AND LOY, INC.


3 0 3 6 Miles
OHIO RIVER
Legend
Raccoon Creek Watershed
Agricultural / Grassland
Forest
Industrial / Commercial
Residential
Barren Lands
Strip Mines
Transportation
Water
Wetlands
RACCOON CREEK WATERSHED ASSOCIATION
AMD SURVEY AND PRELIMINARY RESTORATION PLAN
RACCOON CREEK WATERSHED
ALLEGHENY, BEAVER AND WASHINGTON COUNTIES
LAND USE / LAND COVER
FIGURE - 6
SKELLY AND LOY, INC.


3 0 3 6 Miles
OHIO RIVER
HOPEWELL AREA
SOUTH SIDE AREA
WEST ALLEGHENY AREA
BURGETTSTOWN AREA
FORT CHERRY AREA
AVELLA AREA
117
Legend
Raccoon Creek Watershed
Public School Districts
Streams
Trails
Environmental Bio-Diversity Areas
PA State Game Lands
Open Space
Parks (State, County, Local)
Ambridge / Service Creek Reservoir
RACCOON CREEK WATERSHED ASSOCIATION
SCHOOL DISTRICTS & PUBLIC LANDS
FIGURE - 7
SKELLY AND LOY, INC.

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# APPENDICES

# APPENDIX A

## Water Quality Tables

# Discharge Water Quality Table

| Site | Date | Sample | pH | Alkalinity | Aciditiy | Iron | Manganese | Aluminum | Sulfates | Est. Flow (gpm) | FeAvgTons | MnAvgTon | AlAvgTons | AcidAvgTons/Yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E1 | 2/16/96 | 4166627 | 6.2 | 124 | 58 | 71.10 | 1.33 | 0.50 | 831.00 | 112.72 | 17.63 | 0.33 | 0.12 | 14.38 |
| E1 | 3/11/96 | 4166665 | 6.3 | 190 | 0 | 70.10 | 1.45 | 0.50 | 844.00 | 112.72 | 17.38 | 0.36 | 0.12 | 0.00 |
| E1 | 4/12/96 | 4166811 | 5.9 | 92 | 36 | 67.60 | 1.43 | 0.71 | 884.00 | 112.72 | 16.76 | 0.35 | 0.18 | 8.93 |
| E1 | 5/16/96 | 4166880 | 6.2 | 174 | 44 | 60.60 | 1.36 | 2.01 | 901.00 | 112.72 | 15.03 | 0.34 | 0.50 | 10.91 |
| E1 | 7/1/96 | 4166998 | 6.2 | 100 | 0 | 71.40 | 1.40 | 0.59 | 826.00 | 112.72 | 17.71 | 0.35 | 0.15 | 0.00 |
| E1 | 7/12/96 | 4166048 | 6.1 | 178 | 24 | 74.00 | 1.51 | 0.50 | 860.00 | 112.72 | 18.35 | 0.37 | 0.12 | 5.95 |
| E1 | 8/30/96 | 4166167 | 6 | 102 | 0 | 83.60 | 1.54 | 0.90 | 861.00 | 112.72 | 20.73 | 0.38 | 0.22 | 0.00 |
| E1 | 9/26/96 | 4166240 | 6.3 | 186 | 30 | 67.80 | 1.42 | 0.86 | 806.00 | 112.72 | 16.81 | 0.35 | 0.21 | 7.44 |
| E1 | 10/17/96 | 4166329 | 6.2 | 168 | 40 | 73.60 | 1.50 | 0.88 | 897.00 | 112.72 | 18.25 | 0.37 | 0.22 | 9.92 |
| E1 | 11/26/96 | 4166405 | 6.4 | 186 | 40 | 70.80 | 1.36 | 0.90 | 924.00 | 112.72 | 17.56 | 0.34 | 0.22 | 9.92 |
| E1 | 12/30/96 | 4166549 | 6.3 | 186 | 0 | 82.10 | 1.52 | 0.73 | 880.00 | 112.72 | 20.36 | 0.38 | 0.18 | 0.00 |
| E1 | 1/29/97 | 4166636 | 6.3 | 188 | 32 | 67.30 | 1.34 | 0.53 | 844.00 | 112.72 | 16.69 | 0.33 | 0.13 | 7.94 |
| E1 | 3/3/97 | 4166587 | 6.2 | 174 | 20 | 71.10 | 1.35 | 0.50 | 770.00 | 112.72 | 17.63 | 0.33 | 0.12 | 4.96 |
| E1 | 4/29/97 | 4166716 | 6.2 | 186 | 9.8 | 61.90 | 1.36 | 0.50 | 801.00 | 112.72 | 15.35 | 0.34 | 0.12 | 2.43 |
| E1 | 10/27/97 | 4117085 | 6.4 | 182 | 94 | 82.40 | 1.54 | 1.04 | 899.00 | 112.72 | 20.43 | 0.38 | 0.26 | 23.31 |
| E1 | 11/19/97 | 4117179 | 6.4 | 192 | 86 | 73.10 | 1.46 | 0.98 | 864.00 | 112.72 | 18.13 | 0.36 | 0.24 | 21.33 |
| E1 | 2/25/98 | 4117213 | 6.4 | 206 | 0 | 61.70 | 1.30 | 0.54 | 815.00 | 112.72 | 15.30 | 0.32 | 0.13 | 0.00 |
| E1 | 3/26/98 | 4117344 | 6.2 | 200 | 0 | 60.70 | 1.24 | 0.50 | 744.00 | 112.72 | 15.05 | 0.31 | 0.12 | 0.00 |
| E1 | 4/23/98 | 4117486 | 6.3 | 200 | 0 | 61.70 | 1.23 | 0.50 | 395.00 | 112.72 | 15.30 | 0.31 | 0.12 | 0.00 |
| E1 | 5/20/98 | 4117574 | 6.4 | 206 | 0 | 57.70 | 1.26 | 0.50 | 720.00 | 112.72 | 14.31 | 0.31 | 0.12 | 0.00 |
| E1 | 6/30/98 | 4117655 | 6.3 | 160 | 0 | 89.10 | 1.40 | 0.84 | 789.00 | 112.72 | 22.10 | 0.35 | 0.21 | 0.00 |
| E1 | 7/28/98 | 4117746 | 6.2 | 162 | 0 | 101.00 | 1.35 | 0.86 | 780.00 | 112.72 | 25.05 | 0.33 | 0.21 | 0.00 |
| E1 | 8/27/98 | 4117838 | 6.3 | 180 | 0 | 66.80 | 1.28 | 0.50 | 893.00 | 112.72 | 16.57 | 0.32 | 0.12 | 0.00 |
| E1 | 9/29/98 | 4117904 | 6.3 | 196 | 0 | 90.10 | 1.74 | 1.09 | 916.00 | 112.72 | 22.34 | 0.43 | 0.27 | 0.00 |
| E1 | 10/29/98 | 4117013 | 6.3 | 170 | 0 | 90.30 | 1.44 | 1.82 | 891.00 | 112.72 | 22.39 | 0.36 | 0.45 | 0.00 |
| E1 | 11/18/98 | 4117051 | 6.3 | 156 | 9.6 | 73.90 | 1.49 | 2.23 | 915.00 | 112.72 | 18.33 | 0.37 | 0.55 | 2.38 |
| E1 | 12/14/98 | 4117099 | 6.3 | 162 | 2.8 | 82.50 | 1.63 | 1.96 | 941.00 | 112.72 | 20.46 | 0.40 | 0.49 | 0.69 |
| E1 | 1/20/99 | 4117073 | 6.3 | 174 | 7.6 | 72.80 | 1.39 | 1.75 | 729.00 | 112.72 | 18.05 | 0.34 | 0.43 | 1.88 |
| E1 | 2/24/99 | 4117220 | 6.4 | 218 | 0 | 65.20 | 1.33 | 0.50 | 753.00 | 112.72 | 16.17 | 0.33 | 0.12 | 0.00 |
| E1 | 3/17/99 | 4117280 | 6.4 | 220 | 0 | 64.00 | 1.30 | 0.55 | 707.00 | 112.72 | 15.87 | 0.32 | 0.14 | 0.00 |
| E1 | 1/10/00 | 4117023 | 6.4 | 186 | 0 | 79.30 | 1.38 | 1.31 | 819.30 | 112.72 | 19.67 | 0.34 | 0.32 | 0.00 |
| E1 | 2/16/00 | 4117195 | 6.4 | 172 | 0 | 68.60 | 1.28 | 0.97 | 705.00 | 112.72 | 17.01 | 0.32 | 0.24 | 0.00 |
| E1 | 3/7/00 | 4117273 | 6.4 | 190 | 0 | 77.50 | 1.37 | 0.63 | 1016.70 | 112.72 | 19.22 | 0.34 | 0.16 | 0.00 |
| E1 | 4/20/00 | 4117436 | 6.3 | 196 | 0 | 66.50 | 1.30 | 0.50 | 718.20 | 112.72 | 16.49 | 0.32 | 0.12 | 0.00 |
| H3 | 5/21/98 | 4117585 | 5.5 | 14 | 122 | 75.50 | 6.28 | 0.00 | 766.20 | 74.85 | 12.43 | 1.03 | 0.00 | 20.09 |
| H3 | 6/1/98 | 4117645 | 6.1 | 26 | 40 | 32.60 | 5.26 | 0.00 | 584.00 | 74.85 | 5.37 | 0.87 | 0.00 | 6.59 |
| H3 | 7/22/98 | 4117730 | 5.3 | 10.8 | 120 | 63.00 | 7.13 | 0.00 | 828.30 | 74.85 | 10.37 | 1.17 | 0.00 | 19.76 |
| H3 | 9/28/98 | 4117887 | 5.5 | 10.6 | 86 | 50.40 | 8.80 | 0.00 | 904.50 | 74.85 | 8.30 | 1.45 | 0.00 | 14.16 |
| H3 | 2/24/99 | 4117228 | 6.1 | 28 | 114 | 66.00 | 6.51 | 0.00 | 709.10 | 74.85 | 10.87 | 1.07 | 0.00 | 18.77 |
| H3 | 4/14/99 | 527235 | 6 | 17.2 | 64 | 53.60 | 5.56 | 0.00 | 532.00 | 74.85 | 8.83 | 0.92 | 0.00 | 10.54 |
| H3 | 4/22/99 | 4117425 | 6.1 | 26 | 24 | 32.10 | 3.95 | 0.00 | 407.60 | 74.85 | 5.29 | 0.65 | 0.00 | 3.95 |
| H3 | 6/23/99 | 4117571 | 5.4 | 12.4 | 122 | 74.00 | 7.80 | 0.00 | 923.60 | 74.85 | 12.19 | 1.28 | 0.00 | 20.09 |
| H3 | 7/29/99 | 4117686 | 6.5 | 40 | 0 | 4.32 | 2.60 | 0.00 | 441.00 | 74.85 | 0.71 | 0.43 | 0.00 | 0.00 |
| H3 | 10/26/99 | 4117960 | 6.1 | 20 | 38 | 20.80 | 8.76 | 0.00 | 920.10 | 74.85 | 3.43 | 1.44 | 0.00 | 6.26 |
| H3 | 10/28/99 | 4117002 | 5.9 | 16.6 | 62 | 28.30 | 7.01 | 0.00 | 834.20 | 74.85 | 4.66 | 1.15 | 0.00 | 10.21 |

Discharge Water Quality Table

| Site | Date | Sample | pH | Alkalinity | Aciditiy | Iron | Manganese | Aluminum | Sulfates | Est. Flow (gpm) | FeAvgTons | MnAvgTon | AlAvgTons | AcidAvgTons/Yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H3 | 4/26/00 | 4117467 | 5.9 | 19.8 | 60 | 40.90 | 5.18 | 0.00 | 619.30 | 74.85 | 6.74 | 0.85 | 0.00 | 9.88 |
| H3 | 6/20/00 | 4117697 | 5.9 | 19.6 | 78 | 42.10 | 5.45 | 0.00 | 665.70 | 74.85 | 6.93 | 0.90 | 0.00 | 12.84 |
| JB1 | 1/11/95 | 4166298 | 4.6 | 14.2 | 226 | 69.10 | 1.77 | 10.20 | 830.00 | 979.50 | 148.90 | 3.81 | 21.98 | 487.01 |
| JB1 | 2/24/95 | 4166416 | 4.5 | 11.4 | 170 | 53.70 | 1.55 | 7.83 | 737.00 | 979.50 | 115.72 | 3.34 | 16.87 | 366.33 |
| JB1 | 3/17/95 | 4166446 | 4.7 | 14.6 | 146 | 46.70 | 1.43 | 6.59 | 618.00 | 979.50 | 100.63 | 3.08 | 14.20 | 314.62 |
| JB1 | 4/13/95 | 4166513 | 4.6 | 13.2 | 118 | 43.50 | 1.45 | 6.81 | 571.00 | 979.50 | 93.74 | 3.12 | 14.67 | 254.28 |
| JB1 | 5/4/95 | 4166589 | 4.6 | 12 | 128 | 44.00 | 1.51 | 6.97 | 611.00 | 979.50 | 94.82 | 3.25 | 15.02 | 275.83 |
| JB1 | 6/13/95 | 4166686 | 4.7 | 13.6 | 148 | 48.00 | 1.69 | 7.22 | 603.00 | 979.50 | 103.44 | 3.64 | 15.56 | 318.93 |
| JB1 | 8/8/95 | 4166861 | 4.8 | 15.8 | 138 | 51.10 | 1.62 | 6.98 | 633.00 | 979.50 | 110.12 | 3.49 | 15.04 | 297.38 |
| JB1 | 10/26/95 | 4166372 | 4.9 | 17.6 | 180 | 56.40 | 1.67 | 6.46 | 747.00 | 979.50 | 121.54 | 3.60 | 13.92 | 387.88 |
| JB1 | 11/8/95 | 4166407 | 4.8 | 15.4 | 194 | 63.50 | 1.86 | 6.53 | 722.00 | 979.50 | 136.84 | 4.01 | 14.07 | 418.05 |
| JB1 | 12/13/95 | 4166462 | 5.1 | 26 | 132 | 53.00 | 1.52 | 4.61 | 715.00 | 979.50 | 114.21 | 3.28 | 9.93 | 284.45 |
| JB1 | 1/11/96 | 4166515 | 5.3 | 24 | 124 | 59.10 | 1.63 | 4.71 | 780.00 | 979.50 | 127.35 | 3.51 | 10.15 | 267.21 |
| JB1 | 3/18/96 | 4166704 | 4.6 | 10.6 | 190 | 45.30 | 1.44 | 7.39 | 667.00 | 979.50 | 97.62 | 3.10 | 15.92 | 409.43 |
| JB1 | 4/9/96 | 4166788 | 4.3 | 7.4 | 194 | 43.60 | 1.36 | 8.46 | 653.00 | 979.50 | 93.95 | 2.93 | 18.23 | 418.05 |
| JB1 | 5/21/96 | 4166899 | 4.4 | 9 | 158 | 40.20 | 1.50 | 9.50 | 682.00 | 979.50 | 86.63 | 3.23 | 20.47 | 340.47 |
| JB1 | 6/6/96 | 4166921 | 4.5 | 9.6 | 168 | 42.90 | 1.58 | 9.66 | 658.00 | 979.50 | 92.45 | 3.40 | 20.82 | 362.02 |
| JB1 | 7/1/96 | 4166006 | 4.6 | 12.4 | 170 | 41.40 | 1.54 | 9.00 | 612.00 | 979.50 | 89.21 | 3.32 | 19.39 | 366.33 |
| JB1 | 8/1/96 | 4166108 | 4.6 | 11.8 | 128 | 38.40 | 1.36 | 7.38 | 616.00 | 979.50 | 82.75 | 2.93 | 15.90 | 275.83 |
| JB1 | 9/10/96 | 4166188 | 4.7 | 13.2 | 170 | 42.10 | 1.39 | 6.53 | 696.00 | 979.50 | 90.72 | 3.00 | 14.07 | 366.33 |
| JB1 | 10/24/96 | 4166360 | 4.7 | 14 | 156 | 48.60 | 1.55 | 6.00 | 751.00 | 979.50 | 104.73 | 3.34 | 12.93 | 336.16 |
| JB1 | 11/8/96 | 4166381 | 4.8 | 16.2 | 127 | 46.40 | 1.42 | 5.79 | 662.00 | 979.50 | 99.99 | 3.06 | 12.48 | 273.67 |
| JB1 | 12/30/96 | 4166544 | 4.7 | 13.8 | 14 | 40.80 | 1.51 | 6.82 | 670.00 | 979.50 | 87.92 | 3.25 | 14.70 | 30.17 |
| JB1 | 1/23/97 | 4166619 | 4.7 | 13.6 | 124 | 30.40 | 1.18 | 5.10 | 730.00 | 979.50 | 65.51 | 2.54 | 10.99 | 267.21 |
| JB1 | 2/25/97 | 4166578 | 4.6 | 12.4 | 118 | 27.60 | 1.29 | 5.13 | 626.00 | 979.50 | 59.48 | 2.78 | 11.05 | 254.28 |
| JB1 | 3/24/97 | 4166636 | 4.5 | 11 | 92 | 25.30 | 1.23 | 5.27 | 496.00 | 979.50 | 54.52 | 2.65 | 11.36 | 198.25 |
| JB1 | 4/28/97 | 4166703 | 4.6 | 12.2 | 116 | 23.90 | 1.20 | 5.46 | 586.00 | 979.50 | 51.50 | 2.59 | 11.77 | 249.97 |
| JB1 | 5/21/97 | 4166752 | 4.7 | 14.6 | 114 | 26.40 | 1.26 | 5.24 | 753.00 | 979.50 | 56.89 | 2.72 | 11.29 | 245.66 |
| JB1 | 6/24/97 | 4166813 | 4.6 | 9.8 | 124 | 29.40 | 1.34 | 5.99 | 523.00 | 979.50 | 63.35 | 2.89 | 12.91 | 267.21 |
| JB1 | 7/14/97 | 4166871 | 4.9 | 17.4 | 156 | 30.10 | 1.25 | 4.79 | 486.00 | 979.50 | 64.86 | 2.69 | 10.32 | 336.16 |
| JB1 | 10/23/97 | 4117060 | 5.1 | 17.8 | 160 | 41.80 | 1.36 | 4.55 | 626.00 | 979.50 | 90.07 | 2.93 | 9.80 | 344.78 |
| JB1 | 2/11/98 | 4117158 | 4.9 | 16.6 | 78 | 34.20 | 1.19 | 3.79 | 575.00 | 979.50 | 73.70 | 2.56 | 8.17 | 168.08 |
| JB1 | 4/16/98 | 4117445 | 4.9 | 18 | 104 | 33.00 | 1.31 | 4.48 | 574.00 | 979.50 | 71.11 | 2.82 | 9.65 | 224.11 |
| JB1 | 6/10/98 | 4117624 | 4.7 | 11.8 | 104 | 35.20 | 1.27 | 5.29 | 588.00 | 979.50 | 75.85 | 2.74 | 11.40 | 224.11 |
| JB1 | 8/24/98 | 4117823 | 5 | 22 | 80 | 34.30 | 1.09 | 3.41 | 639.00 | 979.50 | 73.91 | 2.35 | 7.35 | 172.39 |
| JB1 | 10/29/98 | 4117021 | 5.2 | 24 | 92 | 44.70 | 1.37 | 3.75 | 685.00 | 979.50 | 96.32 | 2.95 | 8.08 | 198.25 |
| JB1 | 12/16/98 | 4117122 | 5.3 | 22 | 102 | 56.70 | 1.64 | 4.48 | 747.00 | 979.50 | 122.18 | 3.53 | 9.65 | 219.80 |
| JB1 | 1/27/99 | 4117114 | 5.3 | 28 | 86 | 52.40 | 1.52 | 4.09 | 629.00 | 979.50 | 112.92 | 3.28 | 8.81 | 185.32 |
| JB1 | 2/8/99 | 4117169 | 5.2 | 26 | 92 | 49.90 | 1.49 | 4.31 | 695.00 | 979.50 | 107.53 | 3.21 | 9.29 | 198.25 |
| JB1 | 3/9/99 | 4117264 | 5 | 18.6 | 84 | 39.70 | 1.34 | 3.88 | 514.00 | 979.50 | 85.55 | 2.89 | 8.36 | 181.01 |
| JB1 | 4/14/99 | 4117378 | 4.8 | 16 | 80 | 37.70 | 1.42 | 4.67 | 582.00 | 979.50 | 81.24 | 3.06 | 10.06 | 172.39 |
| JB1 | 2/2/00 | 4117144 | 5.5 | 34 | 100 | 46.10 | 1.23 | 3.42 | 786.20 | 979.50 | 99.34 | 2.65 | 7.37 | 215.49 |
| JB1 | 3/6/00 | 4117264 | 5.3 | 32 | 108 | 63.80 | 1.73 | 4.26 | 679.80 | 979.50 | 137.48 | 3.73 | 9.18 | 232.73 |
| JB1 | 4/20/00 | 4117453 | 5.2 | 24 | 110 | 47.60 | 1.36 | 3.36 | 623.60 | 979.50 | 102.57 | 2.93 | 7.24 | 237.04 |
| JB1 | 5/2/00 | 4117488 | 5.1 | 22 | 68 | 0.42 | 1.26 | 3.22 | 654.00 | 979.50 | 0.91 | 2.72 | 6.94 | 146.53 |

Discharge Water Quality Table

| Site | Date | Sample | pH | Alkalinity | Aciditiy | Iron | Manganese | Aluminum | Sulfates | Est. Flow (gpm) | FeAvgTons | MnAvgTor | AlAvgTons | AcidAvgTons/Yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JB2 | 1/11/95 | 4166297 | 3.6 | 0 | 406 | 101.00 | 6.19 | 23.90 | 1145.00 | 93.67 | 20.81 | 1.28 | 4.93 | 83.67 |
| JB2 | 2/24/95 | 4166415 | 3.7 | 0 | 348 | 87.70 | 5.81 | 22.60 | 1116.00 | 93.67 | 18.07 | 1.20 | 4.66 | 71.71 |
| JB2 | 4/13/95 | 4166512 | 3.7 | 0 | 278 | 78.30 | 5.60 | 18.20 | 1013.00 | 93.67 | 16.14 | 1.15 | 3.75 | 57.29 |
| JB2 | 5/4/95 | 4166591 | 3.7 | 0 | 264 | 74.90 | 5.17 | 15.20 | 999.00 | 93.67 | 15.43 | 1.07 | 3.13 | 54.40 |
| JB2 | 6/13/95 | 4166688 | 3.6 | 0 | 294 | 73.90 | 5.35 | 16.70 | 981.00 | 93.67 | 15.23 | 1.10 | 3.44 | 60.59 |
| JB2 | 12/13/95 | 4166463 | 3.6 | 0 | 312 | 78.20 | 5.57 | 17.60 | 1050.00 | 93.67 | 16.11 | 1.15 | 3.63 | 64.30 |
| JB2 | 1/11/96 | 4166514 | 3.6 | 0 | 282 | 73.80 | 5.36 | 17.60 | 1113.00 | 93.67 | 15.21 | 1.10 | 3.63 | 58.11 |
| JB2 | 3/18/96 | 4166703 | 3.6 | 0 | 250 | 39.10 | 5.18 | 14.10 | 958.00 | 93.67 | 8.06 | 1.07 | 2.91 | 51.52 |
| JB2 | 4/9/96 | 4166787 | 3.7 | 0 | 208 | 37.30 | 4.70 | 12.00 | 929.00 | 93.67 | 7.69 | 0.97 | 2.47 | 42.86 |
| JB2 | 6/6/96 | 4166922 | 3.7 | 0 | 236 | 63.80 | 5.90 | 13.70 | 1032.00 | 93.67 | 13.15 | 1.22 | 2.82 | 48.63 |
| JB2 | 7/1/96 | 4166005 | 3.6 | 0 | 242 | 76.60 | 5.73 | 14.80 | 971.00 | 93.67 | 15.79 | 1.18 | 3.05 | 49.87 |
| JB2 | 8/1/96 | 4166110 | 3.6 | 0 | 262 | 72.80 | 5.18 | 12.40 | 1087.00 | 93.67 | 15.00 | 1.07 | 2.56 | 53.99 |
| JB2 | 9/10/96 | 4166187 | 3.6 | 0 | 298 | 80.80 | 5.18 | 13.10 | 1287.00 | 93.67 | 16.65 | 1.07 | 2.70 | 61.41 |
| JB2 | 12/30/96 | 4166542 | 3.9 | 0 | 246 | 74.10 | 5.39 | 14.00 | 951.00 | 93.67 | 15.27 | 1.11 | 2.89 | 50.69 |
| JB2 | 1/23/97 | 4166620 | 3.6 | 0 | 278 | 64.70 | 4.98 | 13.50 | 1183.00 | 93.67 | 13.33 | 1.03 | 2.78 | 57.29 |
| JB2 | 2/25/97 | 4166579 | 3.7 | 0 | 236 | 62.50 | 5.02 | 12.20 | 1010.00 | 93.67 | 12.88 | 1.03 | 2.51 | 48.63 |
| JB2 | 3/24/97 | 4166634 | 3.8 | 0 | 208 | 50.60 | 4.80 | 10.40 | 831.00 | 93.67 | 10.43 | 0.99 | 2.14 | 42.86 |
| JB2 | 4/28/97 | 4166705 | 3.8 | 0 | 232 | 53.20 | 4.47 | 9.48 | 826.00 | 93.67 | 10.96 | 0.92 | 1.95 | 47.81 |
| JB2 | 5/21/97 | 4166753 | 3.8 | 0 | 236 | 58.40 | 4.63 | 9.50 | 1015.00 | 93.67 | 12.03 | 0.95 | 1.96 | 48.63 |
| JB2 | 6/24/97 | 4166812 | 3.8 | 0 | 202 | 52.90 | 4.79 | 9.33 | 775.00 | 93.67 | 10.90 | 0.99 | 1.92 | 41.63 |
| JB2 | 7/14/97 | 4166868 | 4 | 3.6 | 246 | 61.00 | 5.17 | 8.98 | 892.00 | 93.67 | 12.57 | 1.07 | 1.85 | 50.69 |
| JB2 | 8/25/97 | 4167890 | 3.8 | 0 | 242 | 66.80 | 4.80 | 8.81 | 940.00 | 93.67 | 13.77 | 0.99 | 1.82 | 49.87 |
| JB2 | 9/18/97 | 4117930 | 3.8 | 0 | 246 | 73.30 | 4.88 | 9.70 | 935.00 | 93.67 | 15.11 | 1.01 | 2.00 | 50.69 |
| JB2 | 10/22/97 | 4117061 | 3.7 | 0 | 280 | 75.20 | 4.78 | 11.30 | 841.00 | 93.67 | 15.50 | 0.99 | 2.33 | 57.70 |
| JB2 | 11/12/97 | 4117143 | 3.8 | 0 | 260 | 68.40 | 4.48 | 11.10 | 881.00 | 93.67 | 14.10 | 0.92 | 2.29 | 53.58 |
| JB2 | 1/28/98 | 4117093 | 3.7 | 0 | 210 | 57.90 | 5.54 | 10.50 | 952.00 | 93.67 | 11.93 | 1.14 | 2.16 | 43.28 |
| JB2 | 2/11/98 | 4117157 | 3.8 | 0 | 186 | 55.50 | 4.87 | 9.46 | 897.00 | 93.67 | 11.44 | 1.00 | 1.95 | 38.33 |
| JB2 | 3/24/98 | 4117327 | 4 | 3 | 146 | 47.70 | 4.62 | 8.73 | 820.00 | 93.67 | 9.83 | 0.95 | 1.80 | 30.09 |
| JB2 | 4/16/98 | 4117444 | 4.1 | 5.4 | 192 | 57.20 | 5.12 | 9.11 | 868.00 | 93.67 | 11.79 | 1.06 | 1.88 | 39.57 |
| JB2 | 5/20/98 | 4117582 | 4 | 3 | 154 | 46.20 | 4.65 | 7.90 | 870.00 | 93.67 | 9.52 | 0.96 | 1.63 | 31.74 |
| JB2 | 6/10/98 | 4117625 | 3.9 | 0 | 202 | 60.70 | 4.84 | 8.31 | 841.00 | 93.67 | 12.51 | 1.00 | 1.71 | 41.63 |
| JB2 | 8/24/98 | 4117824 | 3.7 | 0 | 212 | 64.10 | 4.24 | 7.73 | 1041.00 | 93.67 | 13.21 | 0.87 | 1.59 | 43.69 |
| JB2 | 9/16/98 | 4117880 | 3.7 | 0 | 211 | 78.80 | 4.95 | 9.69 | 1011.00 | 93.67 | 16.24 | 1.02 | 2.00 | 43.48 |
| JB2 | 10/29/98 | 4117022 | 3.8 | 0 | 258 | 85.80 | 4.90 | 11.70 | 999.00 | 93.67 | 17.68 | 1.01 | 2.41 | 53.17 |
| JB2 | 12/16/98 | 4117121 | 4 | 1.6 | 274 | 104.00 | 5.15 | 14.20 | 1034.00 | 93.67 | 21.43 | 1.06 | 2.93 | 56.46 |
| JB2 | 1/27/99 | 4117115 | 4.2 | 5 | 158 | 54.40 | 4.26 | 10.90 | 861.00 | 93.67 | 11.21 | 0.88 | 2.25 | 32.56 |
| JB2 | 2/8/99 | 4117170 | 4.5 | 10.8 | 160 | 60.00 | 5.38 | 10.00 | 878.00 | 93.67 | 12.36 | 1.11 | 2.06 | 32.97 |
| JB2 | 3/9/99 | 4117265 | 4.3 | 8 | 170 | 55.50 | 4.74 | 10.30 | 875.00 | 93.67 | 11.44 | 0.98 | 2.12 | 35.03 |
| JB2 | 4/14/99 | 4117379 | 4.4 | 9.8 | 164 | 62.30 | 4.97 | 10.20 | 823.00 | 93.67 | 12.84 | 1.02 | 2.10 | 33.80 |
| JB2 | 2/2/00 | 4117145 | 3.7 | 0 | 250 | 62.90 | 4.05 | 11.50 | 1503.20 | 93.67 | 12.96 | 0.83 | 2.37 | 51.52 |
| JB2 | 3/6/00 | 4117265 | 3.9 | 0 | 174 | 62.30 | 5.00 | 10.80 | 826.40 | 93.67 | 12.84 | 1.03 | 2.23 | 35.86 |
| JB2 | 4/20/00 | 4117454 | 3.9 | 0 | 178 | 43.90 | 4.51 | 9.30 | 881.70 | 93.67 | 9.05 | 0.93 | 1.92 | 36.68 |
| JB2 | 5/2/00 | 4117487 | 4 | 3.2 | 152 | 44.20 | 4.32 | 9.40 | 848.00 | 93.67 | 9.11 | 0.89 | 1.94 | 31.32 |
| L2 | 2/2/96 | 4166574 | 6 | 282 | 282 | 257.00 | 4.28 | 0.50 | 2518.00 | 113.50 | 64.17 | 1.07 | 0.12 | 70.42 |
| L2 | 2/13/96 | 4166605 | 6.1 | 272 | 322 | 233.00 | 3.99 | 0.50 | 2431.00 | 113.50 | 58.18 | 1.00 | 0.12 | 80.40 |

| Site | Date | Sample | pH | Alkalinity | Aciditiy | Iron | Manganese | Aluminum | Sulfates | Est. Flow (gpm) | FeAvgTons | MnAvgTor | AlAvgTons | AcidAvgTons/Yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L2 | 3/26/96 | 4166730 | 6.2 | 278 | 256 | 245.00 | 4.18 | 0.50 | 1985.00 | 113.50 | 61.18 | 1.04 | 0.12 | 63.92 |
| L2 | 4/12/96 | 4166807 | 5.6 | 104 | 312 | 240.00 | 4.04 | 0.50 | 2727.00 | 113.50 | 59.93 | 1.01 | 0.12 | 77.91 |
| L2 | 5/16/96 | 4166882 | 6.1 | 286 | 328 | 220.00 | 3.71 | 0.50 | 1877.00 | 113.50 | 54.93 | 0.93 | 0.12 | 81.90 |
| L2 | 7/1/96 | 4166994 | 6.1 | 266 | 246 | 217.00 | 3.77 | 0.50 | 2260.00 | 113.50 | 54.18 | 0.94 | 0.12 | 61.43 |
| L2 | 7/11/96 | 4166043 | 6.1 | 258 | 234 | 204.00 | 3.61 | 0.50 | 2253.00 | 113.50 | 50.94 | 0.90 | 0.12 | 58.43 |
| L2 | 8/30/96 | 4166162 | 6 | 178 | 298 | 198.00 | 3.88 | 0.50 | 2534.00 | 113.50 | 49.44 | 0.97 | 0.12 | 74.41 |
| L2 | 9/26/96 | 4166236 | 6.1 | 254 | 270 | 189.00 | 3.24 | 0.50 | 2274.00 | 113.50 | 47.19 | 0.81 | 0.12 | 67.42 |
| L2 | 10/17/96 | 4166321 | 6 | 270 | 272 | 210.00 | 3.53 | 0.50 | 2221.00 | 113.50 | 52.44 | 0.88 | 0.12 | 67.92 |
| L2 | 11/26/96 | 4166402 | 6.2 | 272 | 340 | 218.00 | 3.54 | 0.50 | 2369.00 | 113.50 | 54.43 | 0.88 | 0.12 | 84.90 |
| L2 | 12/30/96 | 4166546 | 6.3 | 262 | 170 | 209.00 | 3.63 | 0.50 | 2463.00 | 113.50 | 52.19 | 0.91 | 0.12 | 42.45 |
| L2 | 1/29/97 | 4166633 | 6.2 | 276 | 208 | 204.00 | 3.33 | 0.50 | 2429.00 | 113.50 | 50.94 | 0.83 | 0.12 | 51.94 |
| L2 | 2/28/97 | 4166584 | 6 | 282 | 234 | 211.00 | 3.54 | 5.00 | 2501.00 | 113.50 | 52.69 | 0.88 | 1.25 | 58.43 |
| L2 | 4/1/97 | 4166644 | 6.1 | 270 | 230 | 197.00 | 3.40 | 0.50 | 2463.00 | 113.50 | 49.19 | 0.85 | 0.12 | 57.43 |
| L2 | 4/29/97 | 4166713 | 6.2 | 268 | 374 | 228.00 | 3.79 | 0.14 | 2435.00 | 113.50 | 56.93 | 0.95 | 0.03 | 93.39 |
| L2 | 9/4/97 | 4117908 | 6 | 260 | 401 | 248.00 | 3.70 | 0.20 | 2276.00 | 113.50 | 61.93 | 0.92 | 0.05 | 100.13 |
| L2 | 10/16/97 | 4117045 | 6.2 | 268 | 348 | 205.00 | 3.45 | 0.50 | 2452.00 | 113.50 | 51.19 | 0.86 | 0.12 | 86.90 |
| L2 | 11/19/97 | 4117175 | 6.2 | 296 | 226 | 233.00 | 3.86 | 0.50 | 2541.00 | 113.50 | 58.18 | 0.96 | 0.12 | 56.43 |
| L2 | 2/12/98 | 4117173 | 6.2 | 308 | 220 | 230.00 | 3.65 | 0.50 | 2731.00 | 113.50 | 57.43 | 0.91 | 0.12 | 54.93 |
| L2 | 3/26/98 | 4117340 | 6.1 | 290 | 172 | 231.00 | 3.68 | 0.50 | 2894.00 | 113.50 | 57.68 | 0.92 | 0.12 | 42.95 |
| L2 | 4/23/98 | 4117482 | 6.3 | 282 | 176 | 209.00 | 3.36 | 0.50 | 1526.00 | 113.50 | 52.19 | 0.84 | 0.12 | 43.95 |
| L2 | 5/20/98 | 4117570 | 6.2 | 300 | 164 | 215.00 | 3.63 | 0.50 | 2394.00 | 113.50 | 53.69 | 0.91 | 0.12 | 40.95 |
| L2 | 6/30/98 | 4117651 | 6.2 | 292 | 158 | 198.00 | 3.31 | 0.50 | 2502.00 | 113.50 | 49.44 | 0.83 | 0.12 | 39.45 |
| L2 | 7/28/98 | 4117742 | 6.1 | 284 | 148 | 198.00 | 3.21 | 0.50 | 2172.00 | 113.50 | 49.44 | 0.80 | 0.12 | 36.96 |
| L2 | 8/27/98 | 4117834 | 6.2 | 266 | 132 | 170.00 | 2.81 | 0.50 | 2425.00 | 113.50 | 42.45 | 0.70 | 0.12 | 32.96 |
| L2 | 10/29/98 | 4117009 | 6.4 | 300 | 102 | 183.00 | 3.29 | 0.50 | 2334.00 | 113.50 | 45.70 | 0.82 | 0.12 | 25.47 |
| L2 | 2/24/99 | 4117215 | 6.2 | 330 | 244 | 259.00 | 4.34 | 0.50 | 1976.00 | 113.50 | 64.67 | 1.08 | 0.12 | 60.93 |
| L2 | 5/15/00 | 4117520 | 6.2 | 320 | 270 | 277.00 | 4.31 | 0.50 | 2.31 | 113.50 | 69.17 | 1.08 | 0.12 | 67.42 |
| P6 | 7/1/96 | 4166003 | 5.4 | 34 | 76 | 30.00 | 6.68 | 5.12 | 1186.00 | 18.91 | 1.25 | 0.28 | 0.21 | 3.16 |
| P6 | 7/12/96 | 4166050 | 5.4 | 32 | 90 | 28.60 | 6.74 | 5.08 | 1370.00 | 18.91 | 1.19 | 0.28 | 0.21 | 3.74 |
| P6 | 8/30/96 | 4166169 | 5.5 | 24 | 110 | 29.80 | 5.95 | 4.83 | 1351.00 | 18.91 | 1.24 | 0.25 | 0.20 | 4.58 |
| P6 | 9/26/96 | 4166242 | 5.2 | 28 | 104 | 32.00 | 6.26 | 5.41 | 1601.00 | 18.91 | 1.33 | 0.26 | 0.23 | 4.33 |
| P6 | 10/17/96 | 4166325 | 5.2 | 30 | 118 | 32.20 | 6.50 | 5.47 | 1624.00 | 18.91 | 1.34 | 0.27 | 0.23 | 4.91 |
| P6 | 11/26/96 | 4166407 | 5.5 | 38 | 58 | 34.10 | 7.14 | 4.04 | 1293.00 | 18.91 | 1.42 | 0.30 | 0.17 | 2.41 |
| P6 | 1/29/97 | 4166637 | 5.5 | 36 | 96 | 30.90 | 6.32 | 4.48 | 1227.00 | 18.91 | 1.29 | 0.26 | 0.19 | 3.99 |
| P6 | 3/3/97 | 4166589 | 5.4 | 34 | 82 | 28.30 | 6.10 | 3.79 | 1151.00 | 18.91 | 1.18 | 0.25 | 0.16 | 3.41 |
| P6 | 4/1/97 | 4166648 | 5.6 | 38 | 82 | 26.70 | 6.19 | 3.61 | 1258.00 | 18.91 | 1.11 | 0.26 | 0.15 | 3.41 |
| P6 | 4/29/97 | 4166718 | 5.8 | 38 | 82 | 27.80 | 5.84 | 4.92 | 1154.00 | 18.91 | 1.16 | 0.24 | 0.20 | 3.41 |
| P6 | 10/27/97 | 4117086 | 5.4 | 46 | 106 | 31.90 | 5.96 | 4.66 | 1210.00 | 18.91 | 1.33 | 0.25 | 0.19 | 4.41 |
| P6 | 11/19/97 | 4117180 | 5.5 | 38 | 110 | 28.50 | 6.12 | 3.48 | 1148.00 | 18.91 | 1.19 | 0.25 | 0.14 | 4.58 |
| P6 | 2/25/98 | 4117217 | 5.5 | 46 | 70 | 24.60 | 5.69 | 2.88 | 1193.00 | 18.91 | 1.02 | 0.24 | 0.12 | 2.91 |
| P6 | 3/26/98 | 4117348 | 5.6 | 42 | 42 | 26.80 | 6.45 | 3.67 | 1249.00 | 18.91 | 1.11 | 0.27 | 0.15 | 1.75 |
| P6 | 4/23/98 | 4117490 | 5.3 | 26 | 74 | 25.20 | 5.66 | 4.09 | 1282.00 | 18.91 | 1.05 | 0.24 | 0.17 | 3.08 |
| P6 | 5/20/98 | 4117578 | 5.3 | 26 | 58 | 23.90 | 6.03 | 4.60 | 1131.00 | 18.91 | 0.99 | 0.25 | 0.19 | 2.41 |
| P6 | 6/30/98 | 4117659 | 5 | 24 | 140 | 35.90 | 7.23 | 7.42 | 1357.00 | 18.91 | 1.49 | 0.30 | 0.31 | 5.82 |
| P6 | 7/28/98 | 417750 | 4.9 | 19.4 | 94 | 34.60 | 6.37 | 6.57 | 1311.00 | 18.91 | 1.44 | 0.27 | 0.27 | 3.91 |

Discharge Water Quality Table

| Site | Date | Sample | pH | Alkalinity | Aciditiy | Iron | Manganese | Aluminum | Sulfates | Est. Flow (gpm) | FeAvgTons | MnAvgTor | AlAvgTons | AcidAvgTons/Yr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P6 | 8/27/98 | 4117842 | 5 | 22 | 102 | 36.90 | 6.27 | 6.75 | 1472.00 | 18.91 | 1.54 | 0.26 | 0.28 | 4.24 |
| P6 | 9/29/98 | 4117908 | 4.9 | 18.2 | 92 | 41.50 | 6.53 | 7.13 | 1435.00 | 18.91 | 1.73 | 0.27 | 0.30 | 3.83 |
| P6 | 10/29/98 | 4117017 | 4.8 | 19 | 108 | 41.00 | 6.53 | 7.55 | 1411.00 | 18.91 | 1.71 | 0.27 | 0.31 | 4.49 |
| P6 | 11/18/98 | 4117055 | 5 | 26 | 120 | 40.30 | 6.51 | 7.55 | 1345.00 | 18.91 | 1.68 | 0.27 | 0.31 | 4.99 |
| P6 | 12/14/98 | 4117103 | 4.8 | 18.4 | 126 | 42.30 | 6.64 | 8.05 | 1460.00 | 18.91 | 1.76 | 0.28 | 0.33 | 5.24 |
| P6 | 1/20/99 | 4117077 | 5.3 | 30 | 70 | 26.90 | 5.78 | 3.75 | 1144.00 | 18.91 | 1.12 | 0.24 | 0.16 | 2.91 |
| P6 | 2/24/99 | 4117224 | 5.2 | 22 | 78 | 31.40 | 6.46 | 5.88 | 903.00 | 18.91 | 1.31 | 0.27 | 0.24 | 3.24 |
| P6 | 3/17/99 | 4117284 | 5.3 | 30 | 66 | 26.90 | 5.66 | 5.11 | 1014.00 | 18.91 | 1.12 | 0.24 | 0.21 | 2.75 |
| P6 | 4/20/99 | 4117402 | 5.3 | 30 | 54 | 29.50 | 6.45 | 5.14 | 1161.00 | 18.91 | 1.23 | 0.27 | 0.21 | 2.25 |
| P6 | 3/7/00 | 4117277 | 4.3 | 7.8 | 102 | 31.00 | 6.17 | 6.89 | 1052.00 | 18.91 | 1.29 | 0.26 | 0.29 | 4.24 |
| P6 | 4/20/00 | 4117440 | 4.4 | 7.8 | 82 | 26.00 | 5.92 | 6.15 | 1083.70 | 18.91 | 1.08 | 0.25 | 0.26 | 3.41 |
| P6 | 5/15/00 | 4117529 | 4.2 | 3.8 | 102 | 29.70 | 6.17 | 7.19 | 1.69 | 18.91 | 1.24 | 0.26 | 0.30 | 4.24 |
| P7 | 4/26/96 | 4166243 | 5.7 | 68 | 94 | 72.00 | 2.52 | 0.50 | 1082.00 | 247.06 | 39.13 | 1.37 | 0.27 | 51.09 |
| P7 | 7/1/96 | 4166002 | 5.8 | 74 | | 70.40 | 2.62 | 0.50 | 976.00 | 247.06 | 38.26 | 1.42 | 0.27 | 0.00 |
| P7 | 7/12/96 | 4166051 | 5.8 | 7 | 104 | 65.20 | 2.43 | 0.50 | 1026.00 | 247.06 | 35.44 | 1.32 | 0.27 | 56.53 |
| P7 | 8/30/96 | 4166170 | 5.8 | 62 | 128 | 72.60 | 2.58 | 0.50 | 1060.00 | 247.06 | 39.46 | 1.40 | 0.27 | 69.57 |
| P7 | 10/17/96 | 4166326 | 5.7 | 7 | 162 | 75.00 | 2.55 | 0.50 | 1061.00 | 247.06 | 40.76 | 1.39 | 0.27 | 88.05 |
| P7 | 11/26/96 | 4166408 | 5.8 | 78 | 110 | 74.90 | 2.57 | 0.50 | 1111.00 | 247.06 | 40.71 | 1.40 | 0.27 | 59.79 |
| P7 | 1/29/97 | 4166638 | 5.8 | 76 | 100 | 72.60 | 2.45 | 0.50 | 1069.00 | 247.06 | 39.46 | 1.33 | 0.27 | 54.35 |
| P7 | 3/3/97 | 4166590 | 5.7 | 76 | 104 | 70.80 | 2.47 | 0.50 | 1239.00 | 247.06 | 38.48 | 1.34 | 0.27 | 56.53 |
| P7 | 4/1/97 | 4166649 | 5.9 | 78 | 110 | 64.90 | 2.25 | 0.50 | 985.00 | 247.06 | 35.28 | 1.22 | 0.27 | 59.79 |
| P7 | 4/29/97 | 4166719 | 6.1 | 68 | 118 | 59.90 | 2.32 | 0.50 | 942.00 | 247.06 | 32.56 | 1.26 | 0.27 | 64.14 |
| P7 | 10/27/97 | 4117087 | 5.8 | 80 | 154 | 76.50 | 2.58 | 0.50 | 1101.00 | 247.06 | 41.58 | 1.40 | 0.27 | 83.70 |
| P7 | 11/19/97 | 4117181 | 5.8 | 80 | 188 | 77.50 | 2.61 | 0.50 | 1078.00 | 247.06 | 42.12 | 1.42 | 0.27 | 102.18 |
| P7 | 2/25/98 | 4117216 | 5.9 | 82 | 108 | 67.20 | 2.24 | 0.50 | 908.00 | 247.06 | 36.53 | 1.22 | 0.27 | 58.70 |
| P7 | 3/26/98 | 4117347 | 5.7 | 8 | 110 | 72.50 | 2.50 | 0.50 | 983.00 | 247.06 | 39.41 | 1.36 | 0.27 | 59.79 |
| P7 | 4/23/98 | 4117489 | 5.9 | 84 | 94 | 63.00 | 2.12 | 0.50 | 928.00 | 247.06 | 34.24 | 1.15 | 0.27 | 51.09 |
| P7 | 5/20/98 | 4117577 | 6 | 90 | 80 | 65.70 | 2.30 | 0.50 | 884.00 | 247.06 | 35.71 | 1.25 | 0.27 | 43.48 |
| P7 | 6/30/98 | 4117658 | 5.8 | 88 | 124 | 73.50 | 2.64 | 0.50 | 979.00 | 247.06 | 39.95 | 1.43 | 0.27 | 67.40 |
| P7 | 7/28/98 | 4117749 | 5.9 | 86 | 74 | 64.80 | 2.24 | 0.50 | 87.40 | 247.06 | 35.22 | 1.22 | 0.27 | 40.22 |
| P7 | 8/27/98 | 4117841 | 5.9 | 88 | 78 | 67.50 | 2.38 | 0.50 | 1079.00 | 247.06 | 36.69 | 1.29 | 0.27 | 42.40 |
| P7 | 9/29/98 | 4117907 | 5.9 | 84 | 72 | 79.00 | 2.63 | 0.50 | 1043.00 | 247.06 | 42.94 | 1.43 | 0.27 | 39.13 |
| P7 | 10/29/98 | 4117016 | 5.9 | 88 | 88 | 77.10 | 2.59 | 0.50 | 1054.00 | 247.06 | 41.91 | 1.41 | 0.27 | 47.83 |
| P7 | 11/18/98 | 4117054 | 5.9 | 88 | 94 | 78.50 | 2.57 | 0.50 | 967.00 | 247.06 | 42.67 | 1.40 | 0.27 | 51.09 |
| P7 | 12/14/98 | 4117102 | 5.9 | 86 | 98 | 86.00 | 2.74 | 0.50 | 1147.00 | 247.06 | 46.74 | 1.49 | 0.27 | 53.27 |
| P7 | 1/20/99 | 4117076 | 5.9 | 84 | 108 | 77.20 | 2.57 | 0.50 | 1099.00 | 247.06 | 41.96 | 1.40 | 0.27 | 58.70 |
| P7 | 2/24/99 | 4117223 | 5.9 | 82 | 76 | 70.00 | 2.31 | 0.50 | 1073.00 | 247.06 | 38.05 | 1.26 | 0.27 | 41.31 |
| P7 | 3/17/99 | 4117283 | 5.9 | 84 | 74 | 69.50 | 2.34 | 0.50 | 863.00 | 247.06 | 37.78 | 1.27 | 0.27 | 40.22 |
| P7 | 4/20/99 | 4117401 | 5.9 | 84 | 68 | 74.60 | 2.53 | 0.50 | 726.00 | 247.06 | 40.55 | 1.38 | 0.27 | 36.96 |
| P7 | 1/10/00 | 4117031 | 5.8 | 86 | 76 | 89.00 | 2.65 | 0.50 | 943.10 | 247.06 | 48.37 | 1.44 | 0.27 | 41.31 |
| P7 | 2/16/00 | 4117202 | 5.8 | 82 | 92 | 69.00 | 2.11 | 0.50 | 1342.00 | 247.06 | 37.50 | 1.15 | 0.27 | 50.00 |
| P7 | 3/7/00 | 4117280 | 5.9 | 80 | 88 | 83.10 | 2.53 | 0.50 | 1023.80 | 247.06 | 45.17 | 1.38 | 0.27 | 47.83 |
| P7 | 4/20/00 | 4117444 | 5.8 | 88 | 70 | 77.80 | 2.41 | 0.50 | 1059.30 | 247.06 | 42.29 | 1.31 | 0.27 | 38.05 |
| P7 | 5/15/00 | 4117533 | 5.9 | 90 | 74 | 72.20 | 2.29 | 0.50 | 949.00 | 247.06 | 39.24 | 1.24 | 0.27 | 40.22 |

Sample Site Water Quality Table

| Site | Date | Sample | pH | Alkalinity | Aciditiy | Iron | Manganese | Aluminum | Sulfates |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 8/9/99 | 4117710 | 7.3 | 160 | 0 | 0.477 | 0.451 | 0.5 | 75.3 |
| 1 | 10/18/99 | 4117930 | 7.7 | 200 | 0 | 0.3 | 0.09 | 0.5 | 85.4 |
| 1 | 11/15/99 | 4117005 | 7.4 | 180 | 0 | 0.447 | 0.103 | 0.5 | 141.3 |
| 1 | 12/1/99 | 4117052 | 7.4 | 166 | 0 | 0.3 | 0.083 | 0.5 | 134.9 |
| 1 | 1/10/00 | 4117034 | 7.9 | 162 | 0 | 0.3 | 0.078 | 0.5 | 57.7 |
| 1 | 2/16/00 | 4117206 | 7.5 | 118 | 0 | 1.32 | 0.084 | 1.03 | 51 |
| 1 | 3/7/00 | 4117284 | 8.3 | 168 | 0 | 0.3 | 0.064 | 0.5 | 71.1 |
| 1 | 4/2/00 | 4117447 | 7.9 | 188 | 0 | 0.3 | 0.082 | 0.5 | 121 |
| 1 | 5/15/00 | 4117534 | 8.1 | 192 | 0 | 0.3 | 0.089 | 0.5 | 86.1 |
| 1 | 6/27/00 | 4117736 | 7.8 | 210 | 0 | 0.8 | 0.076 | 0.5 | 129 |
| 1 | 7/24/00 | 4117855 | 7.7 | 200 | 0 | 0.3 | 0.052 | 0.5 | 53.1 |
| 1 | 8/28/00 | 4117937 | 7.9 | 200 | 0 | 0.3 | 0.05 | 0.5 | 66.9 |
| 2 | 9/13/99 | 4117804 | 7.9 | 264 | 0 | 0.3 | 0.227 | 0.5 | 151.2 |
| 2 | 10/18/99 | 4117915 | 8 | 246 | 0 | 0.3 | 0.164 | 0.5 | 165 |
| 2 | 11/15/99 | 4117989 | 7.5 | 226 | 0 | 0.3 | 0.133 | 0.5 | 135 |
| 2 | 12/1/99 | 4117037 | 7.5 | 212 | 0 | 0.356 | 0.182 | 0.5 | 98.9 |
| 2 | 1/10/00 | 4117021 | 8 | 184 | 0 | 0.3 | 0.085 | 0.5 | 54.5 |
| 2 | 2/16/00 | 4117193 | 7.5 | 148 | 0 | 1.11 | 0.074 | 0.766 | 45 |
| 2 | 3/7/00 | 4117271 | 8.1 | 200 | 0 | 0.308 | 0.077 | 0.5 | 65.4 |
| 2 | 4/2/00 | 4117434 | 7.7 | 200 | 0 | 0.374 | 0.077 | 0.5 | 81.9 |
| 2 | 5/15/00 | 4117523 | 8.1 | 214 | 0 | 0.46 | 0.167 | 0.5 | 50 |
| 2 | 6/27/00 | 4117725 | 7.9 | 226 | 0 | 1.84 | 0.148 | 1.25 | 72 |
| 2 | 7/24/00 | 4117844 | 8 | 228 | 0 | 0.423 | 0.76 | 0.5 | 55.2 |
| 2 | 8/28/00 | 4117926 | 7.9 | 238 | 0 | 0.3 | 0.05 | 0.5 | 91.7 |
| 3 | 9/13/99 | 4117803 | 7.4 | 204 | 0 | 0.64 | 1.52 | 0.5 | 860.3 |
| 3 | 10/18/99 | 4117914 | 7.7 | 200 | 0 | 0.411 | 1.07 | 0.5 | 675 |
| 3 | 11/15/99 | 4117988 | 7.1 | 202 | 0 | 0.559 | 0.778 | 0.5 | 490 |
| 3 | 12/1/99 | 4117036 | 7.3 | 202 | 0 | 0.942 | 0.5 | 0.5 | 287.2 |
| 3 | 1/10/00 | 4117020 | 7.5 | 154 | 0 | 1.51 | 0.502 | 0.5 | 254.2 |
| 3 | 2/16/00 | 4117192 | 6.9 | 110 | 0 | 1.11 | 0.316 | 0.684 | 147 |
| 3 | 3/7/00 | 4117270 | 7.6 | 180 | 0 | 1.56 | 0.463 | 0.5 | 254 |
| 3 | 4/20/00 | 4117433 | 7.2 | 170 | 0 | 1.31 | 0.3 | 0.607 | 225 |
| 3 | 5/15/00 | 4117522 | 7.9 | 218 | 0 | 1.22 | 0.502 | 0.5 | 460 |
| 3 | 6/27/00 | 4117724 | 7.1 | 172 | 0 | 4.57 | 0.663 | 0.5 | 376 |

Sample Site Water Quality Table

| Site | Date | Sample | pH | Alkalinity | Acidity | Iron | Manganese | Aluminum | Sulfates |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 7/24/00 | 4117843 | 7.2 | 194 | 0 | 2.45 | 0.935 | 0.5 | 502.2 |
| 3 | 8/28/00 | 4117925 | 6.9 | 168 | 0 | 9.49 | 0.955 | 0.5 | 725 |
| 4 | 9/13/99 | 4117811 | 6.2 | 70 | 58 | 60.6 | 2.86 | 0.5 | 1068 |
| 4 | 10/18/99 | 4117922 | 6.2 | 60 | 50 | 49.2 | 2.4 | 0.5 | 1036 |
| 4 | 11/15/99 | 4117996 | 6.1 | 62 | 54 | 50.7 | 2.78 | 0.5 | 1166 |
| 4 | 12/1/99 | 4117044 | 6.4 | 72 | 58 | 58.8 | 3.18 | 0.5 | 924 |
| 4 | 1/10/00 | 4117028 | 6.6 | 134 | 0 | 36 | 2.37 | 0.5 | 529.7 |
| 4 | 2/16/00 | 4117200 | 6.6 | 126 | 0 | 20.2 | 1.27 | 0.581 | 406 |
| 4 | 3/7/00 | 4117278 | 6.5 | 120 | 0 | 33.3 | 1.86 | 0.5 | 589 |
| 4 | 4/20/00 | 4117441 | 6.5 | 126 | 0 | 26.3 | 1.58 | 0.5 | 541 |
| 4 | 5/15/00 | 4117528 | 6.4 | 212 | 0 | 49.9 | 2.69 | 0.5 | 854 |
| 4 | 6/27/00 | 4117730 | 6.5 | 126 | 0 | 28.2 | 1.7 | 0.5 | 498 |
| 4 | 7/24/00 | 4117849 | 6.3 | 98 | 0 | 44.6 | 2.46 | 0.5 | 798.8 |
| 4 | 8/28/00 | 4117931 | 6.4 | 92 | 0 | 30.5 | 1.79 | 0.5 | 657.3 |
| 5 | 9/9/99 | 4117792 | 6.4 | 28 | 0 | 1.4 | 3.52 | 0.5 | 1520 |
| 5 | 10/18/99 | 4117926 | 6.6 | 48 | 0 | 0.453 | 2.94 | 0.5 | 1242 |
| 5 | 11/15/99 | 4117001 | 6.3 | 52 | 0 | 1.72 | 2.94 | 1.04 | 1355 |
| 5 | 12/1/99 | 4117048 | 6.5 | 58 | 0 | 3.66 | 2.86 | 1.76 | 1026 |
| 5 | 1/10/00 | 4117032 | 6.6 | 42 | 0 | 2.77 | 2.11 | 3.58 | 833.1 |
| 5 | 2/16/00 | 4117204 | 6.8 | 68 | 0 | 1.64 | 1.37 | 1.63 | 576 |
| 5 | 3/7/00 | 4117282 | 5.2 | 11.4 | 16.8 | 4 | 2.05 | 6.11 | 938 |
| 5 | 4/20/00 | 4117445 | 4.8 | 11.8 | 44 | 7.82 | 2.29 | 8.18 | 1115 |
| 5 | 5/15/00 | 4117535 | 4.6 | 11.2 | 66 | 3.39 | 2.59 | 8.96 | 1481 |
| 5 | 6/27/00 | 4117737 | 4.8 | 10.8 | 30 | 2.93 | 2.66 | 6.19 | 1104 |
| 5 | 7/24/00 | 4117856 | 4.9 | 11.6 | 22 | 3.13 | 2.63 | 5.95 | 1284 |
| 5 | 8/28/00 | 4117938 | 4.5 | 11 | 82 | 3.51 | 3.5 | 12.9 | 1917 |
| 6 | 8/9/99 | 4117712 | 6.8 | 70 | 0 | 0.3 | 0.589 | 0.5 | 938.2 |
| 6 | 10/18/99 | 4117927 | 7.1 | 74 | 0 | 0.3 | 0.362 | 2.83 | 1055 |
| 6 | 11/15/99 | 4117002 | 6.5 | 68 | 0 | 0.3 | 0.256 | 0.5 | 1281 |
| 6 | 12/1/99 | 4117049 | 6.7 | 64 | 0 | 0.329 | 0.87 | 0.5 | 885 |
| 6 | 1/10/00 | 4117033 | 6.9 | 52 | 0 | 0.3 | 0.843 | 0.5 | 365.6 |
| 6 | 2/16/00 | 4117205 | 6.7 | 46 | 0 | 0.3 | 1.32 | 0.5 | 538 |
| 6 | 3/7/00 | 4117283 | 6.8 | 48 | 0 | 0.3 | 8.47 | 0.5 | 1361 |
| 6 | 4/20/00 | 4117446 | 6.4 | 30 | 0 | 0.3 | 1.51 | 0.5 | 754 |

Sample Site Water Quality Table

| Site | Date | Sample | pH | Alkalinity | Aciditiy | Iron | Manganese | Aluminum | Sulfates |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 5/15/00 | 4117536 | 6.8 | 38 | 0 | 0.3 | 1.75 | 0.5 | 1042 |
| 6 | 6/27/00 | 4117738 | 6.8 | 68 | 0 | 0.3 | 0.582 | 0.5 | 929 |
| 6 | 7/24/00 | 4117857 | 6.7 | 72 | 0 | 0.3 | 0.413 | 0.5 | 991 |
| 6 | 8/28/00 | 4117939 | 6.4 | 32 | 0 | 0.457 | 6.59 | 0.5 | 1180 |
| 7 | 9/9/99 | 4117793 | 6.6 | 56 | 0 | 1.2 | 2.41 | 0.5 | 829 |
| 7 | 10/18/99 | 4117928 | 7 | 88 | 0 | 0.557 | 1.92 | 0.5 | 979 |
| 7 | 11/15/99 | 4117003 | 6.6 | 98 | 0 | 0.672 | 1.73 | 0.5 | 697 |
| 7 | 12/1/99 | 4117050 | 6.9 | 116 | 0 | 2.33 | 1.27 | 0.5 | 577.3 |
| 7 | 1/10/00 | 4117036 | 7.5 | 132 | 0 | 2.62 | 0.695 | 0.5 | 510 |
| 7 | 2/16/00 | 4117208 | 7.2 | 118 | 0 | 3.11 | 0.438 | 1.11 | 163 |
| 7 | 3/7/00 | 4117285 | 7.4 | 128 | 0 | 4.06 | 0.81 | 1.37 | 280 |
| 7 | 4/20/00 | 4117449 | 7.1 | 136 | 0 | 3.56 | 0.697 | 1.34 | 288.6 |
| 7 | 5/15/00 | 4117537 | 7.3 | 96 | 0 | 4.31 | 1.3 | 1.64 | 691 |
| 7 | 6/27/00 | 4117739 | 7.4 | 150 | 0 | 4.12 | 0.59 | 1.46 | 303 |
| 7 | 7/24/00 | 4117858 | 7 | 110 | 0 | 2.3 | 0.995 | 0.772 | 593.9 |
| 7 | 8/28/00 | 4117940 | 6.7 | 80 |  | 5.86 | 1.78 | 4.08 | 584.4 |
| 8 | 8/9/99 | 4117711 | 4.5 | 8.8 | 72 | 1.04 | 2.45 | 11.5 | 433 |
| 8 | 10/18/99 | 4117929 | 4.7 | 10 | 26 | 1.38 | 2.52 | 5.55 | 561 |
| 8 | 11/12/99 | 4117004 | 4.9 | 12.4 | 24 | 1.56 | 2.74 | 5 | 597 |
| 8 | 12/1/99 | 4117051 | 6.1 | 20 | 4.2 | 2.52 | 2.51 | 4.75 | 538.2 |
| 8 | 1/10/00 | 4117035 | 5.6 | 13.6 | 9.2 | 1.96 | 2.34 | 6.94 | 710.7 |
| 8 | 2/16/00 | 4117207 | 5.5 | 13.8 | 15.2 | 2.12 | 1.82 | 7.41 | 397.7 |
| 8 | 3/7/00 | 4117290 | 3.9 | 0 | 114 | 3.2 | 2.68 | 17.7 | 586 |
| 8 | 4/20/00 | 4117455 | 4.2 | 6 | 122 | 3.35 | 2.32 | 15 | 592 |
| 8 | 5/15/00 | 4117538 | 3.6 | 0 | 142 | 4.98 | 2.5 | 17.4 | 592 |
| 8 | 6/27/00 | 4117740 | 4.1 | 3.4 | 92 | 2.02 | 1.99 | 11.7 | 524.3 |
| 8 | 7/24/00 | 4117859 | 3.9 | 0 | 92 | 2.61 | 2.45 | 14.2 | 873.8 |
| 8 | 8/28/00 | 4117941 | 3.5 | 0 | 204 | 6.53 | 3.5 | 29.4 | 775.7 |
| 9 | 8/18/99 | 4117752 | 6.8 | 68 | 0 | 0.3 | 0.164 | 0.5 | 822 |
| 9 | 10/18/99 | 4117931 | 7.1 | 74 | 0 | 0.3 | 0.164 | 0.5 | 1697 |
| 9 | 11/15/99 | 4117006 | 6.8 | 72 | 0 | 0.3 | 0.475 | 0.5 | 1178 |
| 9 | 12/1/99 | 4117053 | 6.9 | 78 | 0 | 0.3 | 0.358 | 0.5 | 686.5 |
| 9 | 1/10/00 | 4117038 | 7.3 | 74 | 0 | 0.3 | 0.386 | 0.5 | 543.6 |
| 9 | 2/16/00 | 4117210 | 6.9 | 58 | 0 | 0.527 | 0.435 | 0.5 | 303 |

Sample Site Water Quality Table

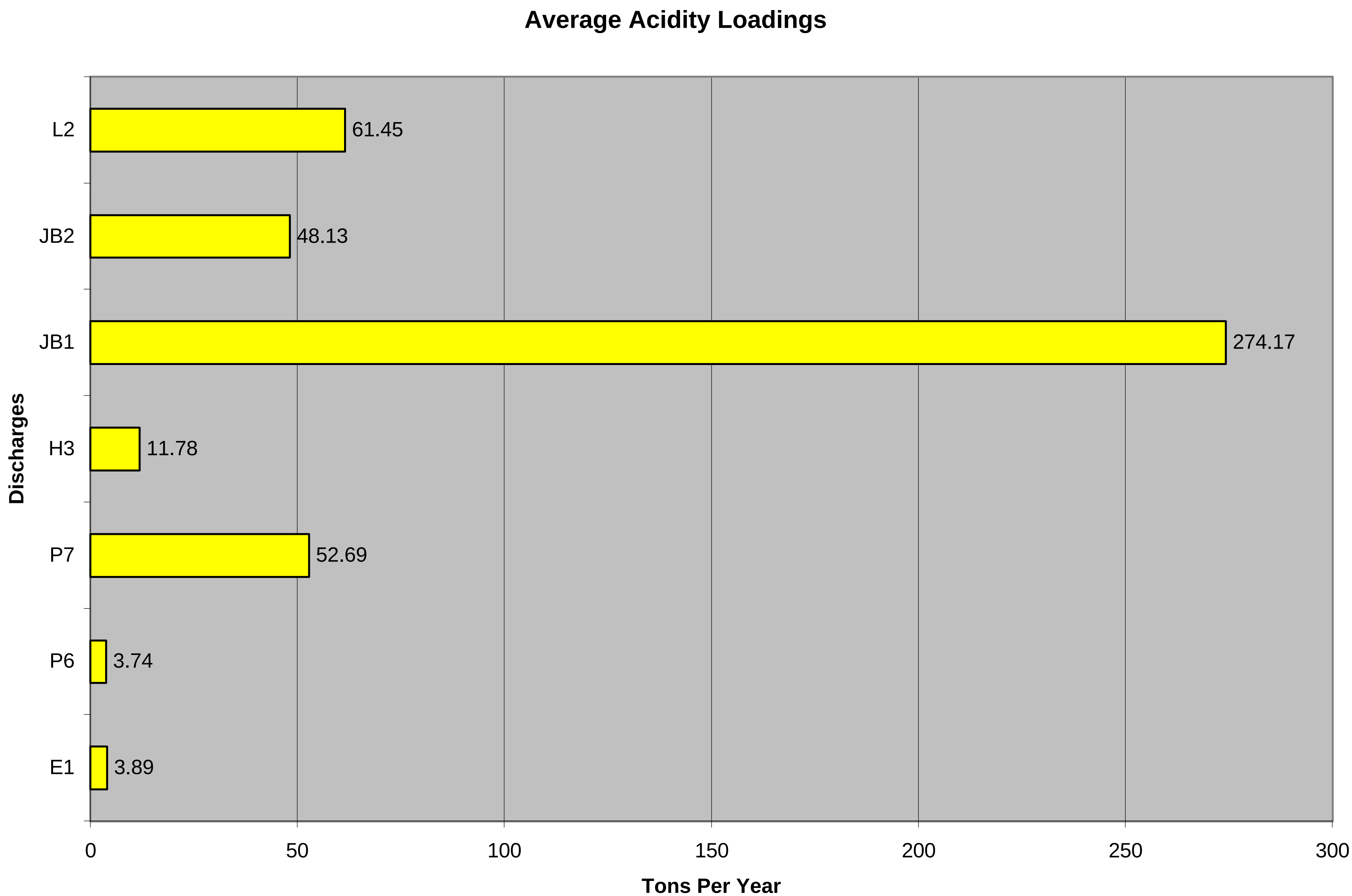
| Site | Date | Sample | pH | Alkalinity | Aciditiy | Iron | Manganese | Aluminum | Sulfates |
|---|---|---|---|---|---|---|---|---|---|
| 9 | 3/7/00 | 4117287 | 7.5 | 80 | 0 | 0.3 | 0.46 | 0.5 | 404 |
| 9 | 4/20/00 | 4117450 | 7.2 | 74 | 0 | 0.3 | 0.4 | 0.5 | 309.5 |
| 9 | 5/15/00 | 4117539 | 7.6 | 88 | 0 | 0.3 | 0.068 | 0.5 | 694 |
| 9 | 6/27/00 | 4117741 | 7.1 | 88 | 0 | 0.3 | 0.105 | 0.5 | 488.3 |
| 9 | 7/24/00 | 4117860 | 6.9 | 88 | 0 | 0.3 | 0.107 | 0.5 | 793.4 |
| 9 | 8/28/00 | 4117942 | 6.9 | 78 | 0 | 0.3 | 0.211 | 0.5 | 644.3 |
| 10 | 10/18/99 | 4117932 | 7.4 | 92 | 0 | 0.3 | 0.198 | 0.5 | 956 |
| 10 | 11/15/99 | 4117007 | 7.1 | 94 | 0 | 0.3 | 0.266 | 0.5 | 859 |
| 10 | 12/1/99 | 4117054 | 7.2 | 102 | 0 | 0.3 | 0.599 | 0.5 | 931.1 |
| 10 | 1/10/00 | 4117039 | 7.6 | 106 | 0 | 0.674 | 0.466 | 0.5 | 370.2 |
| 10 | 2/16/00 | 4117211 | 7.3 | 88 | 0 | 1.73 | 0.384 | 0.671 | 247 |
| 10 | 3/7/00 | 4117288 | 7.8 | 110 | 0 | 6.26 | 0.517 | 0.5 | 400 |
| 10 | 4/20/00 | 4117451 | 7.5 | 112 | 0 | 1.09 | 0.475 | 0.5 | 381 |
| 10 | 5/15/00 | 4117540 | 5.1 | 102 | 0 | 0.3 | 0.123 | 0.5 | 645 |
| 10 | 6/27/00 | 4117742 | 7.6 | 134 | 0 | 0.8 | 0.232 | 0.5 | 413.8 |
| 10 | 7/24/00 | 4117861 | 8.2 | 112 | 0 | 0.3 | 0.13 | 0.5 | 548.9 |
| 10 | 8/28/00 | 4117943 | 7.3 | 84 | 0 | 0.499 | 0.812 | 0.5 | 706.1 |
| 11 | 8/18/99 | 4117764 | 7.3 | 88 | 0 | 0.3 | 0.139 | 0.5 | 1103 |
| 11 | 10/18/99 | 4117933 | 7.5 | 84 | 0 | 0.3 | 0.308 | 0.5 | 1250 |
| 11 | 11/15/99 | 4117008 | 7.2 | 86 | 0 | 0.3 | 0.437 | 0.5 | 1242 |
| 11 | 12/1/99 | 4117055 | 7 | 82 | 0 | 0.3 | 0.874 | 0.5 | 604 |
| 11 | 1/10/00 | 4117040 | 7.4 | 78 | 0 | 0.485 | 1.18 | 0.5 | 723.7 |
| 11 | 2/16/00 | 4117212 | 7 | 58 | 0 | 0.589 | 0.803 | 0.5 | 270 |
| 11 | 3/7/00 | 4117289 | 7.4 | 76 | 0 | 0.3 | 1.15 | 0.5 | 520 |
| 11 | 4/20/00 | 4117452 | 7 | 74 | 0 | 0.414 | 0.885 | 0.5 | 448 |
| 11 | 5/15/00 | 4117541 | 7.8 | 80 | 0 | 0.3 | 0.491 | 0.5 | 1136 |
| 11 | 6/27/00 | 4117743 | 7 | 78 | 0 | 0.3 | 0.372 | 0.5 | 710.5 |
| 11 | 7/24/00 | 4117862 | 7.8 | 84 | 0 | 0.3 | 0.31 | 0.5 | 890.1 |
| 11 | 8/28/00 | 4117944 | 7.1 | 76 | 0 | 0.3 | 0.803 | 0.5 | 1057.8 |
| R1 | 5/12/99 | 4117538 | 7.3 | 106 | 0 | 3.53 | 1.13 | 1.44 | 5.18 |
| R1 | 6/14/99 | 4117613 | 7 | 80 | 0 | 1.09 | 1.46 | 0.553 | 611 |
| R1 | 7/14/99 | 4117622 | 7 | 62 | 0 | 0.3 | 1.69 | 0.5 | 668 |
| R1 | 8/10/99 | 4117726 | 6.5 | 56 | 0 | 0.3 | 1.87 | 0.5 | 847 |
| R1 | 9/13/99 | 4117814 | 6.6 | 50 | 0 | 0.3 | 2.11 | 0.5 | 856 |

Sample Site Water Quality Table

| Site | Date | Sample | pH | Alkalinity | Aciditiy | Iron | Manganese | Aluminum | Sulfates |
|---|---|---|---|---|---|---|---|---|---|
| R1 | 10/18/99 | 4117925 | 6.9 | 84 | 0 | 0.3 | 1.58 | 0.5 | 1061 |
| R1 | 11/15/99 | 4117999 | 6.6 | 90 | 0 | 0.5 | 1.53 | 0.5 | 809 |
| R1 | 12/1/99 | 4117047 | 7 | 118 | 0 | 1.14 | 1.14 | 0.5 | 601 |
| R1 | 1/10/00 | 4117037 | 7.5 | 130 | 0 | 2.07 | 0.687 | 0.5 | 508.3 |
| R1 | 2/16/00 | 4117209 | 7.3 | 114 | 0 | 3.01 | 0.463 | 1.28 | 181 |
| R1 | 3/7/00 | 4117286 | 7.5 | 122 | 0 | 3.14 | 0.775 | 1.13 | 293.7 |
| R1 | 4/20/00 | 4117448 | 7.3 | 132 | 0 | 3.1 | 0.678 | 1.28 | 259.8 |
| R1 | 5/15/00 | 4117542 | 7.8 | 90 | 0 | 0.84 | 1.16 | 0.5 | 634 |
| R1 | 6/27/00 | 4117744 | 7.5 | 146 | 0 | 3.29 | 0.561 | 1.1 | 331.8 |
| R1 | 7/24/00 | 4117863 | 7.9 | 104 | 0 | 0.3 | 0.693 | 0.5 | 482.8 |
| R1 | 8/28/00 | 4117945 | 6.8 | 76 | 0 | 4.29 | 1.57 | 3.21 | 601.8 |

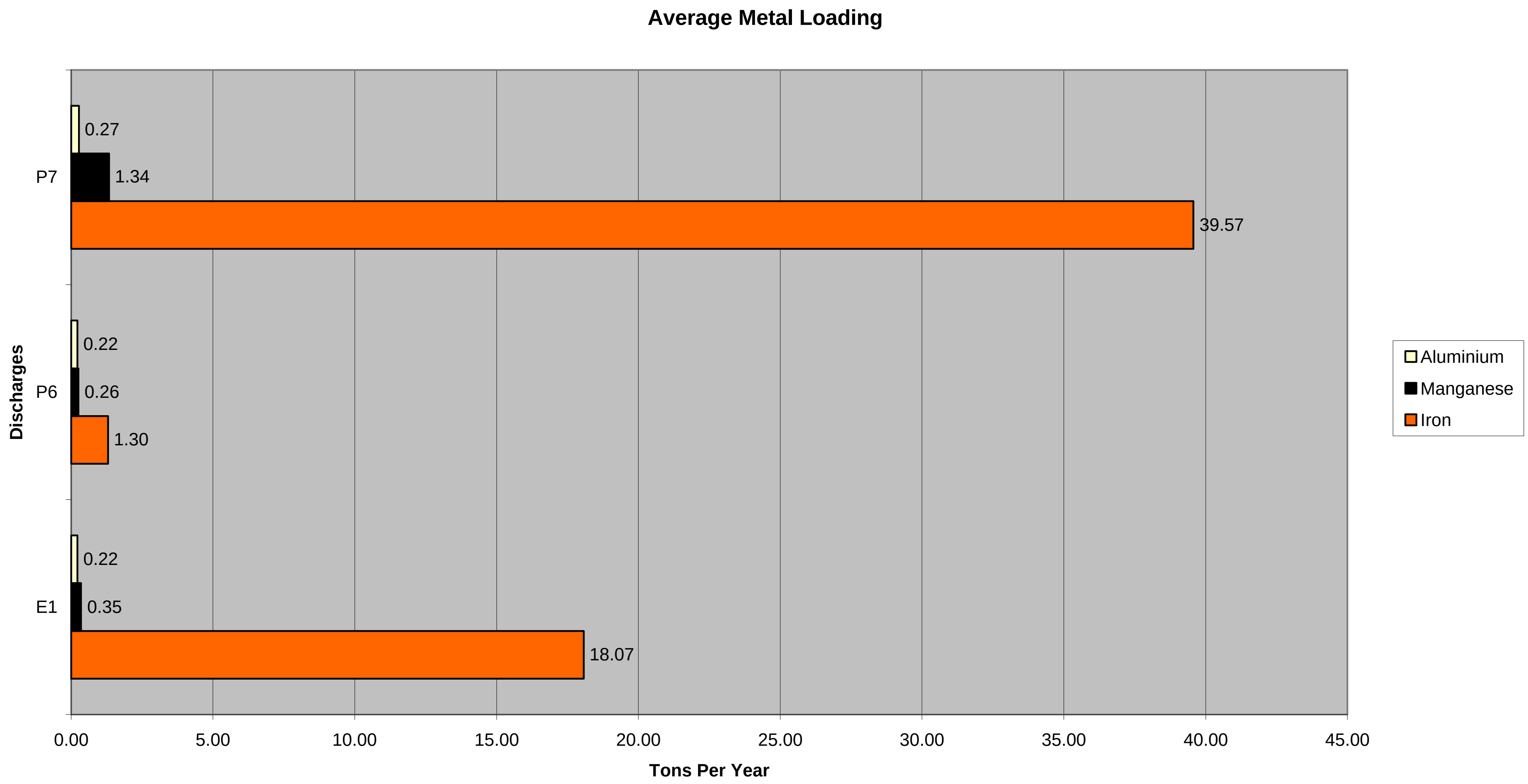
# APPENDIX B

## Annual Acid Loadings Graph

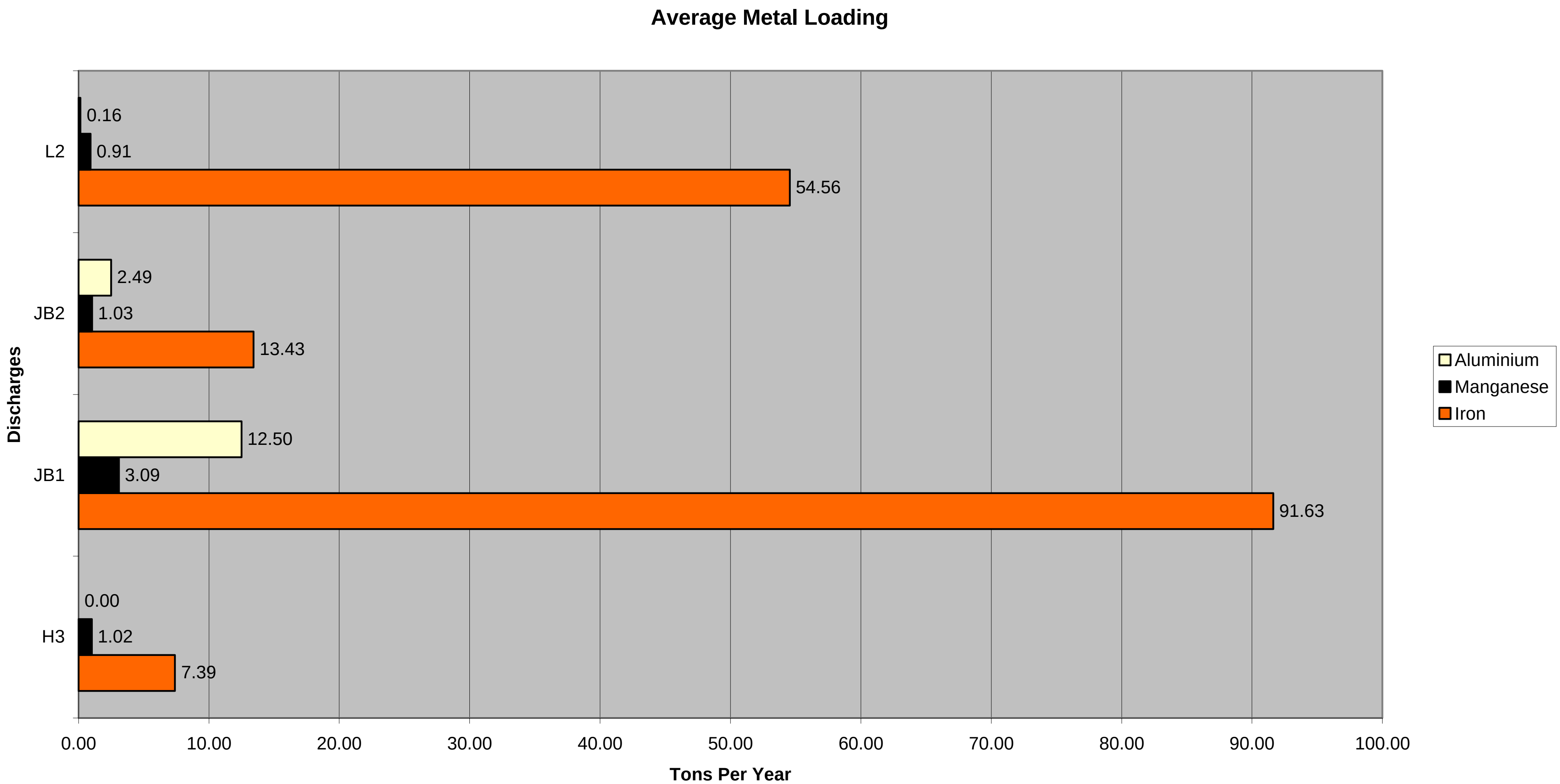

Average Acidity Loadings
Discharges
L2
JB2
JB1
H3
P7
P6
E1
61.45
48.13
274.17
11.78
52.69
3.74
3.89
0
50
100
150
200
250
300
Tons Per Year

# APPENDIX C

## Annual Metal Loadings Graphs



Average Metal Loading
Discharges
P7
P6
E1
0.27
1.34
39.57
0.22
0.26
1.30
0.22
0.35
18.07
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
Tons Per Year
Aluminium
Manganese
Iron


Average Metal Loading
Discharges
L2
JB2
JB1
H3
0.16
0.91
54.56
2.49
1.03
13.43
12.50
3.09
91.63
0.00
1.02
7.39
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Tons Per Year
Aluminium
Manganese
Iron

# APPENDIX D

## Potential Technical & Funding Assistance Sources

# POTENTIAL TECHNICAL & FUNDING ASSISTANCE FOR WATERSHED PROJECTS IN PENNSYLVANIA

| Source of Assistance | Phone | Contact Information | Assistance Information | Planning | Const. | Other |
|---|---|---|---|---|---|---|
| Farm Service Agency | (T) 724-222-3060<br><br>Ms. Linda Barnett | 2800 North Main Street Extension<br>PO Box 329<br>Meadowlands, PA 15347<br><br>www.fsa.usda.gov<br>www.fs.fed.us | FSA offers financial assistance for streambank fencing and crossings for farmers. | NO | YES | YES |
| Allegheny Co. Conservation District | (412) 241-7645<br><br>Mr. Ed Feigel | Lexington Tech Park Building<br>Room 1<br>102-400 North Lexington Street<br>Pittsburgh, PA 15208-2521 | Provides technical and financial assistance for conservation activities. | YES | YES | YES |
| Appalachian Clean Streams Initiative | (T) 412-937-2863<br>Mr. Milton Allen<br><br>(T) 717-782-4036<br>Mr. David Hamilton | Office of Surface Mining<br>1951 Constitution Ave. NW<br>Washington, DC 20240<br><br>mallen@osmre.gov | Assists with restoration activities involving abandoned mine drainage issues throughout Appalachia. | YES | YES | YES |
| DCNR:<br>Rivers Conservation Program | (T) 717-788-8526<br>Mr. Jim Mays<br><br>(T) 412-880-0486<br>Ms. Tracey Robinson | 1405 State Office Building<br>300 Liberty Avenue<br>Pittsburgh, PA 15222<br><br>www.dcnr.state.pa.us | Offer technical and financial assistance for planning, implementation, development, and acquisition grants.<br>Applications: Late August<br>Proposals: Early February | YES | YES | YES |
| DEP:<br>Stormwater Management Program | (T) 717-772-4048<br><br>Mr. Durla Lathia | 400 Market Street<br>Harrisburg, PA 17105<br><br>www.dep.state.pa.us | Watershed planning for stormwater control and implementation of programs at local levels. | YES | YES | YES |
| Dirt and Gravel Road Maintenance<br><br>State Conservation Commission | (T) 717-787-8821<br><br>Mr. Woody Colbert | 2301 North Cameron Street<br>Harrisburg, PA 17110-9408 | Groups may be able to work with their local municipalities and state agencies, regarding erosion and sedimentation control problems, and fugitive dust in watersheds. | YES | YES | YES |
| PA Association of Conservation Districts:<br>Educational Mini-Projects Program | (T) 717-545-8878<br><br>Education Specialist | 4999 Jonestown Road<br>Suite 203<br>Harrisburg, PA 17109 | Small grants for PA based grassroots educational projects that address non-point source watershed concepts. | NO | NO | YES |

# POTENTIAL TECHNICAL & FUNDING ASSISTANCE FOR WATERSHED PROJECTS IN PENNSYLVANIA

| Source of Assistance | Phone | Contact Information | Assistance Information | Planning | Const. | Other |
|---|---|---|---|---|---|---|
| Environmental Protection Agency: Region III | (T) 215-814-5756<br><br>Mr. Bernie Sarnoski | Water Protection Division<br>3WP10, 1650 Arch Street<br>Philadelphia, PA 19103-2029<br>www.epa.gov | Grants awarded to small non-profit groups for various projects in Region III | YES | YES | YES |
| EPA - Region III Environmental Education Grants | (T) 215-814-5546<br><br>Ms. Nan Ides | 3G00, 16th Floor<br>1651 Arch Street<br>Philadelphia, PA 19103<br>www.epa.gov | Grants awarded to small non-profit groups for various projects in Region III | YES | YES | YES |
| Natural Resources Conservation Service (NRCS) | (T) 724-222-3060<br>Mr. Tom Sierzega<br><br>(T) 724-774-7090<br>Mr. Robin Moyer<br><br>(T) 814-445-8979<br>Mr. Dan Seibert | 2800 North Main Street Extension<br>PO Box 329<br>Meadowlands, PA 15347<br><br>www.nrcs.usda.gov | Technical and funding assistance to farmers for planning, design, construction, and maintenance activities. These involve many programs (i.e., fencing and stream crossings, farmland protection). | YES | YES | YES |
| NRCS PL 83-566, Watershed Protection and Flood Prevention Act | (T) 717-782-4429<br><br>(T) 814-445-8979<br>Mr. Dan Seibert | North Ridge Building, Suite 105<br>1590 North Center Avenue<br>Somerset, PA 15501 | Plan development for natural resource concerns within a watershed area: cost-sharing available to carry out plan. | YES | YES | YES |
| Office of Surface Mining Reclamation and Enforcement | (T) 717-782-4473<br>Mr. David Hamilton | 415 Market Street<br>Transportation Building<br>Suite 3C<br>Harrisburg, PA 17101 | Provides funds to Appalachian Clean Streams Initiative for Abandoned Mine related activities. | YES | YES | YES |
| *PA* - Growing Greener | (T) 717- 705-5400<br>1-877-PAGREEN<br><br>Ms. Patricia Grim | Rachel Carson St. Office Bldg.<br>9th Floor, 400 Market Street<br>PO Box 8776<br>Harrisburg, PA 17109-8776<br><br>www.dep.state.pa.us | Funds for PennVest, PA Department of Agriculture, Department of Environmental Protection and Department of Conservation and Natural Resource activities. | YES | YES | YES |
| *PA DEP* -<br>Nonpoint Source Management Program<br>(Section 319 & WRAP) | (T) 717- 787-5259<br><br>Ms. Jane Earle | 400 Market Street<br>PO Box 8555<br>Harrisburg, PA 17105-8555<br><br>www.dep.state.pa.us | Provide funding for improving Non-point source water pollution. | YES | YES | YES |

# POTENTIAL TECHNICAL & FUNDING ASSISTANCE FOR WATERSHED PROJECTS IN PENNSYLVANIA

| Source of Assistance | Phone | Contact Information | Assistance Information | Planning | Const. | Other |
|---|---|---|---|---|---|---|
| PA Organization for Watersheds and Rivers | (T) 717-234-7910<br><br>Mr. Walt Pomeroy<br>wpomeroy@aol.com | PO Box 765<br>Harrisburg, PA 17108 | POWR assists river and watershed organizations in Pennsylvania. | YES | NO | YES |
| PADEP<br><br>Southwest Regional Office | (T) 412-442-4149<br>(F) 412-442-4194<br>Ms. Rita Coleman<br><br>(T) 412-442-4049<br>Ms. Karen Crowley | 400 Waterfront Drive<br>Pittsburgh, PA 15222-4745<br><br>www.dep.state.pa.us | Grants for various environmental, conservation, and educational activities. | YES | YES | YES |
| PA Stream ReLeaf Program | (T) 717-236-8825<br><br>Ms. Susan Richards | Alliance for the Chesapeake Bay<br>600 North Second Street<br>Harrisburg, PA 17101 | Grants for riparian buffers along streams. For the purchase of trees, seed and planting mats.<br>Grants between $500-$1000.00<br>Application: January<br>Begin: Spring<br>Complete: July | YES | YES | YES |
| Penn's Corner RC&D | (T) 724-834-9063<br><br>Mr. Nevin Ulery | Donhoe Center<br>RD 12, Box 202B<br>Greensburg, PA 15601 | Provides technical assistance and small financial grants to non-profit organizations in 9 southwestern PA counties. | YES | YES | YES |
| Pennsylvania Fish and Boat Commission | (T) 814-359-5185<br>(T) 412-341-0370<br><br>Mr. Bob Wheeler | Adopt-A-Stream Program<br>450 Robinson Lane<br>Bellefonte, PA 16823<br><br>www.fish.state.pa.us | Offers technical assistance on design and construction of stabilized stream crossings. | YES | YES | YES |
| Pennsylvania Game Commission | (T) 717-787-6400<br><br>Mr. Dennis Neideigh | 2001 Elmerton Avenue<br>Harrisburg, PA 17110-9797<br><br>www.pgc.state.pa.us | Streambank fencing financial and technical assistance to farmers who participate in one of the commission's cooperative public-access programs. | YES | YES | YES |
| Pennsylvania Senior Environment Corps:<br><br>Environmental Alliance for Senior Involvement | (T) 717-787-9580<br><br>Mr. Christopher Allen | 400 Market Street<br>Harrisburg, PA 17105<br><br>www.dep.state.pa.us | EASI provides technical assistance numerous environmental and education issues amongst many more. | YES | NO | YES |

# POTENTIAL TECHNICAL & FUNDING ASSISTANCE FOR WATERSHED PROJECTS IN PENNSYLVANIA

| Source of Assistance | Phone | Contact Information | Funding Information | Planning | Const. | Other |
|---|---|---|---|---|---|---|
| The Leo Model Foundation | (T) 215-546-8058<br>Extension 3021<br><br>Ms. Margaret Stridick | ICO - Model Entities<br>310 South Juniper Street<br>Philadelphia, PA 19107-5818 | Grants for habitat, conservation, watershed conservation, and species preservation. | YES | YES | YES |
| The Pittsburgh Foundation | (T) 412-391-5122<br><br>Mr. Alfred Wishart, Jr. | The Pittsburgh Foundation<br>One PPG Place - 30 th Floor<br>Pittsburgh, PA 15222-5401 | Funding grants to organizations located in Allegheny County for special projects, seed money for new programs, or grants which would leverage additional funding.<br><br>Submit proposals Jan. 1, March 15, June 1, and Sept. 15 | YES | YES | YES |
| The William Penn Foundation | (T) 215-988-1830<br><br>Ms. Hollister Knowlton | Two Logan Square<br>11th Floor<br>100 North 18 Street<br>Philadelphia, PA 19103-2757 | Grants to preserve natural areas, including environmental education and planning, within the foundation's geographic area. | YES | YES | YES |
| US Army Corps of Engineers | (T) 412-395-7210<br><br>Dr. Ed Smith | 1928 Federal Building<br>1000 Liberty Avenue<br>Pittsburgh, PA 15222<br><br>www.usace.army.mil/ | Provides funding and technical assistance through a variety of planning and construction programs for environmental improvement, flood protection, and other projects. | YES | YES | YES |
| US Geological Survey | (T) 717-730-6916<br>Mr. John Nantz<br><br>jmnantz@usgs.gov | 840 Market Street<br>Lemoyne, PA 17043<br><br>http://pa.water.usgs.gov | Provides technical assistance through planning programs for environmental improvement, flood protection, and other projects. | YES | YES | YES |
| Vira I. Heinz Endowment | (T) 412-281-5777<br>(F) 412-281-5788<br><br>Mr. Andrew McElwaine | 30 CNG Tower<br>625 Liberty Avenue<br>Pittsburgh, PA 15222-3115<br><br>www.heinz.org/low/environment/ | Funds to implement ecosystem programs in selected western PA watersheds. Small matching grants are provided to the DCNR for the Coldwater Heritage program. | YES | YES | YES |
| Washington Co. Conservation District | (T) 724-228-6774<br><br>Mr. Gary Stokum | 602 Courthouse Square<br>100 West Beau Street<br>Washington, PA 15301-4402<br><br>WCCD@COBWEB.NET | Provides technical and financial assistance to farmers, developers, and conservation organizations. | YES | YES | YES |

# POTENTIAL TECHNICAL & FUNDING ASSISTANCE FOR WATERSHED PROJECTS IN PENNSYLVANIA

| Source of Assistance | Phone | Contact Information | Assistance Information | Planning | Const. | Other |
|---|---|---|---|---|---|---|
| Waterways Conservation Grant Program (Conserve 2000 Fund)<br><br>Commonwealth of PA<br>PA Fish and Boat Commission | (T) 717-657-4515<br>717-657-4540<br>(F) 717-657-4033<br><br>(T) 814-445-3454<br>Mr. Rick Lorson | PA Fish and Boat Commission<br>PO Box 67000<br>Harrisburg, PA 17160-7000<br><br>www.fish.state.pa.us | Grants support activities directed at restoring and protecting watersheds; including acquisition, and enhancing riparian habitat.<br>Application Deadline: June. | YES | YES | YES |
| Western PA Watershed Protection Program | (T) 814-869-4847<br><br>Mr. John Dawes | RD #1, Box 152<br>Alexandria, PA 16611 | Provides funding to grassroot organizations and watershed associations for site specific watershed remediation in western PA. | YES | YES | YES |
| WPCAMR:<br>Western PA Coalition For Abandoned Mine Reclamation | (T) 724-837-5271<br>(F) 724-837-4127<br><br>Mr. Mark Killar | Donohoe Center<br>RD # 12 - Box 202-B<br>Greensburg, PA 15601<br><br>wpcamr@westol.com | Grants through the Regional Watershed Support Initiative<br>Applications -December<br>Received - January<br>Complete - June | YES | YES | YES |
| Canaan Valley Institute | (T) 814-768-9584<br><br>Ms. Janie French<br><br>(T) 304-866-4739<br>1-800-922-3601<br><br>Ms. Emily Grafton | 650 Leonard Street<br>Clearfield, PA 16830<br><br>www.canaanvi.org | Promotes the development and growth of local organizations committed to improving or maintaining the natural resources of their watersheds, in the Mid-Atlantic Highlands portions of PA. MD. VA and all of WV. | YES | YES | YES |
| Penn State Cooperative Extension | (T) 412-473-2540<br><br>Mr. Dino De Ciantis | 400 North Lexington Street<br>Pittsburgh, PA 15208<br><br>www.allegheny.extension.psu.edu | Provide technical assistance to homeowners, farmers, and others concerning agricultural issues. | YES | NO | YES |
| League of Women Voters:<br><br>Citizen Education Fund and Water Resources Education Network | (T) 724-465-2595<br>(T) 724-465-4687<br>1-800-692-7281<br><br>Ms. Sherene Hess | 226 Forester Street<br>Harrisburg, PA 17102<br><br>http://www.pa/lwv.org/wren | Grants up to $3000.00<br>Application: January<br>Begin: Spring<br><br>Grants are available for community education or outreach projects pertaining to water resource issues. | YES | YES | NO |

# POTENTIAL TECHNICAL & FUNDING ASSISTANCE FOR WATERSHED PROJECTS
# NATIONAL ORGANIZATIONS

| Source of Assistance | Phone | Address | Assistance Information | Planning | Const. | Other |
|---|---|---|---|---|---|---|
| American Canoe Association | (T) 703-451-0141<br><br>Mr. David Jenkins | 7432 Alban Station Boulevard<br>Suite B232<br>Springfield, VA 22150 | May provide funding for various watershed related projects including starting groups and lobbying. | YES | NO | YES |
| National Park Service:<br><br>Rivers, Trails, and Conservation Assistance Program | (T) 215-597-1581<br><br>Mr. Jody Bellows | 200 Chestnut Street, 3rd Floor<br>Philadelphia, PA 19106 | Provide technical, administrative, public facilitation and other services for a variety of projects. | YES | NO | YES |
| Charles A. and Anne Morrow Lindburgh Foundation | (T) 763-576-1596 | 2150 Third Avenue North, Suite 310<br>Anoka, MN 55303-2200<br><br>www.lindberghfoundation.org | Grants awarded fro the conservation of natural resources and water resource management. | YES | NO | YES |
| American Sportfish Association and Foundation | (T) 703-519-9691<br><br>Mr. Thomas Marshall | 1033 North Fairfax Street, #200<br>Alexandria, VA 22314<br><br>www.fishamerica.org<br>www.asafishing.org | Grants awarded for: stream bank stabilization materials, instream habitat improvements, contracted heavy equipment, and stream morphology work. | NO | YES | NO |
| Scenic America | (T) 202-543-6200<br><br>Ms. Debra Myerson | 801 Pennsylvania Avenue, SE<br>Suite 300<br>Washington, DC 20003<br><br>www.scenic.org | Technical assistance for improving community visual quality assessments, sign control, cellualr tower location, amonst other visual pollution issues. | YES | YES | YES |
| Wildlife Forever | (T) 612-936-0605<br>(F) 612-936-0915<br><br>Ms. Andrea Stoffregen | 12301 Whitewater Drive<br>Suite 210<br>PO Box 3404<br>Minnetonka, MN 55343<br><br>www.wildlife forever.org | Provides technical and financial assistance for habitat enhancement projects. | YES | YES | YES |
| USEPA:<br><br>Five Star Restoration Program | (T) 202-260-8076<br><br>Mr. John Pai | Office of Wetlands, Oceans, and Watersheds (4502F)<br>Ariel Rios Building<br>1200 Pennsylvania Avenue<br>Washington, DC 20460<br><br>www.epa.gov/owow/wetlands/<br>restore/5star/ | Clean Water Act<br>Section 104 (b)(3) Program<br>Applications - Jan./Feb. | YES | YES | YES |

# POTENTIAL TECHNICAL & FUNDING ASSISTANCE FOR WATERSHED PROJECTS
# NATIONAL ORGANIZATIONS

| Source of Assistance | Phone | Contact Information | Assistance Information | Planning | Const. | Other |
|---|---|---|---|---|---|---|
| North American Wetlands Conservation Council | (T) 413-253-8269<br><br>Attention:<br>Small Grants Coordinator | Atlantic Coast Joint Venture<br>US Fish and Wildlife Service<br>300 Westgate Center Drive<br>Hadley, MA 01035-9589<br><br>www.fws.gov/r9nawwo | Program promotes long-term wetland activities through encouraging participation by new partners who may not be able to compete in the standard grant program.<br>Grants no larger than $50,000.<br><br>Application: December | YES | YES | YES |
| WalMart/Sam's Club:<br><br>Environmental Clean Air and Water Grant | See Local WalMart/Sam's Club | Grants are administered through the local stores. Talk with Store Manager for applications.<br><br>Washington and Robinson Town Center, PA Stores. | Funding distributed on a first come first serve basis.<br><br>Funding Distribution: February | YES | YES | YES |
| National Tree Trust | (T) 202-628-8733<br><br>Ms. Joanne Miller | 1120 G Street, NW<br>Suite 770<br>Washington, DC 20005<br><br>www.nationaltreetrust.org/ | Grants awarded: Tree plantings, education, administration, and national/regional programs. | YES | YES | YES |
| The Foundation Center | (T) 212-620-4230<br><br>(T) 412-622-1917 | 4400 Forbes Avenue<br>Pittsburgh, PA 15213<br><br>http://fdncenter.org | An independent national service organization established by foundations to provide an authoritative source of information about private philanthropic giving. | NO | NO | YES |
| National Audubon Society | (T) 412-963-6100 | 614 Dorseyville Road<br>Pittsburgh, PA 15238<br><br>www.audubon.org | Inspire and educate people of southwestern PA to be respectful of the natural world. | NO | NO | YES |
| Wildlife Habitat Council | (T) 301-588-8994<br>(T) 412-433-5900<br><br>Ms. Marsh Mazlavic | 1010 Wayne Avenue, Suite 920<br>Silver Springs, MD 2-910<br><br>http://www.wildlifehc.org | Provide technical assistance to corporate and community organizations to improve wildlife habitat. | YES | NO | YES |
| National Wildlife Federation:<br><br>Community and Backyard Wildlife Habitat Programs | (T) 703-790-4434<br>1-800-822-9919 | 8925 Leesburg Pike<br>Viena, VA 22184-0001<br><br>http://www.nwf.org/habitats | Provide technical assistance to corporate, communities, and organizations to improve wildlife habitat. | YES | NO | YES |

# POTENTIAL TECHNICAL & FUNDING ASSISTANCE FOR WATERSHED PROJECTS IN PENNSYLVANIA

| Source of Assistance | Phone | Contact Information | Assistance Information | Planning | Const. | Other |
|---|---|---|---|---|---|---|
| PennVest (Pennsylvania Infrastructure Investment Authority): V.A. Johnson. 1997. *A Water, Sewer and Stormwater Utility's Guide to Financial and Technical Assistance Programs*. Harrisburg, PA. A 56 page guidance document that provides telephone numbers, addresses, Internet and email addresses, and contacts for a variety of infrastructure grant programs. These include sewer, septic, and water systems, stormwater, floodplain management, community planning, municipal training, Appalachian Regional activities, and rural development activities. For assistance and to receive a copy of this guidance document, please call Ms. Vickie Johnson at 717-783-8618. | | | | | | |
| Pennsylvania Department of Community and Economic Development (PADCED): *PADCED Funding Source Directory*. 2000. A 15 page guidance document that provides sources of information concerning a variety of funding programs to assist in community and economic development. Please contact the PADCED for assistance in attaining this guidance document at 1-800-379-7448. | | | | | | |
| PADEP<br><br>Greensburg District Office | (T) 724-925-5500<br>(F) 724-925-5557<br>Ms. Margaret Hall<br><br>HALL.MARGARET@A1.dep.state.pa.us | RR2, Box 603-C<br>Greensburg, PA 15601-8739<br><br>www.dep.state.pa.us | Grants for various environmental and conservation activities (i.e., Reclaim PA, Community Environmental Projects, and Growing Greener Grants for Mine Drainage Treatment and Mine Reclamation. | YES | YES | YES |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

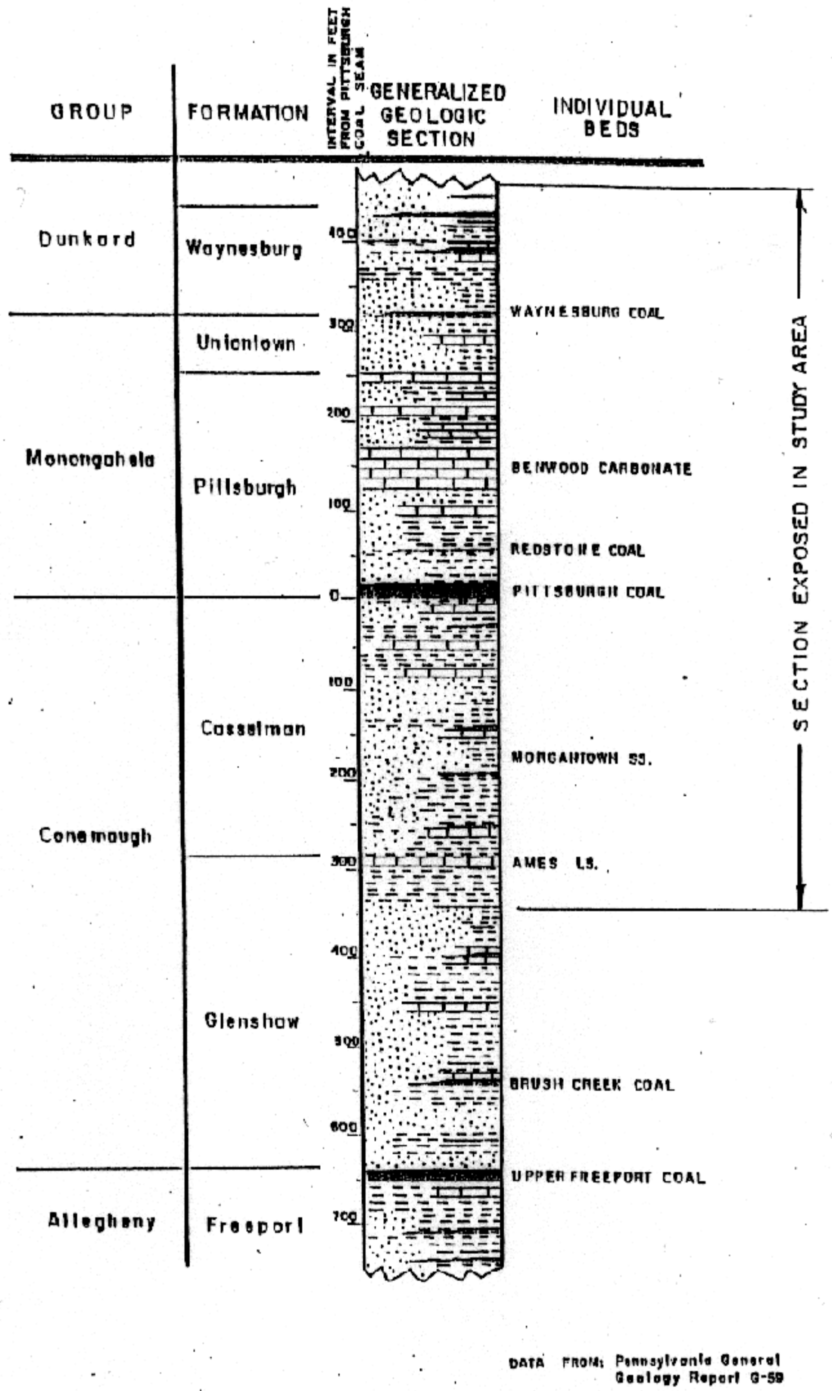
# APPENDIX E

## Scarlift Reports

| Project Number | Project Description | Engineer/Contractor | Project Cost | Project Date | Location1 | Location2 |
|---|---|---|---|---|---|---|
| SL 130 | Feasibility Study of Lengeloth Francis Mine Complex | E. D'Appolonia | 38,903.72 | 1/70-12/75 | Burgetts Fork of Raccoon Creek | Washington Co. |
| SL 130-1 | Study and Design for Acid Mine Drainage Pollution Abatement on State Game Land #117 | E. D'Appolonia | 58,299.20 | | Raccoon Creek, Smith and Hanover Twps. | Washington Co. |
| SL 130-1-101.1 | Construction of Acid Mine Drainage Pollution Abatement Facilities, State Game Land #117 | Anjo Construction Co. | 721,535.99 | 10/75-3/77 | Raccoon Creek, Smith and Hanover Twps. | Washington Co. |
| SL 130-2 | Mine Drainage Pollution Survey | A.C. Ackenheil & Associates, Inc. | 75,420.00 | 9/70-11/72 | Hillman State Park | Washington Co. |
| SL 130-2-1 | Design of Reclamation Project Areas 1A, 1B, 3 and 4 | A. C. Ackenheil & Associates, Inc. | 121,810.00 | 11/72-7/77 | Raccoon Creek, Hillman State Park | Washington Co. |
| SL 130-2-1.1A | Strip Mine Reclamation Project Area 1A | M. F. Fetterolf Coal Co., Inc. | 423,833.73 | 10/73-11/74 | Raccoon Creek, Hillman State Park | Washington Co. |
| SL 130-2-1.1B* | Construction - Acid Mine Drainage Abatement Facilities Project Area #1B | Beaver Construction and Grading Co., Inc. | 1,180,004.88 | 7/75-8/77 | Raccoon Creek, Hillman State Park | Washington Co. |
| SL 130-2-1.3 | Construction of Strip Mine Reclamation Project Area No. 3 | M & M Equipment Sales Co. | 436,063.36 | 8/73-5/75 | Raccoon Creek, Hillman State Park | Washington Co. |
| SL 130-2-1.4 | Strip Mine Reclamation Project Area No. 4 | M. F. Fetterolf Coal | 80,565.00 | 8/73-4/74 | Raccoon Creek, Hillman State Park | Washington Co. |
| SL 130-3 | Remove, transport and sell all coal uncovered | Bologna Coal Co. | 245,446.10 | 1/71-8/72 | Hanover and Smith Townships | Washington Co. |
| SL 130-3-1A | Construction of Acid Mine Drainage Facilities | Transcontinental Construction Co., Inc. | 401,402.26 | 5/78-11/78 | Raccoon Creek, Smith Township | Washington Co. |
| SL 130-4 | Core Drilling - Langeloth Mine | Sprague & Henwood, Inc. | 2,221.82 | 25965 | Raccoon Creek | Washington Co. |
| SL 130-5 | Subsidence Sealing and Backfill | Alex E. Paris Contracting Co. | 13,869.20 | 2/73-3/73 | Cherry Valley, Raccoon Creek | Washington Co. |
| SL 130-7 | Watershed Study | A. C. Ackenheil & Associates, Inc. | 122,455.19 | 9/73-4/76 | Raccoon Creek | Allegheny, Beaver, & Washington Co.s |
| SL 130-7-1 | Design of Abatement Measures Strip Mine Reclamation | A. C. Ackenheil & Associates, Inc. | 30,014.01 | 10/74-7/76 | Raccoon Creek | Washington Co. |
| SL 130-7-2 | Mine Drainage Site Evaluation | A. C. Ackenheil & Associates, Inc | 44,746.33 | | Raccoon Creek | Washington Co. |
| SL 130-8* | Demonstration Project | A. C. Ackenheil & Associates, Inc. | 106,560.40 | | Raccoon Creek | Allegheny, Beaver, & Washington Co.s |
| SL 130-10-101.1 | Channel Construction | M&M Equipment Sales Co. | 9,680.15 | | Smith Township | Washington Co. |

# APPENDIX F

## Plate 1 and 2




# GENERALIZED COLUMNAR SECTION OF RÃCCOON CREEK STUDY AREA

PLATE 1

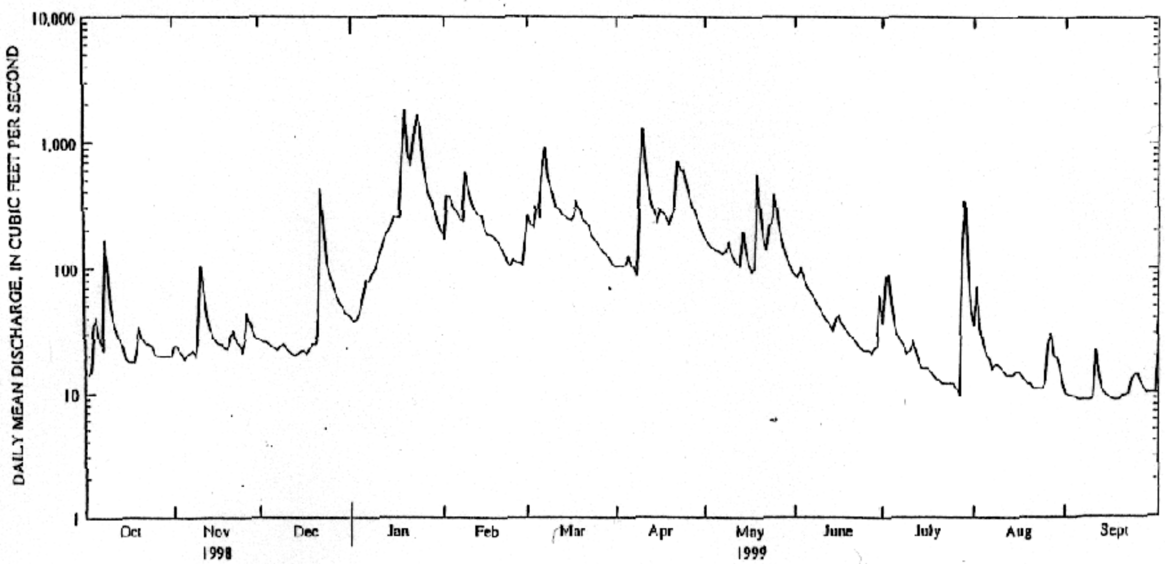
## 03108000 RACCOON CREEK AT MOFFATTS MILL, PA--Continued

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1942 - 1999, BY WATER YEAR (WY)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MEAN | 63.2 | 112 | 193 | 254 | 320 | 409 | 342 | 263 | 142 | 86.1 | 68.9 | 54.8 |
| MAX | 359 | 764 | 717 | 737 | 788 | 1010 | 757 | 618 | 632 | 389 | 651 | 453 |
| (WY) | 1955 | 1986 | 1991 | 1952 | 1956 | 1945 | 1957 | 1983 | 1989 | 1990 | 1980 | 1975 |
| MIN | 7.98 | 14.8 | 15.1 | 34.5 | 47.7 | 56.3 | 94.7 | 65.6 | 26.3 | 15.6 | 10.2 | 9.73 |
| (WY) | 1964 | 1964 | 1964 | 1967 | 1964 | 1969 | 1946 | 1986 | 1988 | 1965 | 1965 | 1964 |

| SUMMARY STATISTICS | FOR 1998 CALENDAR YEAR | | FOR 1999 WATER YEAR | | WATER YEARS 1942 - 1999 | |
|---|---|---|---|---|---|---|
| ANNUAL TOTAL | 66616 | | 49904.7 | | | |
| ANNUAL MEAN | 183 | | 137 | | 192 | |
| HIGHEST ANNUAL MEAN | | | | | 314 | 1951 |
| LOWEST ANNUAL MEAN | | | | | 90.9 | 1954 |
| HIGHEST DAILY MEAN | 2610 | Jan 8 | 1810 | Jan 19 | 6120 | Jan 27 1952 |
| LOWEST DAILY MEAN | 14 | Oct 2 | 8.8 | Sep 5a | 4.8 | Sep 8 1945 |
| ANNUAL SEVEN-DAY MINIMUM | 16 | Sep 14 | 9.1 | Sep 13 | 5.6 | Aug 20 1965 |
| INSTANTANEOUS PEAK FLOW | | | 2570 | Jan 19 | b8590 | Jan 27 1952 |
| INSTANTANEOUS PEAK STAGE | | | c5.18 | Jan 19 | 9.71 | Jan 27 1952 |
| INSTANTANEOUS LOW FLOW | | | 8.8 | Sep 4d | 4.5 | Aug 24 1965 |
| ANNUAL RUNOFF (CFSM) | 1.03 | | .77 | | 1.08 | |
| ANNUAL RUNOFF (INCHES) | 13.92 | | 10.43 | | 14.64 | |
| 10 PERCENT EXCEEDS | 434 | | 321 | | 449 | |
| 50 PERCENT EXCEEDS | 87 | | 42 | | 97 | |
| 90 PERCENT EXCEEDS | 20 | | 13 | | 20 | |

a Also Sept. 6, 7, 15-17.
b From rating curve extended above 3,600 $ft^3/s$.
c Maximum gage height, 5.19 ft, Jan. 18 (backwater from ice).
d Also Sept. 5-8, 14-17.




1-YEAR HYDROGRAPH
OCTOBER 1, 1998 TO SEPTEMBER 30, 1999

PLATE 2

# APPENDIX G

## Scarlift 1974 Data Versus 2000 Data

**RACCOON CREEK WATERSHED** **SCARLIFT WATER QUALITY-STREAM DATA**

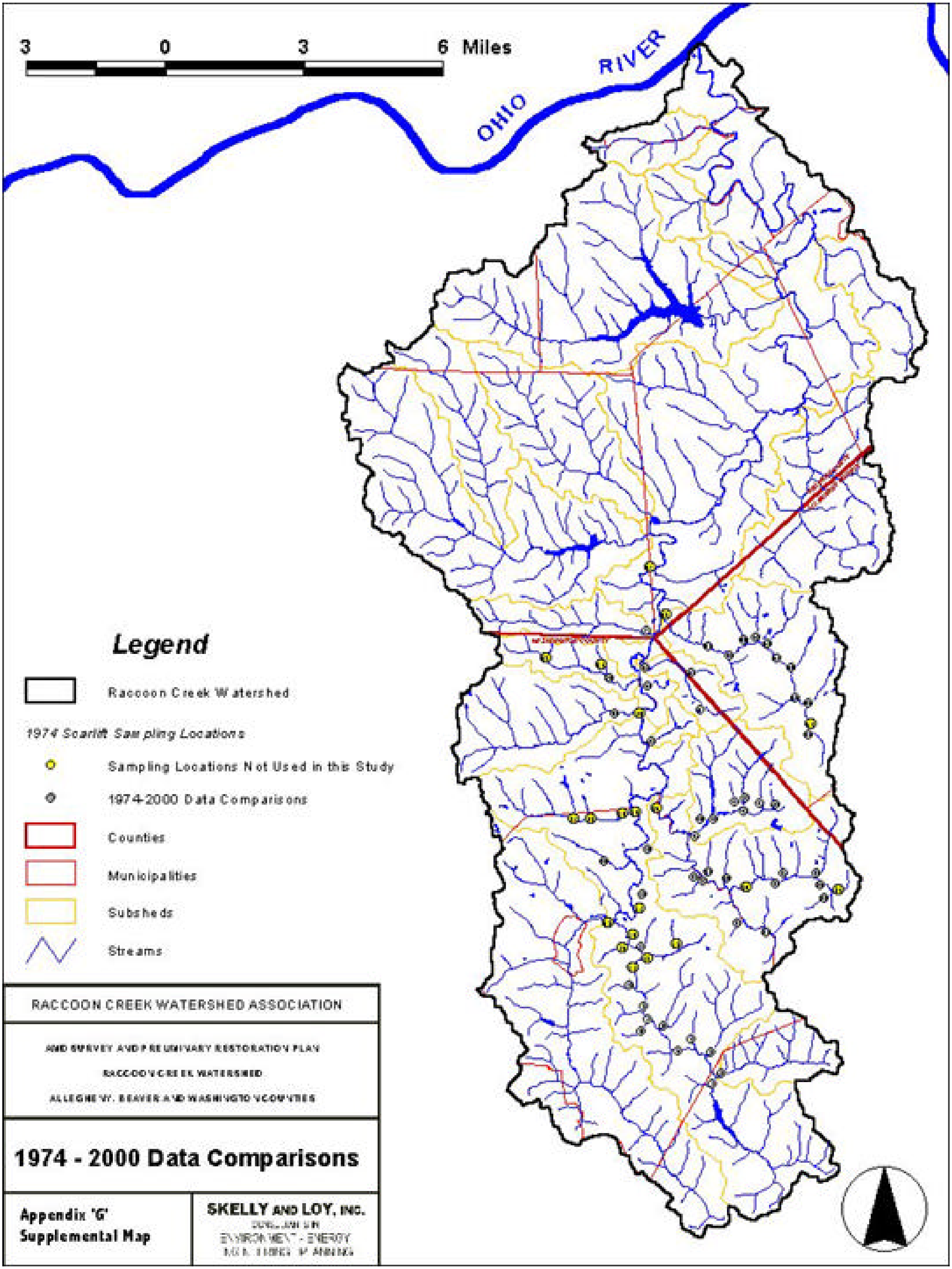
| STREAM | DATA SOURCE | STREAM REACH | AVG FLOW | AVG ACIDITY | AVG TONS OF ACID PER YEAR | AVG ALKALINITY | AVG TONS OF ALK. PER YEAR | AVG TOTAL IRON | AVG TONS OF IRON PER YEAR | AVG SULFATES | AVG TONS OF SULFATES PER YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RACCOON CREEK | SCARLIFT - 1974 | SR-1 | 3005 | 5 | 33 | 275 | 1813 | 0.3 | 2 | 170 | 1121 |
| | J. DAVIDSON - 2000 | | 3005 | 0 | 0 | 144 | 949 | 0.37 | 2 | 42 | 277 |
| | | | | | **33** | | **864** | | **0** | | **844** |
| CHERRY RUN | SCARLIFT - 1974 | SR-2 | 1283 | 0 | 0 | 275 | 774 | 0.3 | 1 | 170 | 478 |
| | J. DAVIDSON - 2000 | | 1283 | | 0 | 200 | 563 | 1.1 | 3 | 41 | 115 |
| | | | | | **0** | | **211** | | **-2** | | **363** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-3 | 480 | 4 | 4 | 351 | 370 | 0.3 | 0 | 170 | 179 |
| | J. DAVIDSON - 2000 | | 480 | 0 | 0 | 264 | 278 | 0.55 | 1 | 222 | 234 |
| | | | | | **4** | | **92** | | **0** | | **-55** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-4 | 93 | 1 | 0 | 351 | 72 | 0.2 | 0 | 170 | 35 |
| | J. DAVIDSON - 2000 | | 93 | 0 | 0 | 264 | 54 | 0.76 | 0 | 44 | 9 |
| | | | | | **0** | | **18** | | **0** | | **26** |
| RACCOON CREEK | SCARLIFT - 1974 | SR-5 | 5489 | 2 | 24 | 251 | 3022 | 0.3 | 4 | 160 | 1927 |
| | J. DAVIDSON - 2000 | | 5489 | 0 | 0 | 188 | 2264 | 1.2 | 14 | 55 | 662 |
| | | | | | **24** | | **759** | | **-11** | | **1264** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-6 | 368 | 0 | 0 | 347 | 280 | 0.2 | 0 | 160 | 129 |
| | J. DAVIDSON - 2000 | | 368 | 0 | 0 | 274 | 221 | 0.39 | 0 | 51 | 41 |
| | | | | | **0** | | **59** | | **0** | | **88** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-7 | 167 | 2 | 1 | 233 | 85 | 0.2 | 0 | 180 | 66 |
| | J. DAVIDSON - 2000 | | 167 | 0 | 0 | 218 | 80 | 0.64 | 0 | 49 | 18 |
| | | | | | **1** | | **5** | | **0** | | **48** |
| RACCOON CREEK | SCARLIFT - 1974 | SR-8 | 6518 | 41 | 586 | 119 | 1701 | 13.6 | 194 | 290 | 4146 |
| | J. DAVIDSON - 2000 | | 6518 | 0 | 0 | 162 | 2316 | 10 | 143 | 182.5 | 2609 |
| | | | | | **586** | | **-615** | | **51** | | **1537** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-9 | 183 | 1 | 0 | 278 | 112 | 0.1 | 0 | 160 | 64 |
| | J. DAVIDSON - 2000 | | 183 | 0 | 0 | 232 | 93 | 0.72 | 0 | 50 | 20 |
| | | | | | **0** | | **18** | | **0** | | **44** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-10 | 86 | 4 | 1 | 377 | 71 | 1.3 | 0 | 370 | 70 |
| | J. DAVIDSON - 2000 | | 86 | 0 | 0 | 292 | 55 | 0.3 | 0 | 416 | 78 |
| | | | | | **1** | | **16** | | **0** | | **-9** |
| UNT. RACCOON CK. | | SR-11 | 64 | 3 | 0 | 233 | 33 | 0.2 | 0 | 180 | 25 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **0** | | **33** | | **0** | | **25** |
| UNT. RACCOON CK. | | SR-12 | 855 | 317 | 595 | 0 | 0 | 21.8 | 41 | 800 | 1500 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **595** | | **0** | | **41** | | **1500** |
| UNT. RACCOON CK. | | SR-13 | 97 | 650 | 138 | 0 | 0 | 0.7 | 0 | 830 | 177 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **138** | | **0** | | **0** | | **177** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-14 | 171 | 133 | 50 | 3 | 1 | 140 | 53 | 560 | 210 |
| | J. DAVIDSON - 2000 | | 171 | 0 | 0 | 154 | 58 | 0.4 | 0 | 263 | 99 |
| | | | | | **50** | | **-57** | | **52** | | **111** |
| UNT. RACCOON CK. | | SR-15 | 191 | 110 | 46 | 2 | 1 | 12.5 | 5 | 610 | 256 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **46** | | **1** | | **5** | | **256** |
| RACCOON CREEK | | SR-16 | 27336 | 66 | 3958 | 69 | 4138 | 13.2 | 792 | 410 | 24586 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **3958** | | **4138** | | **792** | | **24586** |
| UNT. RACCOON CK. | | SR-17 | 67 | 93 | 14 | 4 | 1 | 1.7 | 0 | 970 | 143 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **14** | | **1** | | **0** | | **143** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-18 | 27 | 18 | 1 | 50 | 3 | 1.1 | 0 | 750 | 44 |
| | J. DAVIDSON - 2000 | | 27 | 0 | 0 | 60 | 4 | 3.2 | 0 | 487 | 29 |

| STREAM | DATA SOURCE | STREAM REACH | AVG FLOW | AVG ACIDITY | AVG TONS OF ACID PER YEAR | AVG ALKALINITY | AVG TONS OF ALK. PER YEAR | AVG TOTAL IRON | AVG TONS OF IRON PER YEAR | AVG SULFATES | AVG TONS OF SULFATES PER YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | **1** | | **-1** | | **0** | | **16** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-19 | 47 | 425 | 44 | 2 | 0 | 6.8 | 1 | 1370 | 141 |
| | J. DAVIDSON - 2000 | | 47 | 228 | 24 | 0 | 0 | 5.5 | 1 | 1105 | 114 |
| | | | | | **20** | | **0** | | **0** | | **27** |
| RACCOON CK. | | SR-20 | 22562 | 57 | 2821 | 64 | 3168 | 11.2 | 554 | 560 | 27716 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **2821** | | **3168** | | **554** | | **27716** |
| L. RACCOON CK | SCARLIFT - 1974 | SR-21 | 328 | 4822 | 3470 | 0 | 0 | 2416.4 | 1739 | 640 | 460 |
| | J. DAVIDSON - 2000 | | 328 | 0 | 0 | 104 | 75 | 0.3 | 0 | 473 | 340 |
| | | | | | **3470** | | **-75** | | **1738** | | **120** |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-22 | 62 | 4 | 1 | 235 | 32 | 0.1 | 0 | 300 | 41 |
| | J. DAVIDSON - 2000 | | 62 | 0 | 0 | 160 | 22 | 0.37 | 0 | 314 | 43 |
| | | | | | **1** | | **10** | | **0** | | **-2** |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-23 | 185 | 9 | 4 | 52 | 21 | 0.8 | 0 | 780 | 317 |
| | J. DAVIDSON - 2000 | | 185 | 0 | 0 | 44 | 18 | 0.3 | 0 | 787 | 319 |
| | | | | | **4** | | **3** | | **0** | | **-3** |
| UNT. L. RACCOON CK | | SR-24 | 84 | 3 | 1 | 190 | 35 | 0.3 | 0 | 300 | 55 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **1** | | **35** | | **0** | | **55** |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-25 | 450 | 5 | 5 | 115 | 114 | 1 | 1 | 630 | 622 |
| | J. DAVIDSON - 2000 | | 450 | 0 | 0 | 130 | 128 | 0.3 | 0 | 549 | 542 |
| | | | | | **5** | | **-15** | | **1** | | **80** |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-26 | 351 | 66 | 51 | 10 | 8 | 9.4 | 7 | 1460 | 1124 |
| | J. DAVIDSON - 2000 | | 351 | 0 | 0 | 78 | 60 | 0.3 | 0 | 921 | 709 |
| | | | | | **51** | | **-52** | | **7** | | **415** |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-27 | 171 | 303 | 114 | 1 | 0 | 2.3 | 1 | 1740 | 653 |
| | J. DAVIDSON - 2000 | | 171 | 0 | 0 | 92 | 35 | 0.45 | 0 | 359 | 135 |
| | | | | | **114** | | **-34** | | **1** | | **518** |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-28 | 1414 | 152 | 471 | 5 | 16 | 6.5 | 20 | 1360 | 4218 |
| | J. DAVIDSON - 2000 | | 1414 | 0 | 0 | 50 | 155 | 0.71 | 2 | 238 | 738 |
| | | | | | **471** | | **-140** | | **18** | | **3480** |
| UNT. L. RACCOON CK | | SR-29 | 3105 | 114 | 776 | 7 | 48 | 4.4 | 30 | 1220 | 8310 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **776** | | **48** | | **30** | | **8310** |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-30 | 188 | 10 | 4 | 75 | 31 | 0.2 | 0 | 290 | 120 |
| | J. DAVIDSON - 2000 | | 188 | 0 | 0 | 74 | 31 | 0.53 | 0 | 316 | 130 |
| | | | | | **4** | | **0** | | **0** | | **-11** |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-31 | 84 | 3 | 1 | 119 | 22 | 0.2 | 0 | 240 | 44 |
| | J. DAVIDSON - 2000 | | 84 | | 0 | 98 | 18 | 0.7 | 0 | 140.4 | 26 |
| | | | | | **1** | | **4** | | **0** | | **18** |
| L. RACCOON CK | SCARLIFT - 1974 | SR-32 | 3296 | 789 | 5705 | 0 | 0 | 291 | 2104 | 850 | 6146 |
| | J. DAVIDSON - 2000 | | 3296 | 0 | 0 | 92 | 665 | 0.3 | 2 | 343.4 | 2483 |
| | | | | | **5705** | | **-665** | | **2102** | | **3663** |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-33 | 333 | 45 | 33 | 24 | 18 | 6.6 | 5 | 1030 | 752 |
| | J. DAVIDSON - 2000 | | 333 | 0 | 0 | 110 | 80 | 0.4 | 0 | 716.9 | 524 |
| | | | | | **33** | | **-63** | | **5** | | **229** |
| UNT. POTATO GAR | SCARLIFT - 1974 | SR-34 | 558 | 1339 | 1639 | 0 | 0 | 237.3 | 290 | 2460 | 3011 |
| | J. DAVIDSON - 2000 | | 558 | 0 | 0 | 294 | 360 | 1 | 1 | 1205 | 1475 |
| | | | | | **1639** | | **-360** | | **289** | | **1536** |
| RACCOON CREEK | | SR-35 | 15128 | 378 | 12544 | 0 | 0 | 102.1 | 3388 | 770 | 25553 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **12544** | | **0** | | **3388** | | **25553** |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-36 | 347 | 83 | 63 | 6 | 5 | 6.2 | 5 | 1460 | 1111 |
| | J. DAVIDSON - 2000 | | 347 | 0 | 0 | 120 | 91 | 0.3 | 0 | 1330 | 1012 |
| | | | | | **63** | | **-87** | | **4** | | **99** |

| STREAM | DATA SOURCE | STREAM REACH | AVG FLOW | AVG ACIDITY | AVG TONS OF ACID PER YEAR | AVG ALKALINITY | AVG TONS OF ALK. PER YEAR | AVG TOTAL IRON | AVG TONS OF IRON PER YEAR | AVG SULFATES | AVG TONS OF SULFATES PER YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| UNT. RACCOON CK. | | SR-37 | 218 | 3 | 1 | 143 | 68 | 0.2 | 0 | 900 | 430 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **1** | | **68** | | **0** | | **430** |
| | | | | | | | | | | | |
| UNT. RACCOON CK. | | SR-38 | 141 | 0 | 0 | 287 | 89 | 0.3 | 0 | 840 | 260 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **0** | | **89** | | **0** | | **260** |
| | | | | | | | | | | | |
| UNT. RACCOON CK. | | SR-39 | 1800 | 3 | 12 | 106 | 419 | 0.5 | 2 | 920 | 3633 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **12** | | **419** | | **2** | | **3633** |
| | | | | | | | | | | | |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-40 | 44 | 8 | 1 | 40 | 4 | 0.7 | 0 | 690 | 67 |
| | J. DAVIDSON - 2000 | | 44 | 94 | 9 | 0 | 0 | 2.87 | 0 | 611 | 59 |
| | | | | | **-8** | | **4** | | **0** | | **8** |
| | | | | | | | | | | | |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-41 | 72 | 10 | 2 | 48 | 8 | 0.4 | 0 | 860 | 136 |
| | J. DAVIDSON - 2000 | | 72 | 0 | 0 | 46 | 7 | 0.3 | 0 | 522.7 | 83 |
| | | | | | **2** | | **0** | | **0** | | **53** |
| | | | | | | | | | | | |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-42 | 660 | 53 | 77 | 9 | 13 | 5.8 | 8 | 1350 | 1955 |
| | J. DAVIDSON - 2000 | | 660 | 0 | 0 | 82 | 119 | 0.4 | 1 | 871.7 | 1262 |
| | | | | | **77** | | **-106** | | **8** | | **692** |
| | | | | | | | | | | | |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-43 | 379 | 23 | 19 | 17 | 14 | 4.4 | 4 | 760 | 632 |
| | J. DAVIDSON - 2000 | | 379 | 0 | 0 | 102 | 85 | 0.3 | 0 | 543 | 451 |
| | | | | | **19** | | **-71** | | **3** | | **180** |
| | | | | | | | | | | | |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-44 | 58 | 0 | 0 | 169 | 22 | 3.8 | 0 | 220 | 28 |
| | J. DAVIDSON - 2000 | | 58 | 0 | 0 | 154 | 20 | 0.73 | 0 | 134 | 17 |
| | | | | | **0** | | **2** | | **0** | | **11** |
| | | | | | | | | | | | |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-45 | 2126 | 26 | 121 | 8 | 37 | 3.8 | 18 | 810 | 3778 |
| | J. DAVIDSON - 2000 | | 2126 | 0 | 0 | 72 | 336 | 0.3 | 1 | 757.5 | 3533 |
| | | | | | **121** | | **-298** | | **16** | | **245** |
| | | | | | | | | | | | |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-46 | 76 | 2 | 0 | 177 | 30 | 0.5 | 0 | 180 | 30 |
| | J. DAVIDSON - 2000 | | 76 | 0 | 0 | 184 | 31 | 0.3 | 0 | 42.6 | 7 |
| | | | | | **0** | | **-1** | | **0** | | **23** |
| | | | | | | | | | | | |
| UNT. L. RACCOON CK | SCARLIFT - 1974 | SR-47 | 2341 | 23 | 118 | 14 | 72 | 0.3 | 2 | 830 | 4262 |
| | J. DAVIDSON - 2000 | | 2341 | 0 | 0 | 74 | 380 | 0.5 | 3 | 702 | 3605 |
| | | | | | **118** | | **-308** | | **-1** | | **657** |
| | | | | | | | | | | | |
| CHAMBERLAIN RUN | SCARLIFT - 1974 | SR-48 | 377 | 8 | 7 | 57 | 47 | 0.1 | 0 | 590 | 488 |
| | J. DAVIDSON - 2000 | | 377 | 0 | 0 | 94 | 78 | 0.3 | 0 | 475 | 393 |
| | | | | | **7** | | **-31** | | **0** | | **95** |
| | | | | | | | | | | | |
| RACCOON CREEK | | SR-49 | 31206 | 78 | 5339 | 14 | 958 | 21.1 | 1444 | 560 | 38335 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **5339** | | **958** | | **1444** | | **38335** |
| | | | | | | | | | | | |
| UNT. RACCOON CK. | SCARLIFT - 1974 | SR-50 | 90 | 4 | 1 | 77 | 15 | 0.9 | 0 | 230 | 45 |
| | J. DAVIDSON - 2000 | | 90 | 0 | 0 | 80 | 16 | 0.8 | 0 | 126 | 25 |
| | | | | | **1** | | **-1** | | **0** | | **21** |
| | | | | | | | | | | | |
| BIGGER RUN | SCARLIFT - 1974 | SR-51 | 333 | 82 | 60 | 0 | 0 | 12.8 | 9 | 1440 | 1052 |
| | J. DAVIDSON - 2000 | | 333 | 0 | 0 | 104 | 76 | 0.5 | 0 | 878 | 641 |
| | | | | | **60** | | **-76** | | **9** | | **411** |
| | | | | | | | | | | | |
| UNT. BIGGER RUN | SCARLIFT - 1974 | SR-52 | 75 | 5 | 1 | 135 | 22 | 0.6 | 0 | 240 | 39 |
| | J. DAVIDSON - 2000 | | 75 | 0 | 0 | 110 | 18 | 0.47 | 0 | 110 | 18 |
| | | | | | **1** | | **4** | | **0** | | **21** |
| | | | | | | | | | | | |
| BIGGER RUN | SCARLIFT - 1974 | SR-53 | 1041 | 16 | 37 | 31 | 71 | 2.3 | 5 | 940 | 2147 |
| | J. DAVIDSON - 2000 | | 1041 | 0 | 0 | 110 | 251 | 0.3 | 1 | 894 | 2042 |
| | | | | | **37** | | **-180** | | **5** | | **105** |
| | | | | | | | | | | | |
| POTATO GARDEN | | SR-54 | 1596 | 1047 | 3666 | 0 | 0 | 191.4 | 670 | 2210 | 7737 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **3666** | | **0** | | **670** | | **7737** |
| | | | | | | | | | | | |
| UNT POTATO GAR | SCARLIFT - 1974 | SR-55 | 522 | 150 | 172 | 0 | 0 | 23.9 | 27 | 1390 | 1592 |
| | J. DAVIDSON - 2000 | | 522 | 0 | 0 | 84 | 96 | 0.3 | 0 | 845 | 968 |
| | | | | | **172** | | **-96** | | **27** | | **624** |

| STREAM | DATA SOURCE | STREAM REACH | AVG FLOW | AVG ACIDITY | AVG TONS OF ACID PER YEAR | AVG ALKALINITY | AVG TONS OF ALK. PER YEAR | AVG TOTAL IRON | AVG TONS OF IRON PER YEAR | AVG SULFATES | AVG TONS OF SULFATES PER YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| UNT POTATO GAR | SCARLIFT - 1974 | SR-56 | 324 | 10 | 7 | 99 | 70 | 6.6 | 5 | 390 | 277 |
| | J. DAVIDSON - 2000 | | 324 | 0 | 0 | 60 | 43 | 5.8 | 4 | 291 | 207 |
| | | | | | **7** | | **28** | | **1** | | **70** |
| POTATO GARDEN | SCARLIFT - 1974 | SR-57 | 2583 | 595 | 3371 | 9 | 51 | 80.2 | 454 | 1370 | 7763 |
| | J. DAVIDSON - 2000 | | 2583 | 0 | 0 | 78 | 442 | 1.5 | 8 | 597 | 3383 |
| | | | | | **3371** | | **-391** | | **446** | | **4380** |
| UNT POTATO GAR | SCARLIFT - 1974 | SR-58 | 733 | 13 | 21 | 20 | 32 | 1.3 | 2 | 300 | 482 |
| | J. DAVIDSON - 2000 | | 733 | 0 | 0 | 60 | 96 | 1.6 | 3 | 160 | 257 |
| | | | | | **21** | | **-64** | | **0** | | **225** |
| UNT POTATO GAR | SCARLIFT - 1974 | SR-59 | 399 | 3 | 3 | 132 | 116 | 0.5 | 0 | 180 | 158 |
| | J. DAVIDSON - 2000 | | 399 | 0 | 0 | 110 | 96 | 0.5 | 0 | 38.7 | 34 |
| | | | | | **3** | | **19** | | **0** | | **124** |
| UNT POTATO GAR | SCARLIFT - 1974 | SR-60 | 133 | 4 | 1 | 133 | 39 | 3.7 | 1 | 180 | 53 |
| | J. DAVIDSON - 2000 | | 133 | 0 | 0 | 92 | 27 | 0.56 | 0 | 38 | 11 |
| | | | | | **1** | | **12** | | **1** | | **41** |
| POTATO GARDEN | SCARLIFT - 1974 | SR-61 | 4961 | 452 | 4919 | 0 | 0 | 70.9 | 772 | 990 | 10774 |
| | J. DAVIDSON - 2000 | | 4961 | 0 | 0 | 78 | 849 | 0.92 | 10 | 460 | 5006 |
| | | | | | **4919** | | **-849** | | **762** | | **5768** |
| POTATO GARDEN | | SR-62 | 5949 | 403 | 5259 | 0 | 0 | 49.8 | 650 | 1130 | 14747 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **5259** | | **0** | | **650** | | **14747** |
| UNT. DILLOE RUN | | SR-63 | 48 | 8 | 1 | 35 | 4 | 0.5 | 0 | 860 | 91 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **1** | | **4** | | **0** | | **91** |
| UNT. DILLOE RUN | | SR-64 | 162 | 5 | 2 | 231 | 82 | 2.9 | 1 | 340 | 121 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **2** | | **82** | | **1** | | **121** |
| UNT POTATO GAR | SCARLIFT - 1974 | SR-65 | 336 | 267 | 197 | 0 | 0 | 46.2 | 34 | 900 | 663 |
| | J. DAVIDSON - 2000 | | 336 | 0 | 0 | 66 | 49 | 0.3 | 0 | 346 | 255 |
| | | | | | **197** | | **-49** | | **34** | | **408** |
| UNT POTATO GAR | SCARLIFT - 1974 | SR-66 | 353 | 334 | 259 | 0 | 0 | 19.5 | 15 | 1180 | 914 |
| | J. DAVIDSON - 2000 | | 353 | 0 | 0 | 36 | 28 | 4.6 | 4 | 712.3 | 552 |
| | | | | | **259** | | **-28** | | **12** | | **362** |
| RACCOON CREEK | | SR-67 | 43470 | 72 | 6866 | 9 | 858 | 16.1 | 1535 | 620 | 59122 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **6866** | | **858** | | **1535** | | **59122** |
| BURGETTS FORK | | SR-68 | 9531 | 57 | 1192 | 48 | 1004 | 17.6 | 368 | 740 | 15472 |
| | | | | | 0 | | 0 | | 0 | | 0 |
| | | | | | **1192** | | **1004** | | **368** | | **15472** |
| BRUSH RUN | SCARLIFT - 1974 | SR-69 | 4573 | 5 | 50 | 134 | 1344 | 0.2 | 2 | 1070 | 10734 |
| | J. DAVIDSON - 2000 | | 4573 | 0 | 0 | 124 | 1244 | 0.3 | 3 | 995 | 9981 |
| | | | | | **50** | | **100** | | **-1** | | **752** |
| DILLOE RUN | SCARLIFT - 1974 | SR-70 | 1766 | 10 | 39 | 56 | 217 | 1.2 | 5 | 810 | 3138 |
| | J. DAVIDSON - 2000 | | 1766 | 0 | 0 | 62 | 240 | 0.3 | 1 | 1034 | 4006 |
| | | | | | **39** | | **-23** | | **3** | | **-868** |
| WINGFIELD RUN | SCARLIFT - 1974 | SR-71 | 2713 | 4 | 24 | 96 | 571 | 0.6 | 4 | 460 | 2738 |
| | J. DAVIDSON - 2000 | | 2713 | 0 | 0 | 104 | 619 | 0.3 | 2 | 289 | 1720 |
| | | | | | **24** | | **-48** | | **2** | | **1018** |

Notes: 2000 data has been subtracted from scarlift to get a net change in loading. Therefore, a negative number means there has been a net increase in loading.
Sampling Reach points highlighted in green indicate increases in alkalinity loading, increases in acid, iron and sulfates are highlighted in red.
Numbers have been rounded to one decimal, so sometimes the product of the formula is 0 even if there is a small amount of a pollutant.
Sampling Reach points highlighted in yellow is where new data is needed for comparison.
Scarlift flow data at each point was assumed for comparison purposes.


3 0 3 6 Miles
OHIO RIVER
Legend
Raccoon Creek Watershed
1974 Scarlift Sampling Locations
Sampling Locations Not Used in this Study
1974-2000 Data Comparisons
Counties
Municipalities
Subsheds
Streams
RACCOON CREEK WATERSHED ASSOCIATION
AMD SURVEY AND PRELIMINARY RESTORATION PLAN
RACCOON CREEK WATERSHED
ALLEGHENY, BEAVER AND WASHINGTON COUNTIES
1974 - 2000 Data Comparisons
Appendix 'G'
Supplemental Map
SKELLY AND LOY, INC.

# APPENDIX H

## RCWA Benthic Macro-Invertebrate Study

**Raccoon Creek Watershed Association**
**Raccoon Creek Macro-Invertebrate Study**
**Identification to Order/Family**
**1999/2000**

| Sample Location and Organism | Sampling Event | | |
|---|---|---|---|
| | 10/99 | 4/00 | 10/00 |
| **Location A (Keys Run @ Joffre)** | | | |
| Order: Megaloptera<br>Family: Sialidae (Alderfly) | 2 | 1 | 0 |
| Order: Megaloptera<br>Family: Corydalidae (Dobsonfly/Hellgrammite) | 0 | 0 | 1 |
| Order: Diptera<br>Family: Chironomidae (Midges) | 0 | 2 | 0 |
| Order: Amphipoda (Scud) | 0 | 1 | 0 |
| Phylum: Annelida<br>Class: Oligochaeta | 0 | 1 | 0 |
| **Water Quality Rating** | **3.2 (Poor)** | **8.8 (Poor)** | **5.0 (Poor)** |

| Sample Location and Organism | Sampling Event | | |
|---|---|---|---|
| | 10/99 | 4/00 | 10/00 |
| **Location B (Burgetts Fork @ Burgettstown)** | | | |
| Order: Diptera<br>Family: Chironomidae (Midges) | 155 | 3 | 0 |
| Order: Diptera<br>Family: Ceratopogonidae (Biting midges) | 2 | 0 | 0 |
| Order: Odonata<br>Family: Zygoptera (Dragonfly) | 1 | 0 | 0 |
| Order: Megaloptera<br>Family: Sialidae (Alderfly) | 5 | 0 | 0 |
| Order: Megaloptera<br>Family: Corydalidae (Dobsonfly/Hellgrammite) | 0 | 0 | 5 |
| Phylum: Trichoptera<br>Class: Hydropsychidae<br>(Caddisfly, Net-spinning) | 0 | 0 | 5 |
| Phylum: Annelida<br>Class: Oligochaeta | 0 | 23 | 0 |
| **Water Quality Rating** | **4.2 (Poor)** | **2.3 (Poor)** | **8.2 (Poor)** |

**Raccoon Creek Watershed Association**
**Raccoon Creek Macro-Invertebrate Study**
**Identification to Order/Family**
**1999/2000**

| **Sample Location and Organism** | **Sampling Event** | | |
|---|---|---|---|
| | **10/99** | **4/00** | **10/00** |
| **Location C (Raccoon Creek @ Bavington)** | | | |
| Order: Plecoptera<br>Family: Capniidae (Winter stonefly) | 1 | 0 | 0 |
| Order: Megaloptera<br>Family: Corydalidae (Dobsonfly) | 1 | 0 | 1 |
| Order: Diptera<br>Family: Simuliidae (Blackfly) | 0 | 7 | 0 |
| Order: Diptera<br>Family: Tipulidae (Cranefly) | 9 | 3 | 6 |
| Family: Chironomidae (Midge) | 0 | 0 | 1 |
| Order: Odonata<br>Family: Anisoptera (Dragonfly nymph) | 0 | 0 | 1 |
| Order: Coleptera (Riffle Beetle) | 0 | 0 | 2 |
| Order: Decapoda (Crayfish) | 0 | 0 | 1 |
| Order: Trichoptera<br>Family: Polycentropodidae<br>(Tube-making caddisfly) | 0 | 9 | 2 |
| Order: Trichoptera<br>Family: Hydropsychidae<br>(Net spinner caddisfly) | 73 | 0 | 104 |
| **Water Quality Rating** | **11.6 (Poor)** | **7.6 (Poor)** | **28.8 (Fair)** |

**Raccoon Creek Watershed Association**
**Raccoon Creek Macro-Invertebrate Study**
**Identification to Order/Family**
**1999/2000**

| Sample Location and Organism | Sampling Event | | |
|---|---|---|---|
| | 10/99 | 4/00 | 10/00 |
| **Location D (Raccoon Creek @ Murdocksville)** | | | |
| Order: Plecoptera<br>Family: Perolidae (Perlodid stonefly) | SNS | 1 | 0 |
| Order: Megaloptera<br>Family: Sialidae (Alderfly) | SNS | 1 | 0 |
| Order: Megaloptera<br>Family: Corydalidae (Dobsonfly/Hellgrammite) | SNS | 0 | 1 |
| Order: Diptera<br>Family: Tipulidae (Cranefly) | SNS | 1 | 21 |
| Order: Diptera<br>Family: Ceratopogonidae (Biting Midge) | SNS | 0 | 9 |
| Order: Trichoptera<br>Family: Glososomatidae (Saddlecase making caddisfly) | SNS | 3 | 0 |
| **Order: Trichoptera**<br>Family: Hydropsychidae (Net spinner caddisfly) | SNS | 1 | 178 |
| Order: Trichoptera<br>Family: Philopotamidae (Fingernet caddisfly) | SNS | 0 | 1 |
| Class: Crustacea<br>Order: Amphipoda (Scuds) | SNS | 0 | 3 |
| Class: Crustacea<br>Order: Decapoda (Crayfish) | SNS | 1 | 3 |
| **Water Quality Rating** | **NA** | **22.8 (Fair)** | **19.0 (Poor)** |

SNS = Site not sampled
NA = Not Applicable

**Raccoon Creek Watershed Association**
**Raccoon Creek Macro-Invertebrate Study**
**Identification to Order/Family**
**1999/2000**

| Sample Location and Organism | Sampling Event | | |
|---|---|---|---|
| | 10/99 | 4/00 | 10/00 |
| **Location E (Potato Garden Run near Murdocksville)** | | | |
| Order: Plecoptera<br>Family: Perolidae (Perlodid stonefly) | 1 | 1 | 2 |
| Order: Plecoptera<br>Family: Peloperlidae (Roachlike stonefly) | 0 | 1 | 0 |
| Order: Diptera<br>Family: Tipulidae (Cranefly) | 1 | 3 | 9 |
| Order: Diptera<br>Family: Ceratopogonidae (Biting midges) | 0 | 1 | 0 |
| Order: Diptera<br>Family: Empididae (Aquatic dance flies) | 0 | 0 | 8 |
| Order: Diptera<br>Family: Chironomidae (Midges) | 0 | 0 | 2 |
| Order: Diptera<br>Family: Athericidae (Watersnipefly) | 1 | 0 | 0 |
| Order: Trichoptera<br>Family:Polycentropodidae<br>(Tube making caddisfly) | 1 | 7 | 0 |
| Order: Trichoptera<br>Family: Hydropsychidae (Net spinner caddisfly) | 21 | 9 | 111 |
| Order: Trichoptera<br>Family: Limnephidae (Northern casemaker caddisfly) | 0 | 1 | 1 |
| Order: Trichoptera<br>Family: Philopamidae (Fingernet caddisfly) | 246 | 0 | 0 |
| Order: Trichoptera<br>Family: Hydroptilidae (Micro caddisfly) | 0 | 0 | 62 |
| Class: Crustacea<br>Order: Decapoda (Crayfish) | 0 | 2 | 0 |
| **Water Quality Rating** | **16.9 (Poor)** | **20.8 (Poor/Fair)** | **18.6 (Poor)** |

# APPENDIX I

## Primary AMD Site Photographs

Discharge JB-1 which flows into main stem Raccoon Creek and
is located at the end of Bonnymeade Drive in Smith Township.

Discharge JB-2 which flows into main stem Raccoon Creek and
is located adjacent to State Route 4015 across from the Penn-Balt, Inc. Mine No.1
Refuse Disposal Site.

Discharge P6: This discharge flows into Plum Run, and is downstream
discharge P7. It is best accessed at 37 Plum Run

Discharge P7: This discharge is located upstream of discharge P6, and
into Plum Run. It is accessed off of Plum Run Avenue at a “No Dumping”

Discharge L2 : This discharge is being passively treated
facility located at Balogna Industrial Road and then flows
into Burgetts Fork

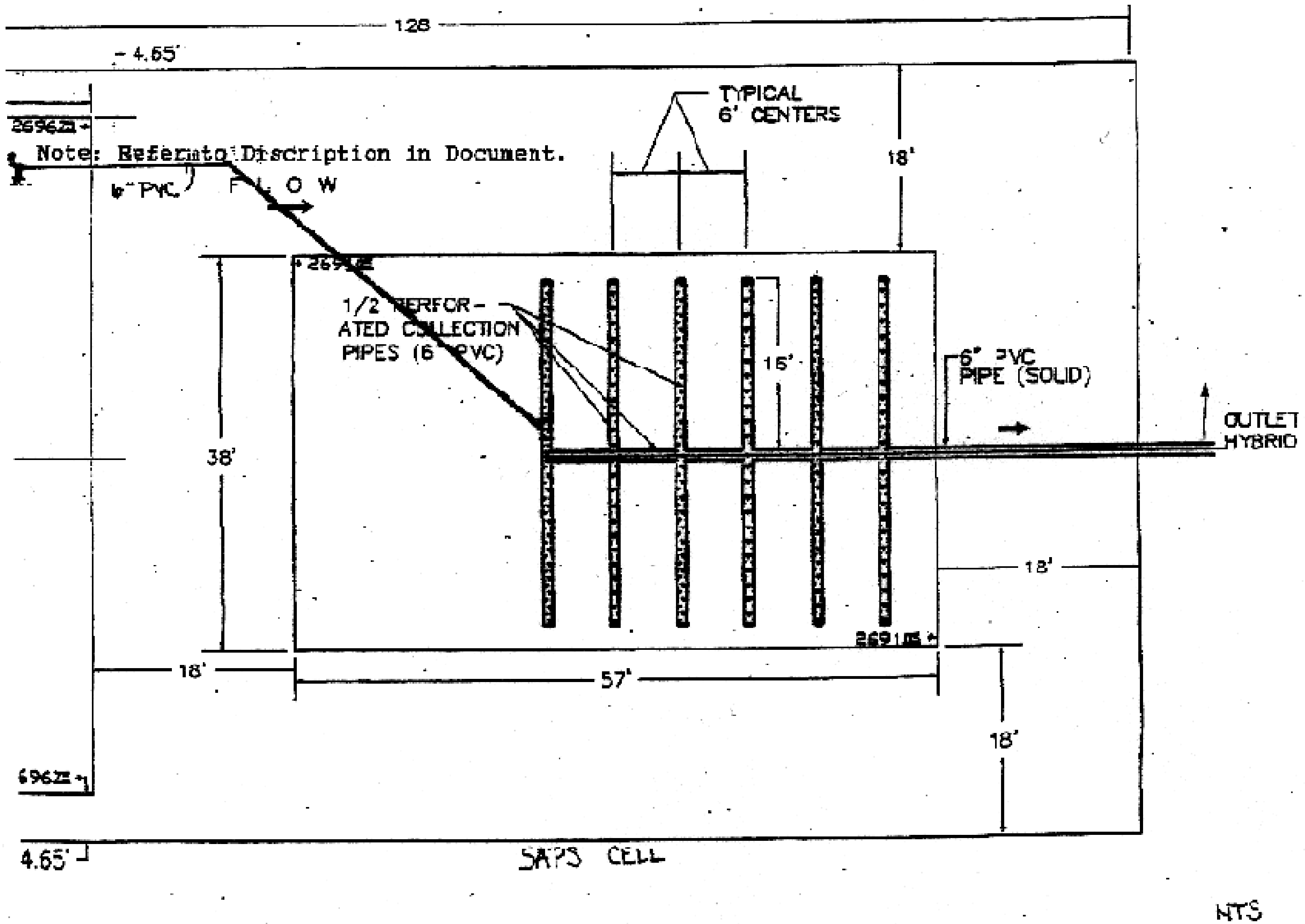
Discharge E1: This discharge flows into Burgetts Fork and is
Ballfield Road and the High School Stadium in Burgettstown.

Discharge H3: This discharge flows into a un-named tributary of Potato Garden Run
and is located approximately 0.3 mile from State Route 3089 above an abandoned farm house

# APPENDIX J

## Emerging Technology Information

## Passive Aluminum Flushing System



Please visit

www.pondaeration.com

for the latest in passive treatment technologies.

# APPENDIX K

## PADEP: Environmental Good Samaritan Act and Project Instructions, Proposal, and Approval Forms

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF MINING AND RECLAMATION

# ENVIRONMENTAL GOOD SAMARITAN PROJECT PROPOSAL

| DEP USE ONLY |
|---|
| Date Received |
| I.D. Number |

## SECTION A. APPLICANT

**1. Applicant's Name:**
**Mailing Address:**

**E-mail address:**

**Applicant is**: (check appropriate blocks)

- ☐ an individual
- ☐ an authority
- ☐ an association
- ☐ other body of local government
- ☐ a business
- ☐ a state or federal agency
- ☐ Other: describe: ____________________

**2. Project Coordinator's Name:**
**Mailing Address:**

**E-mail address:**

**Telephone No.:** (    )    -

**3. Provide the names and addresses of project landowners on Attachment A and project participants on Attachment B. Provide the names and addresses of adjacent and downstream landowners on Attachment C.**

## SECTION B. LOCATION

**1. County:** **Municipality:**

2. Narrative description of the boundaries of the project; identify the properties and their owners within and adjacent to the project area. The applicant may attach a map that provides this information instead of the narrative.

**3. Newspaper with general circulation in the locality of the project:**
**Name:**
**Address:**

**Telephone:**

## SECTION C. DESCRIPTION OF PROJECT

1. **Project Name:** ____________________

Has project started? ☐ Yes When? ____________ ☐ No

Check type of project: ☐ Water Pollution Abatement ☐ Reclamation ☐ Both

2. **Project Area:** ____________ acres **Project duration (months)** ____________

3. **Project Description -** Describe the problem to be addressed by the project and the sequence and timing of project activities, include identifiable milestones and the timetable for completing each milestone. If the project has started, identify the activities currently taking place.

4. **Right of Entry:** Attach documentation that each landowner has given the applicant, the participants and the Department permission to enter onto the project area to Attachment D.

5. **Certification and Signature:**

I certify that the information in this application is true and correct to the best of my knowledge.

Submitted by: ____________________ ____________
Applicant Date

Signature: ____________________ ____________
Title

5600-PM-MR0020 Rev. 8/2000 (Interim)

**Department I.D.**

# Attachment A
# List of Landowners

**(Project Name)** **(Township)** **(County)**

The following landowners have or will have provided access to their land for the reclamation or water pollution abatement project identified above. These landowners may be eligible for coverage under the Environmental Good Samaritan Act of 1999.

| | |
|---|---|
| Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature ______ | Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______ |
| Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature ______ | Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature ______ |
| Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______ | Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______ |
| Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______ | Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______ |

| Department I.D. |
|---|
| |

# Attachment B
## List of Project Participants

**(Project Name)** **(Township)** **(County)**

The following persons have or will have provided equipment, materials or services for the reclamation or water pollution abatement project identified above. These persons may be eligible for coverage under the Environmental Good Samaritan Act of 1999.

| | |
|---|---|
| Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature ______________________ | Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature ______________________ |
| Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______________________ | Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______________________ |
| Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature ______________________ | Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______________________ |
| Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______________________ | Name:<br>Mailing<br>Address:<br><br>Phone #:<br>Type of person:<br>☐ Individual ☐ Partnership ☐ Corporation<br>☐ Association ☐ Authority or Local Government<br>☐ State or federal agency ☐ Other<br>Signature______________________ |

5600-PM-MR0020 Rev. 8/2000 (Interim)

| Department I.D. |
|---|
| |

# Attachment C
# List of Adjacent and Riparian Landowners

(Project Name) (Township) (County)

The following landowners either:

(1) own property immediately next to the property on which the project will take place; or

(2) own stream-side property within 1,000 feet (304.8 meters) downstream of the project.

| | |
|---|---|
| Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream | Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream |
| Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream | Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream |
| Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream | Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream |
| Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream | Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream |
| Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream | Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream |
| Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream | Name:<br>Mailing Address:<br><br>☐ Adjacent ☐ Downstream |

| Department I.D. |
| --- |
| |

# Attachment D
# Permission to Enter Project Area

Each landowner, whose property will be used for the proposed project or used to provide access to the project area, must give in writing his or her permission for the project applicant and participants to come onto the property to work on the proposed project. Each landowner must also give the Department of Environmental Protection permission to come onto the property to observe project activities, collect samples and otherwise do its job. Attach documents here.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF MINING AND RECLAMATION

# APPROVAL OF COVERAGE UNDER THE ENVIRONMENTAL GOOD SAMARITAN ACT

In compliance with the provisions of the Environmental Good Samaritan Act of 1999, the Pennsylvania Department of Environmental Protection hereby approves the ____________________
(Name of Project)

__________________________________________________________________________________.
(Water Pollution Abatement and/or Reclamation Project)

to be conducted by the ______________________________________________________________
(Applicant)

in ____________________________________, ____________________________________.
(township) (county)

The attached lists of landowners and project participants may qualify for the protections and immunities provided by the Environmental Good Samaritan Act for their voluntary reclamation of land or water adversely affected by abandoned mining, oil or gas extraction or exploration for these resources. A person who under existing law is or may become responsible to reclaim the land or address the water pollution or anyone who by order or otherwise is required to or agrees to perform the reclamation or abate the water pollution is not eligible for the protections and immunities provided by the Environmental Good Samaritan Act. This project approval makes no determination as to the eligibility of the landowners and participants identified on the attached lists for protection and immunities provided by the Environmental Good Samaritan Act.

The following permits must be applied for and issued before work on the project site may begin. Applications for these permits may be obtained from this DEP office.

__________________________________________________________

__________________________________________________________

__________________________________________________________

Coverage approval date ________________________

Authorized by ________________________________

___________________ Office

Attachments

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

# BUREAU OF MINING AND RECLAMATION

## ENVIRONMENTAL GOOD SAMARITAN PROJECT PROPOSAL

## INSTRUCTIONS

### GENERAL INFORMATION

1. Eligible Projects are:

   Projects that reclaim lands that have been adversely affected by mining, oil or gas extraction or exploration for these resources.

   Projects that treat or abate water pollution caused by mining or oil or gas extraction.

2. This information is provided to assist the applicant in obtaining DEP approval for reclamation and water pollution abatement projects under the Environmental Good Samaritan Act.
3. Complete the application by typing or printing clearly. If additional space is required to provide information in this application, attach an 8½ x 11 inch sheet of paper appropriately labeled.
4. One original of this application must be completed and submitted to the appropriate DEP District Mining Office.

### GROWING GREENER PROJECTS

If a project is approved for a grant under the Pennsylvania Growing Greener program, the applicant may apply for coverage under the Environmental Good Samaritan Act by completing Attachments A, B, C and D and sending them along with one copy of the Growing Greener grant application to the appropriate District Mining office.

---

### SECTION A. APPLICANT INFORMATION

1. **Applicant:** Identify the person or organization under which the application is filed, the applicant's legal mailing address, and the type of person or persons. The applicant is usually the person who has overall responsibility and control of the project activities.
2. **Project Coordinator:** Give the name of the individual representing the applicant and having primary control of on-site activities; the daytime telephone number for the project coordinator; and the legal mailing address of the project coordinator.
3. **List of Landowners:** Identify all landowners within the project area on Attachment A.
4. **List of Project Participants:** Identify the persons or organizations that will be working on the project on Attachment B. It is not necessary, but it is a good idea, to identify individual members of participating organizations. The project applicant can add

persons to this list as the project progresses. Persons not on the list are not prohibited from working on the project.

5. **List of Adjacent and Riparian Landowners:** Provide the names and addresses of property owners adjacent to the property(ies) on which the project will take place on Attachment C.

If the project is adjacent to a stream or involves a discharge to a stream, provide the names and addresses of persons who own property along the stream downstream of the project area.

---

## SECTION B. LOCATION

1. **Location:** Give the name of the county and municipality, for each site.
2. **Project boundaries:** Provide a narrative describing the boundaries of the project or a map of the project boundaries. Identify the properties and their owners within and adjacent to the project area.
3. **Newspaper of general circulation published in locality of proposed project:** List the name, address and telephone number of a newspaper of general circulation published in the locality of the proposed project. The Department will be responsible for project notices.

---

## SECTION C. PROJECT DESCRIPTION

1. **Project Name:** Give the name of the project and check the box which identifies the type of project.
2. **Project area:** Give the total area in acres to be affected by the project and indicate the expected duration of the reclamation and abatement activities that will be taking place on the project site.
3. **Description of the problem to be addressed by the project:** If the project is a land reclamation project, describe the existing site conditions and total acres to be reclaimed. If the project is a water pollution abatement project, describe the discharges, identifying the polluting substances and their respective concentrations and flow rates. Describe the general nature of the impacts of the discharges on the receiving stream.

**Describe the work to be done and the sequence and timing of activities.**

a. For reclamation projects, include a description of the reclamation to be accomplished.

b. For water pollution abatement projects, include a description of the abatement or treatment measures planned.

**Include a table that identifies the major project milestones and the estimated date for completing each milestone.**

4. **Permission to Enter Project Area:** Each landowner, whose property will be used for the proposed project or used to provide access to the project area, must give his or her **permission in writing** to the project applicant to come onto the property to work on the proposed project. Each landowner must also give the Department of Environmental Protection permission to come onto the property to observe project activities, collect samples and otherwise do its job. Documentation of landowner permission may be in the

form of a letter to the applicant, signed by the landowner. Documentation should be attached to Attachment D.

Once the project is approved, DEP will maintain a permanent record of the participants and landowners who are protected under the Environmental Good Samaritan Act.

For more information or assistance, please contact DEP's District Mining Offices:

## Pottsville District Mining Office

5 West Laurel Boulevard
Pottsville, PA 17901-2454
Telephone: 570-621-3118
*Counties Served: Adams, Berks, Bucks, Carbon, Chester, Columbia, Cumberland, Dauphin, Delaware, Franklin, Juniata, Lackawanna, Lancaster, Lebanon, Lehigh, Luzerne, Mifflin, Monroe, Montgomery, Montour, Northampton, Northumberland, Perry, Pike, Philadelphia, Schuylkill, Snyder, Susquehanna, Union, Wayne, Wyoming and York.*

**Hawk Run District Mining Office**
Empire Road, P.O. Box 209
Hawk Run, PA 16840-0209
Telephone: 814-342-8200
*Counties Served: Bradford, Cameron, Centre, Clearfield, Clinton, Lycoming, Potter, Sullivan and Tioga.*

***Knox District Mining Office***
*White Memorial Building, P.O. Box 669*
*Knox, PA 16232-0669*
*Telephone: 814-797-1191*
*Counties Serves: Butler, Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango and Warren.*

***Cambria Office***
*286 Industrial Park Road*
*Ebensburg, PA 15931*
*Telephone: 814-472-1900*
*Counties Served: Bedford, Blair, Cambria, Fulton, Huntingdon, Indiana and Somerset.*

***Greensburg District Mining Office***
Armbrust Building, RR 2, Box 603C
Greensburg, PA 15601-0982
Telephone: 724-925-5500
*Counties Served: Allegheny, Armstrong, Beaver, Fayette, Greene, Washington and Westmoreland.*

**McMurray District Mining Office**
3913 Washington Road
McMurray, PA 15317-2532
Telephone: 724-941-7100
Counties Served: All counties with underground bituminous mining and subsidence.