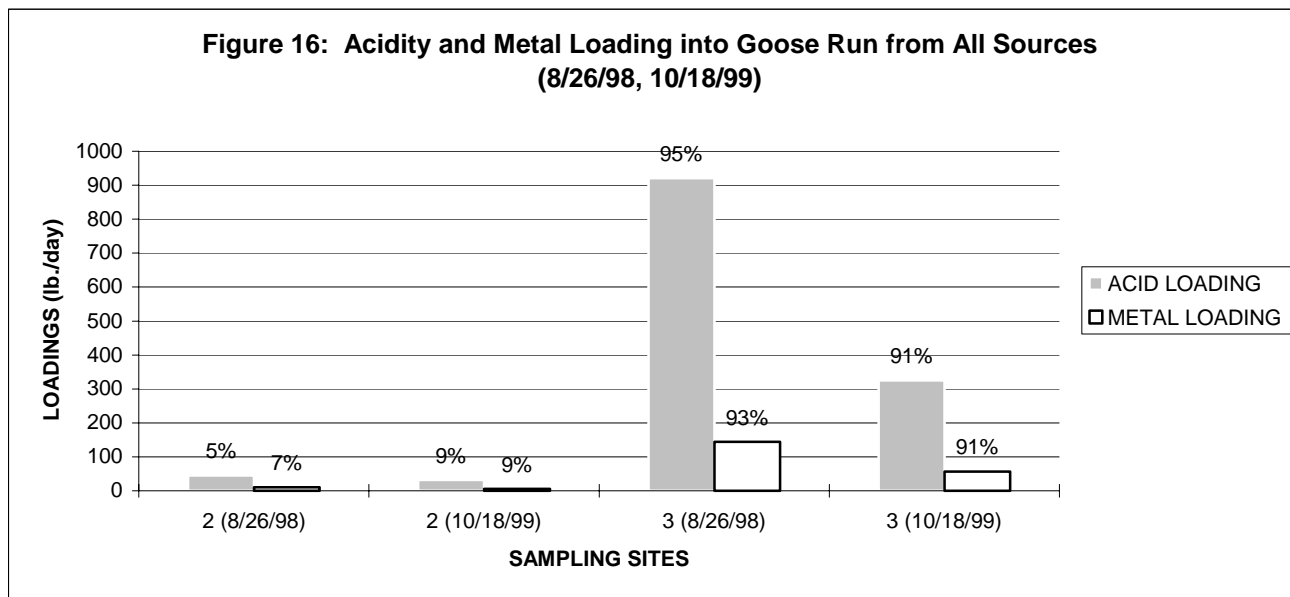


Phase II water sampling occurred on 8/26/98 and again on 10/18/99, recording low-flow conditions (Figure 16). The purpose of this second phase of water sampling is to determine which tributaries entering the Goose Run mainstem contribute a significant amount of AMD. During each canvas, it was determined that tributaries 2 and 3 contributed significant AMD. Tributary 2 contributed 5% of the acidity loading and 7% of the metal loading in Goose Run during August of 1998 and 9% of the acidity loading and 9% of the metal loading at a low-flow period during October of 1999. Tributary 2 has exhibited acidity loading ranges of 30 to 45 lb/day and metal loading of 5 to 10 lb/day. Tributary 3 contributed 95% of the acidity loading and 93% of the metal loading in Goose Run during August of 1998 and 91% of the acidity loading and 91% of the metal loading at a low-flow period during October of 1999. Tributary 3 has exhibited acidity loading ranges of 330 to 920 lb/day and metal loading of 60 to 150 lb/day. Based on available water quality data, tributary 3 is the largest contributor of AMD in the Goose Run sub-watershed followed by tributary 2.

Phase III water sampling occurred between 10/18/99 and 10/20/99 to locate point sources for AMD-generation in each of the affected tributaries. It is important to note that this phase of sampling does not include a high- and low-flow sample. In tributary 2, site 2F was producing 62% of the acidity loading and 74% of the metal loading. This was followed by site 2D which was producing 23% of the acidity loading and 33% of the metal loading in tributary 2.



In tributary 3, site 3B was producing 92% of the acidity loading and 93% of the metal loading. Based on available water quality data, site 3B is the largest contributor of AMD in the Goose Run sub-watershed followed by site 2F and a host of low-priority sites. These sources are described in more detail in the following sections.

2A, 2B, and 2C- Headwaters Of Tributary 2

Location/Access: The headwaters of tributary 2 are located on the Mead reclamation site south of Goose Run Road in Bloomfield Township. These sites are located on the Mulga Quadrangle in the north-central portion of section 10. The Mead reclamation site is easily accessible by vehicle and foot travel. A locked gate secures the access road near Goose Run Road. Permission to access the Mead reclamation site should be directed to Mitch Farley at the Ohio Department of Natural Resources in Jackson, Ohio (740-286-6411). The Mead Paper Company in Chillicothe, Ohio owns the property. The individual in charge of the abandoned mine lands for Mead Paper Company is Steve Mathy (740-772-3472).

Site Description: There are 3 sites associated with the headwaters of tributary 2 including sites 2A, 2B and 2C. These sites are associated with AMD-drainage from the Mead reclamation site. The Mead property was formerly a coal strip mine and was reclaimed by the Ohio Department of Natural Resources. Reclamation activities included grading, capping the mine spoil with BYPRO[®] and grass seeding. Site 2A is a large area of diffuse seeps in the southwest section of the Mead reclamation area. This large wooded drainage apparently was surface-mined and unreclaimed. The confluence of the tributary is located near an abandoned hauling road that connects with the Pattons ville Township Road. Site 2B is associated with an abandoned deep-mine which is not included on the USGS Abandoned Underground Mine map series. The site is located northwest of the high wall on the Mead reclamation site. Site 2C is a small seep draining alongside the Mead reclamation access road near the high wall. This site is believed to be receiving drainage from the Mead Reclamation site.

Water Quality: Site 2A has exhibited acidity loading of 1 lb/day and less than 1 lb/day of metal loading. Site 2B has exhibited acidity loading of 1 lb/day and less than 1 lb/day of metal

loading. Site 2C has exhibited acidity loading of 10 lb/day and metal loading of 2 lb/day. Sites 2A, 2B, and 2C are believed to be low-priority sites that have not been fully characterized in terms of high- and low-flow chemical loadings.

Recommendation: Continuous monitoring should be done for the sites in the headwaters of tributary 2 to capture high- and low-flow conditions and identify a range of acidity and metal loadings. The limited water quality information presently available for these sites may underrate the impact of these sites as significant point sources. It is recommended that monitoring begin with a monthly schedule of filtered Group I samples until reasonable high- and low-flow conditions have been identified. At that time, a reassessment can be made of the impact these sites have upon the sub-watershed. It is recommended that water sampling include sites 2A, 2B, and 2C.

2D - Pattonsville Church Drainage

Location/Access: Site 2D is a part of the Mead reclamation site south of Goose Run Road in Bloomfield Township. Site 2D is located at the confluence of a large drainage valley at the northeast end of the Mead reclamation site. The site is located on the Mulga Quadrangle in the northeast portion of section 10. The reclamation site is easily accessible by vehicle and foot travel. A locked gate secures the access road near Goose Run Road. Permission to access the Mead reclamation site should be directed to Mitch Farley at the Ohio Department of Natural Resources in Jackson, Ohio (740-286-6411). The Mead Paper Company in Chillicothe, Ohio owns the property. The individual in charge of the abandoned mine lands for Mead Paper Company is Steve Mathy (740-772-3472).

Site Description: Site 2D is associated with AMD-drainage from the northeast section of the Mead reclamation site. The Mead property was formerly a coal strip mine and was reclaimed by the Ohio Department of Natural Resources. Reclamation activities included grading, capping the mine spoil with BYPRO[®] and grass seeding. The site consists of a number of diffuse seeps along the southern bank, which drain into the stream above site 2D. Unaffected base flow from the surrounding watershed is believed to be mixing with and diluting the AMD-influx. It is believed

that AMD-generation at the site is due to the reestablishment of a water table within the mine spoil which discharges into nearby streams as base flow.

Water Quality: Site 2D has exhibited acidity loading of 13 lb/day and metal loading of 3 lb/day. Site 2D is believed to be the second largest AMD- producer in tributary 2. This site has not been fully characterized in terms of high- and low-flow chemical loading.

Recommendation: Continuous monitoring is recommended at site 2D to capture high- and low-flow conditions and identify a range of acidity and metal loadings. The limited water quality information presently available for this site may underrate the impact of the site as a significant point source. Monitoring should begin with a monthly schedule of filtered Group I samples until reasonable high- and low-flow conditions have been identified. At that time, a reassessment can be made of the impact this site has upon the sub-watershed. Sampling should include site 2D and a site up-stream which is not impacted by AMD-drainage.

2F - Mead Reclamation Seep

Location/Access: Site 2F is a part of the Mead reclamation site south of Goose Run Road in Bloomfield Township. The site is located on the Mulga Quadrangle in the east-central portion of section 3. The reclamation site is easily accessible by vehicle and foot travel. A locked gate secures the access road near Goose Run Road. Permission to access the reclamation site should be directed to Mitch Farley at the Ohio Department of Natural Resources in Jackson, Ohio (740-286-6411). The Mead Paper Company in Chillicothe, Ohio owns the property. The individual in charge of the abandoned mine lands for Mead Paper Company is Steve Mathy (740-772-3472).

Site Description: Site 2F is a Mead reclamation seep piped with corrugated PVC down the valley from the gas pipeline and the Ohio State University botany test plot. The Mead property was formerly a coal strip mine and was reclaimed by the Ohio Department of Natural Resources. Reclamation activities included grading, capping the mine spoil with BYPRO[®] and grass seeding. It is believed that AMD- generation at the site is due to the reestablishment of a steep sloping water table within the mine spoil which discharges at site 2F.

Water Quality: Site 2F has exhibited acidity loading of 24 lb/day and metal loading of 10 lb/day. Site 2F is believed to be the largest AMD producer in tributary 2. This site has not been fully characterized in terms of high- and low-flow chemical loading.

Recommendation: Site 2F is a Little Raccoon Creek priority treatment site and recommendations for treatment will be covered in section 1 under *Proposed Treatment*. It is suggested that a monthly monitoring schedule of filtered Group II samples be initiated before instituting any treatment programs in order to fully characterize a variety of acidity and metal loading ranges. Sampling sites should include the confluence of the stream draining site 2F.

3A - Deep-Mine JKN-137

Location/Access: Site 3A is located just north of Goose Run Road along an abandoned hauling road in Bloomfield Township. The stream draining site 3A is one of the last streams to merge with tributary 3 before the confluence of Tarr Camp Run. The site is located on the Mulga Quadrangle in the northeast portion of section 3. The site is accessible by foot travel only.

Site Description: This site is an abandoned deep-mine site and most likely associated with deep-mine JKN-137. Site 3A is located upstream from a large waterfall created from a massive sandstone unit underlying the stream bottom at site 3A. The site consists of a small area of diffuse seeps which discharge from soil piping on the west bank of the stream just above the massive sandstone unit. It is believed that a hydraulic connection may exist between the diffuse seeps and deep-mine JKN-137. Deep-mine JKN-137 is located just west of site 3A.

Water Quality: Site 3A has exhibited acidity loading of 2 lb/day and less than 1 lb/day of metal loading. Site 3A is believed to be a low-priority site, but has not been fully characterized in terms of high- and low-flow chemical loading.

Recommendation: Continuous monitoring is recommended at site 3A to capture high- and low-flow conditions and identify a range of acidity and metal loadings. The limited water quality

information presently available for this site may underrate the impact of the site as a significant point source. Monitoring should begin with a monthly schedule of filtered Group I samples until reasonable high- and low-flow conditions have been identified. Sampling sites should include the confluence of the tributary draining site 3A and an upstream site to determine if additional seeps exist.

Treatment for this site has been recommended via an open limestone channel, pending the results of additional sampling. While concentrations are low in Tarr Camp Creek, seasonal loadings of acidity are quite high.

3B - Goose Run Road Seep

Location/Access: Site 3B is located on the north side of Goose Run Road just east of J.C. Cobb Road in Bloomfield Township. An abandoned hauling road runs through the site. The site is located on the Mulga Quadrangle in the west-central portion of section 3. The site is easily accessible by vehicle and foot travel. Cliff Denny, a local resident living on J.C. Cobb Road, owns the property.

Site Description: Sites 3B and 3B1 are abandoned deep-mine sites associated with deep-mine JKN-138 near the confluence of the stream and abandoned deep-mine JKN-129 farther upstream. The majority of the AMD-discharge is emanating from site 3B1, which is near the confluence of tributary 3B. At site 3B1, there is a large area of unreclaimed mine refuse material and a high-flow seep is discharging from the top of the pile. Local residents describe a mine entrance near the location of the seep although no entrance is visible. Upstream from site 3B1 two open mine voids are visible in this vicinity, but they are not discharging. Local residents refer to these mines as low-yield, house coalmines.

Water Quality: The confluence of tributary 3B has exhibited acidity loading of 230 lb/day and metal loading of 60 lb/day. Site 3B1 has exhibited acidity loading of 330 lb/day and metal loading of 100 lb/day. Most of the AMD generated in tributary 3B appears to come from site 3B1, which apparently is the largest AMD-producer in the Goose Run sub-watershed. However, this site has not been fully characterized in terms of high- and low-flow chemical loading.

Recommendation: Site 3B1 is a Little Raccoon Creek priority treatment site and recommendations for treatment will be covered in section 1 under *Proposed Treatment*. It is suggested that a monthly monitoring schedule of filtered Group II samples be initiated before instituting any treatment programs in order to fully characterize the acidity and metal loading ranges. Sampling sites should include the confluence of the tributary 3B and site 3B1.

3C - J.C. Cobb Rd. Seep

Location/Access: Site 3C is located just west of site 3B at the intersection of Goose Run Road and J.C. Cobb Road in Bloomfield Township. The site is located on the Mulga Quadrangle in the west-central portion of section 3. The site is easily accessible by vehicle and foot travel.

Site Description: This site is an abandoned deep-mine site and is most likely associated with deep-mine JKN-145. The mine entrance is not visible, but a bog area and discharge marks the most probable location of the entrance. The site drains underneath both J.C. Cobb Road and Goose Run Road. No significant mine refuse materials were visible in this drainage.

Water Quality: Site 3C has exhibited acidity loading of 11 lb/day and of 2 lb/day of metal loading. Site 3C is believed to be a low-priority site, but has not been fully characterized in terms of high- and low-flow chemical loading.

Recommendation: Continuous monitoring is recommended at site 3C to capture high- and low-flow conditions and identify a range of acidity and metal loadings. The limited water quality information presently available for this site may underrate the impact of the site as a significant point source. Monitoring should begin with a monthly schedule of filtered Group I samples until reasonable high- and low-flow conditions have been identified. At that time, a reassessment can be made of the impact this site has upon the sub-watershed.

3D - Deep-Mine Jkn-174

Location/Access: Site 3D is located just west of site 3C near the intersection of Goose Run Road and J.C. Cobb Road in Bloomfield Township. The site is located on the Mulga Quadrangle in the west-central portion of section 3. The site is only accessible by foot travel.

Site Description: This site is an abandoned deep-mine site and is most likely associated with deep-mine JKN-120. There are a number of open mine voids in this drainage, but none were discharging at the time of sampling. Local residents refer to these mines as low-yield, house coal mines. No significant mine spoil were visible in this drainage.

Water Quality: Site 3D has exhibited acidity loading of 7 lb/day and of 2 lb/day of metal loading. Site 3D is believed to be a low-priority site, but has not been fully characterized in terms of high- and low-flow chemical loading.

Recommendation: Continuous monitoring is recommended at site 3D to capture high- and low-flow conditions and identify a range of acidity and metal loadings. The limited water quality information presently available for this site may underrate the impact of the site as a significant point source. Monitoring should begin with a monthly schedule of filtered Group I samples until reasonable high- and low-flow conditions have been identified. At that time, a reassessment can be made of the impact this site has upon the sub-watershed.

Summary of Potential Treatment Sites: Goose Run⁴

Site	Recommendation	Site Identification
2	Monitor	Headwaters Of Tributary 2
2D	Monitor	Pattonsville Church Drainage
2F	Treatment	Mead Reclamation Seep
3A	Monitor	Deep-Mine Jkn-137

⁴ Raccoon Creek partners are investigating the possibility of constructing a large passive treatment wetland in Goose Run near its confluence with Little Raccoon Creek. This system could be designed to further polish AMD impacted water quality entering from upstream treatment sites.

Site	Recommendation	Site Identification
3B	Treatment	Goose Run Rd. Seep
3C	Monitor	J.C.Cobb Rd. Seep
3D	Monitor	Deep-Mine Jkn-174

PROPOSED TREATMENT

TREATMENT SELECTION AND COSTS

Treatment sites have been selected according to guidelines in Appendix 3, Tables 1 and 2. Site selection and treatment is summarized in Figure 17.

Figure 17: Treatment Recommendations for Sites in Little Raccoon Creek Watershed

<u>Basin</u>	<u>Site</u>	<u>Highest Acidity</u>	<u>Highest lbs./day</u>	<u>Description</u>	<u>Treatment</u>
Middleton Run	3A	1308	361	Lake Rice	Drain and fill lake Reclaim spoils Add alkalinity (slag lined limestone channels or rock dams and below good water pond outlet)
	5A	312	160	Lake Farleigh	Limestone dam in lake with organic compost behind dam, downstream aerobic wetland
	2	314	187	Trailer/Dog site	Eliminate Lake Rice
	11A	832	19	Strip Mine	Reclaim strip mine and add alkalinity via channels
	3B	975	46	Salem Road Seep	Reclaimed strip mine above road and limestone channel below
Goose Run	3B	1213	230	Large seep on hillside	ALD and SAP on hillside strip bench, limestone channel outlet

Goose Run	2F	88	45	Tiled seep on reclaim	Stepped limestone rock dams
	3C	597	11	Roadside waterfall seep	Limestone channel and splash stack of limestone
	Other			Goose Run Mouth	Wetland
	3A			Tarr Camp Run	Limestone channel
Mulga Run	4	211	333	Stream near Sands Hill	Run through limestone beds, slag addition in upland area ponds, anaerobic wetlands not too large
	14	126	392	Mulga Road driving tour	Rock channels and anaerobic wetland
	6A & B	1092	1202	Sands Hill seep	Slag pond development, divert alkaline seep via rock channel
Flint Run	All	2409	711	Flint Run tailings pile	Eliminate lakes, slag in limestone channels, slag recharge areas, cap refuse

BENEFITS AND COST-EFFECTIVENESS

The benefits of eliminating acid mine drainage problems are difficult to quantify, although attempts have been made. Qualitatively, the benefits are ecological, aesthetic and economic. The economic impacts may be direct or indirect. Indirect benefits include diversity and abundance of fish and game for anglers and hunters, reduced erosion and siltation and consequent reduction of flood risks and downstream sedimentation. Direct economic benefits arise from restoration activities themselves, increased tourism and recreation opportunities and increased property values.

The public has collectively expressed to local officials a desire to clean U.S. streams to make them fishable and swimmable. This has resulted in the Clean Water Act and other laws, the formation of watershed groups and the establishment of the EPA. The evaluation of projects becomes a matter of comparing costs to seek the most cost-effective projects, or those that

prevent the most acidity loading or result in the most miles of healthy stream per dollar invested. The projects in this document are placed in a cost-effectiveness context (Figure 18). Although partnerships formed for stream restoration generally have not calculated their project economics in this way (an exception being the state of Maryland), the data are available and should be analyzed.

Figure 18: Treatment Costs and Cost Effectiveness

Middleton Run	
Site	Cost
3A - Lake Rice	
Wetland	\$20,000.00
Revegetation	10,000.00
Sediment control	10,000.00
Fill Lake	36,300.00
Earthwork	67,760.00
Resoiling	31,950.00
Slag bedded channels	81,389.00
Slag filters	14,650.00
5B - Lake Farley	
Limestone dike	\$90,278.00
Open limestone channels	5,787.00
Wetland	37,037.00
Earthwork	14,520.00
Resoiling	4,792.00
Revegetation	3,000.00
3B	
Open limestone channel	\$33,333.00
Resoiling	3,195.00
Revegetation	1,000.00
Subtotal Construction	\$464,991.00
Mobilization	46,500.00
Design	76,723.00
Monitoring	18,400.00
Total Project Cost	\$606,614.00
Goose Run	
Site	Cost
3B	
Excavation and limestone basin	\$17,834.00
Open limestone channel	1,389.00

Goose Run	
Site	Cost
2F	
Limestone splash stack	\$6,111.00
Open limestone channel	3,189.00
3C	
Limestone rip rap	\$2,315.00
Open limestone channel	833.00
3A	
Open limestone channel	\$9,259.00
Subtotal Construction	\$40,750.00
Revegetation	3,000.00
Sediment control	4,000.00
Mobilization	10,663.00
Design	17,223.00
Total Project Cost	\$75,636.00
Mulga Run	
Site	Cost
4	
Slag leach bed (inc. excavation)	\$12,481.00
Wetland	9,259.00
14	
Open limestone channel	\$48,611.00
Wetland	10,000.00
6	
Slag leach bed	\$13,669.00
Wetland	9,259.00
Subtotal	\$103,279.00
Revegetation	3,000.00
Resoiling	9,585.00
Sediment control	3,000.00
Mobilization	17,830.00
Design	34,174.00
Monitoring	18,400.00
Wetland Improvement	50,000.00
Total Project Cost	\$239,268.00
Flint Run	
Site	Cost
All	
Cap refuse pile (1.5' x 140 ac.)	\$847,000.00
Paper mill sludge	100,750.00
Revegetation	116,250.00
Fill lakes	187,500.00
Slag bedded channels	329,444.00
Slag filters	131,000.00

Flint Run	
Sediment control	20,000.00
Mobilization	86,597.00
Design	320,000.00
Monitoring	15,840.00
Total Project Cost	\$2,154,381.00
LRC-HU Estimate Total	\$3,075,899.00

FUNDING OPPORTUNITIES

There are various existing funding sources, which are dedicated to AMD remediation and others that can be adapted to assist in the restoration of Little Raccoon Creek.

Ohio Division of Mineral Resources

- 1) Federally Funded Abandoned Mine Land Program: Federal excise taxes on coal are returned to the State of Ohio for reclamation of abandoned mine land sites that adversely affect the public's health and safety.
- 2) Acid Mine Drainage Set-Aside Program: Up to ten percent of Ohio's federal excise tax monies are set aside for acid mine drainage abatement. Priority is given to leveraging these funds with watershed restoration groups and other government agencies.
- 3) State Abandoned Mine Land Program: State excise taxes on coal and industrial minerals are dedicated to reclamation projects that improve water quality in impacted streams. Priority is given to leveraging these funds with other partners.

Office of Surface Mining, Reclamation and Enforcement

- 1) Appalachian Clean Streams Initiative: A line item grant process in which funds are specifically intended for acid mine drainage remediation on a project basis.
- 2) Direct Grants to Watershed Groups: A grant process for directly funding citizen watershed groups' efforts to restore acid mine drainage impacted streams on a project basis.

Environmental Protection Agency

- 1) EPA Section 319 Non-point Source Grant Program: Funding is available for planning, education and remediation of watershed pollution problems including acid mine drainage.

United States Army Corps of Engineers

- 1) Section 905b-Water Resource Development Act (86): Recent additions to the Army Corps conventional mission includes a habitat restoration grant program for the completion of feasibility studies and project construction where a Federal interest can be verified. A principal non-Federal sponsor must be identified for this cost-share program.

United States Fish and Wildlife Service

- 1) Partners for Fish and Wildlife Program: This program assists private landowners by providing technical and financial assistance to establish self-sustaining native habitats.
- 2) Clean Water Action Plan Fund: The purpose of this fund is to restore streams, riparian areas and wetlands resulting in direct and measurable water quality improvements.

FUTURE MONITORING

PRE-CONSTRUCTION MONITORING

Intensive short-term sampling must be undertaken before design and treatment begins. Sites planned for treatment should be sampled monthly, capturing high and low flows, for one or two years.

POST-CONSTRUCTION MONITORING

Performance of restoration projects must be monitored below treatment sites and/or at confluences with major tributaries, to assess effectiveness.

LONG-TERM WATERSHED MONITORING

The primary goal of the Little Raccoon Creek Project is to achieve warm water habitat designation. A “post-audit” should be conducted every 5-10 years while restoration is underway, depending on how dramatic changes are based on spot checks, and should involve a repeat of the

study done by USGS (USGS, 1999; Appendix 2), namely discharge, field water parameters, IBI and ICI. These parameters provide a measure of the extent to which the overall goal of attaining warm water habitat has been met. For these important long-term samples, ODNR Group II parameters should be analyzed, and should include both filtered and non-filtered samples. Discharge measurements should be made at the time of sampling. In addition a 2-day watershed-wide canvas of all confluence sites should be conducted every five years.

LOW PRIORITY SITES

It is vital to conduct additional monitoring beyond that undertaken in this study to ensure that sites given lower priority in the initial screening in 1998-1999 are not heavier acidity loaders under different hydrological conditions, or as a result of active mining, subsidence, or weathering. Missing an important acidity-loader could undermine restoration efforts. Recommendations for additional monitoring are contained within sections on sub-watersheds. This sampling might be undertaken when restoration efforts focus on a particular sub-watershed. At that time, sites should be sampled quarterly, or as a minimum at high and low flows, for one or two years.

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SECTION 2: ATTACHMENTS

APPENDIX 1: WATER QUALITY DATA 70

- 1) Table 1: Water Quality Data Collected at Sites in the Little Raccoon Creek Basin during current study (1997-2000) and by Wilson (1985).
- 2) Table 2: Water Quality Data Collected in the Mulga Run Sub-watershed of the Little Raccoon Creek Basin.
- 3) Table 3: Water Quality Data Collected in the Rich Run sub-watershed of the Little Raccoon Creek Basin.
- 4) Table 4: Water Quality Data Collected in the 124 Seep Area of the Little Raccoon Creek Basin.
- 5) Table 5: Water Quality Data Collected in the Middleton Run Sub-watershed of the Little Raccoon Creek Basin.
- 6) Table 6: Water Quality Data Collected in Flint Run Sub-watershed of the Little Raccoon Creek Basin.
- 7) Table 7: Water Quality Data Collected in the Goose Run Sub-watershed of the Little Raccoon Creek Basin.

APPENDIX 2: USGS BASELINE BIOLOGICAL DATA 91

- 1) USGS 1999 Project Data from Selected Sites on Little Raccoon Creek (3/28/00)
- 2) Summary of Qualitative Habitat Evaluation Index (QHEI) values from USGS 1999 Field Sheets and a summary of the corresponding ICI and IBI values
- 3) ICI, IBI and QHEI values from the *Biological and Water Quality Study of The Raccoon Creek Basin* by OEPA (1995), specifically sites that correspond with the USGS 1999 Little Raccoon Creek sites
- 4) Ecoregion Biocriteria: Western Allegheny Plateau (WAP) (OEPA, 1995)

APPENDIX 3: TREATMENT SYSTEM SELECTION PARAMETERS 98

- 1) Parameter Limitations of Mitigation Technologies
- 2) Preliminary Flow Sheet for Selection of Passive Treatment Systems

APPENDIX 1: WATER QUALITY DATA

Table 1: Water Quality Data Collected at Sites in the Little Raccoon Creek Basin during current study (1997-2000) and by Wilson (1985).

LRC SAMPLE SITES	SAMPLE ID#	SAMPLE DATE	BASIN	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
1			LITTLE RACCOON CR. BELOW LAKE RUPERT													
		*6/15/79		7.30	195.00	3.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		*9/4/79		7.70	220.00	5.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		*11/2/83		7.50	160.00	1.50	5.00	40.46	40.00	0.14	1.13	0.13	1.05	0.24	1.94	46.00
		1/22/97		7.30	186.00	11.60	0.00	0.00	27.00	0.27	16.89	< 0.1	NA	0.33	20.65	50.00
	3/24/98		7.00	141.00	6.65	0.00	0.00	18.00	0.67	24.03	0.40	14.35	0.32	11.48	63.00	
	OUBLO28	10/14/98		6.98	492.00	NA	0.00	NA	23.00	0.10	NA	<0.1	NA	0.10	NA	235.00
2			SUGAR RUN													
		*09/15/80		3.80	750.00	4.90	70.00	1850.24	0.00	4.75	125.55	3.47	91.72	6.30	166.52	320.00
		*05/16/81		3.30	895.00	6.30	102.00	3466.37	0.00	6.90	234.49	5.80	197.11	6.95	236.19	430.00
		*07/21/81		3.40	1100.00	3.40	164.00	3007.85	0.00	13.39	245.58	13.89	254.75	11.44	209.82	425.00
		*07/20/82		2.80	1900.00	0.28	228.00	344.37	0.00	7.10	10.72	19.00	28.70	21.00	31.72	900.00
		*11/2/83		3.20	1570.00	0.74	159.00	634.69	0.00	6.80	27.14	10.00	39.92	16.00	63.87	780.00
		1/22/97		7.00	940.00	3.90	0.00	0.00	47.00	3.27	68.79	2.09	43.97	3.12	65.64	256.00
		2/27/98		7.50	1193.00	4.03	0.00	0.00	80.00	0.47	10.21	0.40	8.69	0.81	17.60	502.00
		3/24/98		7.40	543.00	6.65	0.00	0.00	31.00	0.47	16.86	0.10	3.59	0.70	25.12	209.00
		OUBL017	10/13/98		7.49	1994.00	0.25	0.00	0.00	119.00	0.24	0.32	0.20	0.26	0.47	0.62
3			LITTLE RACCOON CR. BELOW LAKE ALMA													
		*7/27/81		6.30	360.00	1.70	NA	NA	28.00	0.114	1.05	0.08	0.69	2.59	23.75	135.00
		*7/23/82		6.70	302.00	1.50	NA	NA	25.00	NA	NA	NA	NA	NA	NA	84.00
		1/22/97		7.00	335.00	20.10	0.00	0.00	37.00	0.72	78.07	0.29	31.44	0.92	99.75	87.00
		3/24/98		7.10	193.00	101.92	0.00	0.00	21.00	0.41	225.41	0.30	164.93	0.25	137.44	60.00
	OUBL037	10/14/98		7.18	666.00	NA	0.00	0.00	67.00	0.39	NA	0.30	NA	0.29	NA	300.00
	DMR-LRC-017-BL	6/22/99		6.61	443.00	0.0888	0.00	0.00	63.50	0.48	0.23	1.74	0.83	0.95	0.45	189.00
4			MEADOW RUN													
		1/29/97		7.20	334.00	26.90	0.00	0.00	54.00	0.51	74.00	0.29	42.08	0.38	55.14	60.00
	3/24/98		7.30	343.00	17.25	0.00	0.00	62.00	0.36	33.50	0.50	46.53	0.25	23.26	79.00	
5			LITTLE RACCOON CR. AT U.S. ROUTE 32													
		2/12/97		5.70	294.00	NA	0.00	0.00	46.00	0.73	NA	0.58	NA	0.65	NA	67.00
		3/24/98		7.00	232.00	174.55	0.00	0.00	31.00	0.63	593.19	0.30	282.47	0.30	282.47	85.00
	OUBL033	10/14/98		7.33	573.00	NA	0.00	0.00	133.00	0.54	NA	0.10	NA	0.39	NA	137.00
6			MULGA RUN													
		*11/2/83		3.20	1120.00	1.50	243.00	1966.22	0.00	14.00	113.28	18.00	145.65	11.00	89.01	910.00
		1/29/97		6.40	634.00	19.60	0.00	0.00	22.00	6.10	644.94	4.54	480.01	1.94	205.11	301.00
	2/27/98		6.70	849.00	4.51	0.00	0.00	16.00	7.30	177.60	3.30	80.28	2.17	52.79	461.00	

* U.S. Geological Survey: Water Resources Investigations Report 85-4060, 1985

** Sampled By BBC ENGINEERING INC.

*** U.S. Geological Survey: Water Resource Investigations Report 88-4022, 1988

LRC SAMPLE SITES	SAMPLE ID#	SAMPLE DATE	BASIN	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL AI mg/l	AI LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
		3/24/98	MULGA RUN	6.50	626.00	7.88	14.00	595.10	0.00	3.50	148.77	2.20	93.52	0.99	42.08	502.00
	OUBL027	10/14/98		3.45	2760.00	2.49	130.00	1746.13	0.00	29.20	392.21	12.00	161.18	11.20	150.44	1850.00
	DMR-LRC-001-BL	4/28/99		4.00	1270.00	7.85	79.70	3374.91	0.00	14.90	630.94	5.90	249.84	3.64	154.14	616.00
	DMR-LRC-018-BL	6/22/99		3.39	2540.00	0.233	126.00	158.37	0.00	3.42	4.30	10.40	13.07	11.30	14.20	1358.00
7			LITTLE RACCOON CR. AT HOLLINSHEAD ROAD													
		2/12/98		5.60	293.00	NA	0.00	0.00	46.00	0.76	NA	0.46	NA	0.67	NA	69.00
		3/24/98		7.00	257.00	NA	0.00	0.00	32.00	0.80	NA	0.60	NA	0.39	NA	99.00
8			MIDDLETON RUN													
		*9/15/80		3.10	1600.00	0.63	437.00	1485.10	0.00	27.60	93.80	36.00	122.34	16.40	55.73	740.00
		*7/21/80		3.00	1200.00	0.92	288.00	1429.27	0.00	12.97	64.37	33.11	164.32	13.14	65.21	530.00
		*7/12/82		2.90	1650.00	0.38	427.00	875.28	0.00	23.00	47.15	41.00	84.04	17.00	34.85	760.00
		*11/2/83		2.90	1660.00	0.43	477.00	1106.42	0.00	22.00	51.03	44.00	102.06	22.00	51.03	890.00
		1/29/97		3.50	727.00	5.30	166.00	4745.89	0.00	7.80	223.00	19.70	563.22	6.60	188.69	293.00
		2/27/98		3.10	1002.00	2.36	217.00	2762.52	0.00	17.40	221.51	26.00	330.99	8.10	103.12	427.00
		3/24/98		3.20	959.00	3.20	219.00	3780.32	0.00	15.80	272.74	23.00	397.02	8.20	141.55	370.00
	OUBL029	10/14/98		3.27	1524.00	0.06	353.00	114.25	0.00	16.60	5.37	49.00	15.86	6.00	1.94	915.00
		6/23/99				DRY										
8A			124 STRIP PIT													
		1/12/98		3.20	888.00	NA	220.00	NA	0.00	32.60	NA	10.00	NA	3.20	NA	374.00
		2/4/98		2.90	1353.00	NA	546.00	NA	0.00	78.00	NA	44.00	NA	8.80	NA	630.00
		3/24/98		3.10	1049.00	0.074	236.00	94.21	0.00	31.20	12.45	17.00	6.79	3.84	1.53	434.00
9			RICH RUN													
		2/12/97		3.60	522.00	3.10	35.00	585.28	0.00	3.00	50.17	3.50	58.53	2.60	43.48	201.00
		3/25/98		5.30	315.00	8.88	0.00	0.00	15.00	0.55	26.35	0.10	4.79	0.84	40.24	202.00
	OUBL030	10/14/98		3.20	1406.00	0.03	229.00	37.06	0.00	10.60	1.72	25.00	4.05	3.50	0.57	800.00
	DMR-LRC-023-BL	6/22/99		3.58	723.00	0.00405	76.40	1.67	0.00	21.40	0.47	2.56	0.06	5.46	0.12	292.00
10			LITTLE RACCOON CR. AT STATE ROUTE 124													
		***7/27/81		6.30	560.00	17.00	10.00	917.03	43.00	6.53	598.82	3.00	275.11	4.41	404.41	235.00
		***7/12/82		6.60	428.00	19.00	0.00	0.00	40.00	NA	NA	NA	NA	NA	NA	140.00
		***11/2/83		5.90	705.00	12.00	30.00	1941.94	14.00	0.61	39.49	0.05	3.24	55.00	3560.23	320.00
		***9/27/84		7.20	810.00	3.60	0.00	0.00	150.00	0.08	1.55	< 0.10	NA	1.60	31.07	200.00
		***10/17/84		7.00	840.00	4.50	0.00	0.00	115.00	0.47	11.41	0.30	7.28	4.40	106.81	250.00
		***4/23/85		6.00	460.00	46.00	9.90	2456.56	8.00	0.29	71.96	0.10	24.81	1.80	446.65	190.00
		***6/18/85		7.10	535.00	23.00	0.00	0.00	39.00	0.21	26.05	0.20	24.81	2.60	322.58	190.00
		***9/24/85		8.00	620.00	4.00	0.00	0.00	130.00	0.09	2.03	NA	NA	0.34	7.34	140.00
		***12/18/85		6.00	350.00	79.00	20.00	8522.97	14.00	0.58	247.17	0.10	42.61	1.30	553.99	250.00
		***4/10/86		6.80	560.00	34.00	0.00	0.00	42.00	0.45	82.53	0.06	11.00	2.50	458.51	200.00

* U.S. Geological Survey: Water Resources Investigations Report 85-4060, 1985

** Sampled By BBC ENGINEERING INC.

*** U.S. Geological Survey: Water Resource Investigations Report 88-4022, 1988

Table 1: Water Quality Data Collected at Sites in the Little Raccoon Creek Basin during current study (1997-2000) and by Wilson (1985).

LRC SAMPLE SITES	SAMPLE ID#	SAMPLE DATE	BASIN	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
		***6/25/86		7.40	500.00	9.40	0.00	0.00	75.00	0.09	4.56	0.10	5.07	0.87	44.11	110.00
10			LITTLE RACCOON CR. AT STATE ROUTE 124													
		***8/28/86		6.70	640.00	12.00	0.00	0.00	48.00	0.17	11.00	0.05	3.24	3.10	200.67	240.00
		2/12/97		5.80	356.00	109.05	0.00	0.00	24.00	1.72	1011.78	1.22	717.66	1.23	723.54	99.00
		3/25/98		6.80	287.00	231.13	0.00	0.00	15.00	1.09	1358.99	0.60	748.07	0.74	922.62	117.00
	OUBL024	10/14/98		7.03	941.00	5.85	0.00	0.00	71.00	1.09	34.38	0.40	12.62	1.99	62.77	320.00
	OUBL032	10/15/98		7.03	768.00	5.85	0.00	0.00	79.00	1.22	38.48	0.80	25.23	1.98	62.45	338.00
	DMR-LRC-021-BL	6/22/99		7.07	567.00	6.71	0.00	0.00	134.00	0.725	26.24	2.05	74.20	1.09	39.45	230.00
11			COAL RUN													
		2/5/97		6.90	434.00	2.80	0.00	0.00	54.00	0.53	8.01	1.00	15.10	0.43	6.49	163.00
		3/25/98		7.50	554.00	0.79	0.00	0.00	58.00	0.36	1.53	0.20	0.85	0.36	1.53	263.00
12			FLINT RUN													
		*** 4/23/85		2.60	1650.00	2.40	596.00	7715.99	0.00	64.00	828.56	31.00	401.33	5.30	68.62	830.00
		***6/18/85		2.60	2490.00	1.30	1040.00	7293.07	0.00	150.00	1051.89	44.00	308.55	12.00	84.15	1400.00
		***9/24/85		2.70	3200.00	4.00	1290.00	27834.51	0.00	120.00	2589.26	NA	NA	17.00	366.81	1800.00
		***6/25/86		2.50	2900.00	0.50	997.00	2689.05	0.00	140.00	377.60	62.00	167.22	16.00	43.15	1500.00
		***8/28/86		2.50	2900.00	0.71	1310.00	5017.23	0.00	240.00	919.19	72.00	275.76	17.00	65.11	2100.00
		2/12/97		2.70	1015.00	4.00	187.00	4034.93	0.00	35.20	759.52	10.90	235.19	4.47	96.45	379.00
		3/25/98		3.30	707.00	4.98	137.00	3680.31	0.00	12.70	341.17	4.60	123.57	1.69	45.40	714.00
	OUBL040	10/16/98		2.82	1908.00	0.41	363.00	795.00	0.00	38.70	84.76	20.00	43.80	10.90	23.87	1108.00
	DMR-LRC-024-BL	6/23/99		2.74	1780.00	0.24	365.00	478.45	0.00	28.20	36.96	21.20	27.79	12.50	16.39	1029.00
12a			LITTLE RACCOON CREEK BELOW FLINT RUN CONFLUENCE													
		***10/18/84		4.80	950.00	4.60	30.00	744.41	0.00	0.32	7.94	25.00	620.34	6.00	148.88	380.00
		***4/23/85		5.10	500.00	48.00	30.00	7767.77	2.00	0.45	116.52	10.00	2589.26	3.00	776.78	210.00
		***6/18/85		4.70	587.00	29.00	42.00	6570.24	2.00	0.51	79.78	23.00	3597.99	3.20	500.59	240.00
		***9/24/85		5.60	770.00	4.30	9.90	229.63	7.00	0.36	8.35	15.00	347.93	2.00	46.39	290.00
		***12/18/85		5.40	350.00	95.00	20.00	10249.14	6.00	3.60	1844.85	0.30	153.74	1.80	922.42	160.00
		***6/25/86		7.00	540.00	12.00	0.00	0.00	38.00	0.52	33.66	0.20	12.95	1.50	97.10	160.00
		***8/28/86		5.10	680.00	14.00	21.00	1585.92	4.00	0.46	34.74	0.76	57.40	3.40	256.77	290.00
13			GREASY RUN													
		2/5/97		5.50	275.00	3.30	10.00	178.01	0.00	8.10	144.19	0.90	16.02	0.40	7.12	107.00
		3/24/98		5.90	415.00	0.17	1.00	0.91	0.00	5.40	4.89	0.10	0.09	0.41	0.37	227.00
	OUBL023	10/13/98		6.41	1240.00	0.17	0.00	0.00	24.00	7.60	6.85	<0.1		2.11	1.90	975.00
	DMR-LRC-028-BL	6/23/99		6.16	1220.00	0.05	22.80	6.28	15.00	1.04	0.29	1.77	0.49	2.62	0.72	802.00
14			TARR CAMP													
		*9/16/80		6.20	170.00	0.78	NA	NA	18.00	0.26	1.09	0.20	0.84	0.83	3.49	56.00
		*8/19/81		6.50	210.00	0.26	NA	NA	16.00	0.18	0.25	0.08	0.11	0.42	0.59	52.00

* U.S. Geological Survey: Water Resources Investigations Report 85-4060, 1985
 ** Sampled By BBC ENGINEERING INC.
 *** U.S. Geological Survey: Water Resource Investigations Report 88-4022, 1988

Table 1: Water Quality Data Collected at Sites in the Little Raccoon Creek Basin during current study (1997-2000) and by Wilson (1985).

LRC SAMPLE SITES	SAMPLE ID#	SAMPLE DATE	BASIN	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
		*7/22/82	TARR CAMP	6.60	145.00	0.18	NA	NA	5.00	NA	NA	NA	NA	NA	NA	52.00
		2/5/97		5.40	90.00	12.50	10.00	674.29	0.00	1.94	130.81	2.60	175.31	0.52	35.06	29.00
		3/24/98		6.50	103.00	6.05	0.00	0.00	8.00	0.38	12.40	0.80	26.11	0.31	10.12	38.00
15	OUBL020	10/13/98	GOOSE RUN	6.30	136.00	0.04	0.00	0.00	12.00	0.61	0.13	0.30	0.06	0.56	0.12	46.00
		*11/1/83		2.80	1840.00	0.28	745.00	1125.25	0.00	94.00	141.98	66.00	99.69	5.40	8.16	1100.00
		2/19/97		3.80	690.00	0.70	125.00	472.00	0.00	25.30	95.53	10.40	39.27	1.16	4.38	277.00
		3/24/98		4.10	445.00	1.05	55.00	311.52	0.00	7.60	43.05	2.90	16.43	0.31	1.76	387.00
	OUBL022	10/13/98		3.04	1647.00	0.13	447.00	315.87	0.00	39.00	27.56	33.00	23.32	2.94	2.08	950.00
	DMR-LRC-030-BL	6/24/99		2.94	1250.00	0.175	288.00	271.87	0.00	14.90	14.07	25.80	24.36	3.16	2.98	234.00
16			LITTLE RACCOON CR. ON KEYSTONE ROAD ABOVE DICKASON RUN CONFLUENCE													
		*11/13/75		3.70	700.00	57.00	94.00	28902.58	1.00	NA	NA	NA	NA	NA	NA	290.00
		*8/19/81		4.20	730.00	14.00	50.00	3776.00	0.00	0.69	52.03	2.47	186.31	3.27	246.95	315.00
		*7/22/82		3.70	745.00	15.00	50.00	4045.71	0.00	11.00	890.06	4.00	323.66	3.60	291.29	320.00
		*11/1/83		3.40	975.00	18.00	179.00	17380.39	0.00	6.70	650.55	8.40	815.62	6.20	602.00	430.00
		2/19/97		6.10	387.00	NA	14.00	NA	15.00	3.12	NA	1.70	NA	1.52	NA	124.00
		3/24/98		6.60	253.00	265.48	0.00	0.00	12.00	1.82	2606.40	1.30	1861.71	0.69	988.14	130.00
17			DICKASON RUN MAINSTREAM ALONG KEYSTONE ROAD													
		2/12/97		5.90	241.00	22.20	3.00	359.26	18.00	0.40	47.90	0.15	17.96	0.66	79.04	62.00
		3/25/98		7.00	217.00	21.88	0.00	0.00	17.00	0.38	44.85	< 0.1		0.57	67.28	69.00
	OUBL021	10/13/98		6.65	658.00	0.60	0.00	0.00	24.00	0.56	1.80	< 0.1		2.57	8.25	310.00
18			DIXON RUN CONFLUENCE													
		*9/24/80		5.10	770.00	0.84	35.00	158.59	3.00	3.70	16.77	0.72	3.26	5.40	24.47	410.00
		8/19/81		4.30	800.00	0.31	65.00	108.69	NA	1.58	2.64	3.60	6.02	5.21	8.71	430.00
		7/22/82		3.50	925.00	0.26	65.00	91.16	0.00	3.40	4.77	4.90	6.87	6.00	8.42	430.00
		2/12/97		5.40	446.00	3.30	12.00	213.61	16.00	4.32	76.90	1.48	26.35	1.91	34.00	170.00
		3/25/98		6.30	406.00	4.11	0.00	0.00	12.00	4.29	95.11	1.30	28.82	1.72	38.13	195.00
	OUBL034	10/14/98		6.27	678.00	0.34	0.00	0.00	20.00	3.02	5.46	0.10	0.18	4.11	7.43	320.00
19			DICKASON RUN BELOW DIXON RUN CONFLUENCE													
		2/12/97		5.30	269.00	27.80	0.00	0.00	16.00	1.03	154.46	0.36	53.99	0.77	115.47	81.00
		3/25/98		6.80	248.00	27.08	0.00	0.00	10.00	0.94	137.32	0.30	43.83	0.60	87.65	90.00
	OUBL026	10/14/98		6.38	713.00	0.40	0.00	0.00	24.00	1.72	3.73	0.20	0.43	2.93	6.35	305.00
20			KYGER RUN													

* U.S. Geological Survey: Water Resources Investigations Report 85-4060, 1985

** Sampled By BBC ENGINEERING INC.

*** U.S. Geological Survey: Water Resource Investigations Report 88-4022, 1988

Table 1: Water Quality Data Collected at Sites in the Little Raccoon Creek Basin during current study (1997-2000) and by Wilson (1985).

LRC SAMPLE SITES	SAMPLE ID#	SAMPLE DATE	BASIN	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	MnLOADING lbs/DAY	SULFATE mg/l
20		2/12/97	KYGER RUN	5.40	129.00	4.60	0.00	0.00	18.00	0.38	9.43	0.23	5.71	0.29	7.20	34.00
		3/25/98		6.90	120.00	5.60	0.00	0.00	12.00	0.39	11.78	0.40	12.08	0.22	6.65	36.00
	OUBL025	10/14/98		7.29	247.00	0.074	0.00	0.00	59.00	0.13	0.05	0.20	0.08	0.03	0.01	66.00
21			DICKASON RUN CONFLUENCE													
		*8/9/81		6.10	460.00	0.91	20.00	98.18	16.00	0.23	1.11	0.08	0.37	2.07	10.16	185.00
		*7/22/82		6.20	480.00	0.98	10.00	52.86	10.00	NA	NA	NA	NA	NA	NA	180.00
		*11/1/83		5.10	595.00	3.10	60.00	1003.34	4.00	0.96	16.05	20.00	334.45	55.00	919.73	300.00
		2/12/97		6.40	266.00	27.00	11.00	1602.10	13.00	0.93	135.45	0.40	58.26	0.90	131.08	87.00
		3/25/98		6.90	233.00	37.07	0.00	0.00	12.00	0.87	173.97	0.20	39.99	0.61	121.98	75.00
	OUBL039	10/15/98		6.63	635.00	0.38	0.00	0.00	12.00	0.86	1.76	0.10	0.20	2.47	5.06	328.00
22			LITTLE RACCOON CR.ON KEYSTONE ROAD BEFORE SPRING RUN													
		2/19/97		6.40	359.00	NA	13.00	0.00	15.00	2.41	NA	1.29	NA	1.35	NA	133.00
23			CONFLUENCE OF LITTLE RACCOON CR. AT INTERSECTION OF STATE ROUTE 325 AND WOODS MILL ROAD													
		*9/24/80		5.00	460.00	87.00	25.00	11732.57	2.00	0.180	84.47	1.45	680.49	3.09	1450.15	191.00
		*8/20/81		5.30	620.00	19.00	45.00	4612.11	5.00	0.192	19.68	3.08	315.67	3.22	330.02	275.00
		*8/24/82		4.80	640.00	13.00	30.00	2103.77	0.00	0.084	5.89	1.90	133.24	3.80	266.48	270.00
		*11/2/83		3.50	870.00	28.00	124.00	18728.96	0.00	2.900	438.02	0.04	6.04	4.70	709.89	350.00
		***9/26/84		4.20	770.00	1.40	20.00	151.04	0.00	0.150	1.13	1.00	7.55	2.90	21.90	280.00
		***10/17/84		3.50	975.00	3.50	89.00	1680.32	0.00	0.910	17.18	11.00	207.68	6.00	113.28	410.00
		***11/14/84		4.10	570.00	73.00	40.00	15751.31	0.00	2.500	984.46	3.70	1457.00	2.80	1102.59	230.00
		***12/18/84		4.30	445.00	105.00	30.00	16992.00	0.00	0.340	192.58	3.10	1755.84	2.10	1189.44	180.00
		***3/12/85		4.70	350.00	720.00	30.00	116516.57	3.00	0.900	3495.50	2.70	10486.49	1.50	5825.83	130.00
		***4/17/85		4.20	405.00	171.00	40.00	36896.91	0.00	0.600	553.45	3.10	2859.51	1.40	1291.39	180.00
		***5/14/85		3.90	540.00	81.00	50.00	21846.86	0.00	0.490	214.10	5.00	2184.69	2.60	1136.04	230.00
		***6/18/85		4.20	532.00	42.00	40.00	9062.40	0.00	0.190	43.05	2.50	566.40	2.90	657.02	210.00
		***9/23/85		6.90	610.00	5.80	0.00	0.00	16.00	0.020	0.63	< 0.1	NA	1.30	40.67	240.00
		***9/30/85		6.10	595.00	8.70	11.00	516.23	8.00	0.150	7.04	0.30	14.08	2.00	93.86	240.00
		***10/17/85		5.00	750.00	12.00	18.00	1165.17	2.00	0.020	1.29	1.40	90.62	2.90	187.72	320.00
		***11/19/85		5.40	295.00	488.00	17.00	44750.99	3.00	1.100	2895.65	0.10	263.24	1.00	2632.41	110.00
		***4/8/86		6.60	390.00	87.00	0.00	0.00	6.00	0.160	75.09	0.03	14.08	1.60	750.88	160.00
		***6/25/86		6.80	455.00	4.90	0.00	0.00	19.00	0.150	3.96	0.02	0.53	2.00	52.86	160.00
		***8/27/86		6.70	680.00	9.40	0.00	0.00	17.00	0.040	2.03	0.03	1.52	3.50	177.47	280.00
		2/19/97		6.50	333.00	NA	12.00	NA	15.00	2.70	NA	0.93	NA	1.24	NA	116.00
	3/24/98	4.80	183.00	402.34	2.00	4340.67	0.00	1.01	2192.04	1.10	2387.37	0.46	998.35	60.00		

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** Sampled By BBC ENGINEERING INC.

*** U.S. Geological Survey: Water Resource Investigations Report 88-4022, 1988

Table 1: Water Quality Data Collected at Sites in the Little Raccoon Creek Basin during current study (1997-2000) and by Wilson (1985).

LRC SAMPLE SITES	SAMPLE ID#	SAMPLE DATE	BASIN	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL AI mg/l	AI LOADING lbs/DAY	TOTAL Mn mg/l	MnLOADING lbs/DAY	SULFATE mg/l
	OUBL031	10/14/98		7.18	969.00	9.49	0.00	0.00	40.00	0.40	20.48	<0.1	NA	0.71	36.35	460.00
	OUBL041	10/17/98		7.16	1027.00	9.49	0.00	0.00	44.00	0.41	20.99	0.30	15.36	0.49	25.08	565.00
	DMR-LRC-029-BL	6/24/99		7.16	581.00	7.76	0.00	0.00	69.20	0.46	19.30	2.39	100.04	0.379	15.86	128.00
24			RACCOON CREEK AT ADAMSVILLE													
		2/19/97		6.80	289.00	200.00	4.00	4315.43	17.00	1.10	1186.74	0.71	765.99	0.99	1068.07	88.00
25			124 SEEP													
		2/12/97		3.20	579.00	2.40	51.00	660.26	0.00	3.37	43.63	4.51	58.39	2.84	36.77	205.00
		1/12/98		2.70	3260.00	NA	2263.00	NA	0.00	470.00	NA	2200.00	NA	10.10	NA	2715.00
		2/27/98		3.10	1014.00	0.158	198.00	168.75	0.00	22.60	19.26	14.00	11.93	2.97	2.53	401.00
		3/25/98		3.20	959.00	0.34	173.00	321.02	0.00	26.00	48.25	15.00	27.83	3.82	7.09	307.00
	DMR-LRC-022-BL	6/22/99		2.53	1900.00	0.0102	421.00	23.16	0.00	26.20	1.44	31.40	1.73	8.48	0.47	762.00
26			DEER CREEK													
		2/19/97		6.60	131.00	NA	0.00	0.00	23.00	0.32	NA	0.23	NA	0.25	NA	25.00
		3/24/98		7.00	114.00	6.56	0.00	0.00	21.00	0.38	13.45	<0.1		0.19	6.72	27.00
	OUBL038	10/15/98		7.12	206.00	0.005	0.00	0.00	79.00	3.37	0.09	0.10	0.003	1.79	0.05	38.00
27			LITTLE RACCOON CR. ABOVE BUFFER RUN CONFLUENCE													
		**2/9/96		6.10	473.00	102.30	0.00	0.00	15.00	4.56	2516.37	2.58	1423.74	2.13	1175.41	60.00
28			BUFFER RUN													
		*9/16/80		3.10	2300.00	0.69	596.00	2218.35	0.00	133.00	495.03	29.60	110.17	12.80	47.64	1280.00
		*8/19/81		3.00	2000.00	0.30	571.00	924.04	0.00	88.39	143.04	28.04	45.38	11.71	18.95	1340.00
		*7/12/82		2.50	2550.00	0.40	695.00	1499.61	0.00	160.00	345.23	37.00	79.84	13.00	28.05	1400.00
		*11/2/83		2.70	2660.00	0.35	993.00	1874.78	0.00	140.00	264.32	60.00	113.28	17.00	32.10	1900.00
		**2/9/96		3.50	1332.00	3.70	202.00	4031.69	0.00	61.00	1217.49	16.00	319.34	3.84	76.64	305.00
		3/25/98		3.20	914.00	2.81	171.00	2592.01	0.00	22.50	341.05	6.80	103.07	1.03	15.61	294.00
	DMR-LRC-027-BL	6/23/99		2.88	2100.00	0.169	300.00	273.49	0.00	8.84	8.06	25.10	22.88	8.34	7.60	238.00
	DMR-LRC-032-BL	8/9/99		2.69	2660.00	0.169	321.00	292.63	0.00	14.20	12.95	26.90	24.52	8.58	7.82	1202.00
29			LITTLE RACCOON CR. BELOW BUFFER RUN CONFLUENCE													
		**2/9/96		6.80	491.00	107.20	0.00	0.00	19.00	6.50	3758.74	4.09	2365.11	2.19	1266.41	110.00
		3/25/98		6.40	269.00	NA	0.00	0.00	8.00	1.22	NA	0.60	NA	0.49	NA	144.00
30			LITTLE RACCOON CR. BELOW GOOSE RUN CONFLUENCE													
		***9/27/84		3.60	845.00	4.30	35.00	811.84	0.00	0.36	8.35	1.30	30.15	3.40	78.86	310.00
		***10/17/84		3.30	1060.00	6.40	104.00	3590.44	0.00	1.30	44.88	6.10	210.59	5.30	182.97	420.00
		***11/14/84		3.60	740.00	43.00	74.00	17164.62	0.00	5.90	1368.53	6.20	1438.12	3.50	811.84	270.00

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		***12/19/84		4.10	535.00	76.00	55.00	22548.11	1.00	1.90	778.93	4.30	1762.85	2.80	1147.90	210.00
		***3/13/85		4.50	310.00	518.00	30.00	83827.20	0.00	2.10	5867.90	1.40	3911.94	1.10	3073.66	120.00
		***4/18/85		4.10	465.00	105.00	40.00	22656.00	0.00	1.10	623.04	4.60	2605.44	1.70	962.88	210.00
		***5/14/85		4.20	530.00	54.00	35.00	10195.20	0.00	0.58	168.95	2.30	669.97	2.60	757.36	NA
		***6/18/85		3.90	605.00	3.70	45.00	898.15	0.00	0.71	14.17	2.80	55.88	3.10	61.87	240.00
		***9/24/85		5.10	800.00	3.60	25.00	485.49	3.00	0.14	2.72	2.40	46.61	2.60	50.49	310.00
		***10/16/85		3.80	890.00	3.80	33.00	676.44	0.00	0.82	16.81	2.20	45.10	3.10	63.54	NA
		***11/20/85		5.10	370.00	169.00	27.00	24614.13	2.00	1.80	1640.94	0.40	364.65	1.60	1458.61	140.00
		***4/10/86		5.60	570.00	40.00	13.00	2805.03	4.00	1.20	258.93	0.36	77.68	2.60	561.01	220.00
		***6/25/86		5.70	570.00	8.00	5.00	215.77	3.00	0.50	21.58	0.07	3.02	2.10	90.62	200.00
		***8/28/86		3.60	870.00	14.00	51.00	3851.52	0.00	0.89	67.21	4.50	339.84	4.60	347.39	390.00
30			LITTLE RACCOON CR. BELOW GOOSE RUN CONFLUENCE													
	DVR-LRC-031-BL	6/24/99		6.82	608.00	6.938	0.00	0.00	0.00	0.55	20.55	3.79	141.84	1.12	41.92	746.00
31		10/13/98	JOHNSON RUN			DRY										
32			LEW JONES TRIBUTARY													
	OUBL018	10/13/98		6.67	342.00	0.10	0.00	0.00	20.00	0.53	0.30	0.20	0.11	1.23	0.69	145.00
33		10/15/98	KEYSTONE MINE TRIBUTARY			DRY										
34			TRIPP RUN													
	OUBL016	10/13/98		7.21	650.00	0.012	0.00	0.00	93.00	0.60	0.04	0.20	0.01	0.69	0.05	248.00
35			SPRING RUN													
	OUBL019	10/13/98		7.27	217.00	0.32	0.00	0.00	71.00	1.20	2.07	0.20	0.35	0.58	1.00	48.00
36		10/15/98	WAINWRIGHT TRIBUTARY													
				7.12	58.00											

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** Sampled By BBC ENGINEERING INC

*** U.S. Geological Survey: Water Resource Investigations Report 88-4022, 1988

Table 2: Water quality Data Collection in the Mulga Run Sub-watershed for the Little Raccoon Creek Basin

MULGA RUN SAMPLE SITES	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTION	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL AI mg/l	AI LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
LRC #6			CONFLUENCE OF MULGA RUN													
		*11/2/83		3.20	1120.00	1.50	243.00	1966.22	0.00	14.00	113.28	18.00	145.65	11.00	89.01	910.00
		1/29/97		6.40	634.00	19.60	0.00	0.00	22.00	6.10	644.94	4.54	480.01	1.94	205.11	301.00
		2/27/98		6.70	849.00	4.51	0.00	0.00	16.00	7.30	177.60	3.30	80.28	2.17	52.79	461.00
	DMR-LRC-09	3/24/98		6.50	626.00	7.88	14.00	595.10	0.00	3.50	148.77	2.20	93.52	0.99	42.08	502.00
	DMR-LRC-33	4/28/98		6.58	711.00	7.47	0.00	0.00	25.00	1.19	47.95	0.40	16.12	1.95	78.58	279.00
	OUBL027	10/14/98		3.45	2760.00	2.49	130.00	1746.13	0.00	29.20	392.21	12.00	161.18	11.20	150.44	1850.00
	DMR-LRC-001 BL	4/28/99		4.00	1270.00	7.01	79.70	3013.77	0.00	14.90	563.43	5.90	223.10	3.64	137.64	616.00
	DMR-LRC-018 BL	6/22/99		3.39	2540.00	0.233	126.00	158.37	0.00	3.42	4.30	10.40	13.07	11.30	14.20	1358.00
	DMR-LRC-037 BL	8/9/99		5.84	2260.00	0.817	31.60	139.27	29.90	4.02	17.72	8.59	37.86	5.92	26.09	1383.00
	DMR-LRC-039 BL	9/27/99		3.25	2140.00	0.169	145.00	132.19	0.00	14.80	13.49	19.90	18.14	9.02	8.22	1490.00
1a			MULGA RUN MAINSTREAM, ABOVE WETLAND													
	DMR-LRC-002 BL	4/28/99		5.91	1200.00	6.840	27.10	999.91	23.40	22.60	833.87	3.43	126.56	2.18	80.44	581.00
	DMR-LRC-020 BL	6/22/99		2.72	3120.00	0.233	485.00	609.58	0.00	57.40	72.14	33.10	41.60	10.50	13.20	1762.00
	DMR-LRC-038 BL	8/9/99		4.73	2520.00	0.426	255.00	586.39	0.00	91.20	209.72	12.50	28.74	9.09	20.90	1803.00
	DMR-LRC-040 BL	9/27/99		2.75	2760.00	0.311	441.00	739.83	0.00	77.70	130.35	36.30	60.90	10.60	17.78	1762.00
3			CONFLUENCE OF TRIBUTARY 3													
	DMR-LRC-34	4/29/98		3.55	655.00	0.55	51.00	151.31	0.00	5.90	17.50	4.50	13.35	2.42	7.18	247.00
		9/29/99														
3a			MT. CARMEL SEEPS													
	DMR-LRC-044 BL	9/29/99		2.54	2040.00	0.00477	178.00	4.58	0.00	8.83	0.23	12.50	0.32	9.28	0.24	938.00
3b			MT. CARMEL SEEPS													
		9/29/99														
4			CONFLUENCE OF TRIBUTARY 4													
	DMR-LRC-37	4/29/98		3.05	1331.00	0.293	211.00	333.49	0.00	22.80	36.04	12.00	18.97	4.21	6.65	569.00
		9/29/99														
4a			HOLLINGSHEAD RD. SEEPS													
		9/29/99														
4d			HOLLINGSHEAD RD. SEEPS													
	DMR-LRC-042 BL	9/29/99		2.46	3880.00	0.00108	2228.00	12.98	0.00	659.00	3.84	225.00	1.31	12.30	0.07	3169.00
4e			HOLLINGSHEAD RD. SEEPS													
	DMR-LRC-043 BL	9/29/99		2.67	3570.00	0.00462	1838.00	45.81	0.00	622.00	15.50	85.10	2.12	9.00	0.22	3161.00
6			CONFLUENCE OF TRIBUTARY 6													
	DMR-LRC-35	4/29/98		3.00	1607.00	0.289	229.00	357.00	0.00	43.00	67.03	12.00	18.71	3.26	5.08	726.00
	DMR-LRC-050 BL	10/11/99		2.96	3290.00	0.204	1092.00	1201.67	0.00	369.00	406.06	54.50	59.97	7.62	8.39	2083.00

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 ** Field Meter

Table 2: Water quality Data Collection in the Mulga Run Sub-watershed for the Little Raccoon Creek Basin

SAMPLE #	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTION	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
6a			LINCOLN PIT SEEPS													
	DMR-LRC-048-BL	10/11/99		2.72	5980.00	0.000498	5976.00	16.05	0.00	2067.00	5.55	445.00	1.20	20.90	0.06	4207.00
6B			LINCOLN PIT SEEPS													
	DMR-LRC-046-BL	10/11/99		2.86	5480.00	0.049	4434.00	1181.56	0.00	1720.00	458.34	302.00	80.48	18.40	4.90	4223.00
6C			SANDS HILL SEDIMENTATION POND													
	DMR-LRC-047-BL	10/11/99		6.18	1080.00	0.092	0.00	0.00	104.00	0.54	0.27	3.41	1.69	0.45	0.22	496.00
6D			ALKALINE SEEP													
	DMR-LRC-045-BL	10/11/99		5.96	2020.00	0.01796	0.00	0.00	384.00	31.70	3.07	1.32	0.13	3.78	0.37	1235.00
6E			DEEP-MINE JKN-38													
	DMR-LRC-049-BL	10/11/99		2.72	2680.00	0.00915	1029.00	50.79	0.00	289.00	14.26	51.90	2.56	4.69	0.23	1926.00
6F			DEEP-MINE JKN-38													
	DMR-LRC-051-BL	10/12/99		2.96	2140.00	0.00494	427.00	11.38	0.00	65.40	1.74	29.50	0.79	5.17	0.14	1161.00
7			MULGA MAINSTREAM, DOWNSTREAM OF SITE 6													
		4/15/98		**6.7	**670											
8			UPSTREAM OF SITE 9													
		4/15/98		**6.54	**295											
9			CONFLUENCE OF TRIBUTARY 9													
	DMR-LRC-041-BL	9/27/99		7.30	2030.00	0.0516	0.00	0.00	198.00	5.07	1.41	7.67	2.13	4.91	1.37	1120.00
	DMR-LRC-054-BL	10/13/99		7.01	2050.00	0.1450	0.00	0.00	189.00	7.06	5.52	8.90	6.96	3.46	2.71	1185.00
9A			DEEP-MINE SEEP AT JAYMAR LIMESTONE													
	DMR-LRC-058-BL	10/13/99		3.12	2500.00	0.00241	588.00	7.64	0.00	276.00	3.59	18.20	0.24	8.32	0.11	1918.00
9B			DEEP-MINE SEEP AT JAYMAR LIMESTONE													
	DMR-LRC-057-BL	10/13/99		4.49	2210.00	0.00218	596.00	7.01	0.00	298.00	3.50	25.70	0.30	14.40	0.17	2124.00
9C			DEEP-MINE SEEP AT JAYMAR LIMESTONE													
	DMR-LRC-055-BL	10/13/99		6.87	2270.00	0.0674	0.00	0.00	261.00	4.14	1.51	8.63	3.14	1.27	0.46	1259.00
9C1			MAINSTREAM IN HEADWATERS OF TRIBUTARY 9													
	DMR-LRC-056-BL	10/13/99		6.91	2240.00	0.0674	0.00	0.00	262.00	0.046	0.02	9.02	3.28	0.563	0.20	1292.00
10			ALONG U.S. RT.32													
		4/15/98		**7.04	**393											

* U.S. Geological Survey: water Resources Investigations Report 85-4060, 1985

** Field Meter

Table 2: Water quality Data Collection in the Mulga Run Sub-watershed for the Little Raccoon Creek Basin

SAMPLE #	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTION	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
11			WATERLOO COAL LAND DRAINAGE													
		4/15/98		**6.60	**234											
12			RUMPKE LANDFILL DRAINAGE													
		4/15/98		**7.15	**1309											
13			CONFLUENCE OF TRIBUTARY 13													
	DMR-LRC-38	4/29/98		3.03	1265.00	0.181	179.00	174.77	0.00	19.30	18.84	11.00	10.74	3.04	2.97	450.00
	DMR-LRC-053-BL	10/12/99		2.74	2440.00	0.0136	478.00	35.07	0.00	28.20	2.07	37.40	2.74	5.11	0.37	1095.00
13A			DEEP-MINE JKN-206													
	DMR-LRC-052-BL	10/12/99		2.60	3170.00	0.00443	738.00	17.64	0.00	106.00	2.53	36.60	0.87	6.05	0.14	1679.00
14			MULGA ROAD MINE COMPLEX													
	DMR-LRC-36	4/29/98		3.37	962.00	0.562	126.00	381.98	0.00	4.00	12.13	10.00	30.32	4.06	12.31	902.00
		10/13/99				DRY										
15			DEEP-MINE JKN-77													
	DMR-LRC-43	7/14/98		3.88	489.00	0.406	23.00	50.37	0.00	1.57	3.44	4.10	8.98	0.79	1.73	201.00
16			DOWNSTREAM DRAINAGE FROM DEEP-MINE JKN-77													
	DMR-LRC-44	7/14/98		3.05	1128.00	0.0152	271.00	22.22	0.00	16.90	1.39	29.00	2.38	1.66	0.14	328.00

* U.S. Geological Survey: water Resources Investigations Report 85-4060, 1985

** Field Meter

Table 3: Water Quality Data Collected in the Rich Run Sub-watershed of the Little Raccoon Creek Basin

SAMPLE #	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTOR	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
LRC 9			CONFLUENCE OF RICH RUN													
		2/12/97		3.60	522.00	3.10	35.00	585.28	0.00	3.00	50.17	3.50	58.53	2.60	43.48	201.00
		3/25/98		5.30	315.00	8.88	0.00	0.00	15.00	0.55	26.35	0.10	4.79	0.84	40.24	202.00
	QUBL030	10/14/98		3.20	1406.00	0.03	229.00	37.06	0.00	10.60	1.72	25.00	4.05	3.50	0.57	800.00
	DMR-LRC-023-BL	6/22/99		3.58	723.00	0.00405	76.40	1.67	0.00	21.40	0.47	2.56	0.06	5.46	0.12	292.00
2			DEEP-MINES JKN 184 AND JKN-181													
		6/20/98		*2.71	*1461											
3			RICH RUN MAINSTREAM NEAR TOP OF VALLEY													
		6/20/98		*5.20	*508											
4			DRAINAGE FROM SANDS HILL COAL CO. AT BRIDGE ON MULGA ROAD													
		6/20/98		*7.05	*531											
5			CONFLUENCE OF TRIBUTARY 5													
		6/20/98		*7.46	*460											
6			CONFLUENCE OF TRIBUTARY 6, NEAR INTERSECTION OF MULGA RD. AND ST. RT. 124													
		6/20/98		*3.65	*607											
7			MAINSTREAM NEAR CHRISTIAN BAPTIST CHURCH													
		6/20/98		*7.22	*295											
8			MAINSTREAM JUST BELOW SITE 9													
		6/20/98		*6.59	*406											
9			DEEP-MINE SEEP JKN-100, DRAINING INTO MAINSTREAM													
		6/20/98		*3.26	*1593											
10			CONFLUENCE OF TRIBUTARY 10 AT ST. RT. 124 BRIDGE CROSSING													
		6/20/98		*7.44	*364											
11			MAINSTREAM SITE JUST DOWNSTREAM FROM SITE 10													
		6/20/98		*6.57	*440											

* Field Meter Readings

Table 4: Water Quality Data Collected in the 124 Seep Area of the Little Raccoon Creek Basin

SAMPLE #	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTOR	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL AL m g/l	AL LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
LRC #25			CONFLUENCE OF 124 SEEP													
		2/12/97		3.20	579.00	2.40	51.00	660.26	0.00	3.37	43.63	4.51	58.39	2.84	36.77	205.00
		1/12/98		2.70	3260.00	NA	2263.00	NA	0.00	470.00	NA	2200.00	NA	10.10	NA	2715.00
		2/27/98		3.10	1014.00	0.158	198.00	168.75	0.00	22.60	19.26	14.00	11.93	2.97	2.53	401.00
		3/25/98		3.20	959.00	0.34	173.00	321.02	0.00	26.00	48.25	15.00	27.83	3.82	7.09	307.00
	DMR-LRC-022-BL	6/22/99		2.53	1900.00	0.0102	421.00	23.16	0.00	26.20	1.44	31.40	1.73	8.48	0.47	762.00
	DMR-LRC-057	2/22/99		2.68	1060.00	0.134	396.00	286.24	0.00	30.10	21.76	19.30	13.95	4.23	3.06	130.00
	DMR-LRC-098-BL	11/16/99		2.90	1070.00	0.0287	219.00	33.90	0.00	11.40	1.76	21.60	3.34	7.92	1.23	545.00
2			SOUTH FORK OF MAINSTREAM, ALONG ST.RT.124													
		2/4/98		3.40	1300.00	NA	164.00	NA	0.00	13.50	NA	24.00	NA	13.50	NA	405.00
	DMR-LRC-098-BL	11/16/99		2.90	1070.00	0.0287	219.00	33.90	0.00	11.40	1.76	21.60	3.34	7.92	1.23	545.00
2A			CULVERT PIPE AT HAUL ROAD													
	DMR-LRC-099-BL	11/16/99		5.74	822.00	0.00714	0.00	0.00	61.40	0.103	0.00	0.781	0.03	1.37	0.05	342.00
2B			CULVERT DRAINING UNDER ST. RT.124													
	DMR-LRC-060	2/22/99		6.60	630.00	XXX	56.50		28.80	0.64		2.05		1.12		272.00
	DMR-LRC-100-BL	11/16/99		3.07	756.00	0.00482	123.00	3.20	0.00	2.62	0.07	14.50	0.38	3.15	0.08	408.00
2C																
	DMR-LRC-104-BL	11/16/99		2.33	2180.00	0.00257	862.00	11.95	0.00	135.00	1.87	56.50	0.78	13.20	0.18	1350.00
3			NORTH FORK OF MAINSTREAM													
		2/4/98		2.70	3600.00	NA	2540.00	NA	0.00	630.00	NA	230.00	NA	12.40	NA	3045.00
		11/16/99				DRY										
3A			BELOW UPPER FORK, NEAR CONFLUENCE													
	DMR-LRC-105-BL	11/16/99		2.19	3670.00	0.000407	2894.00	6.35	0.00	394.00	0.87	268.00	0.59	12.60	0.03	3227.00
3B			RIGHT FORK IN STRIP MINE AREA													
	DMR-LRC-106-BL	11/16/99		2.22	5390.00	0.00109	5313.00	31.24	0.00	1348.00	7.93	359.00	2.11	11.90	0.07	4124.00
4A			SMALL PIT LAKE													
	DMR-LRC-059	2/22/99		6.70	748.00	XXX	64.30	XXX	132.00	0.192	XXX	0.21	XXX	0.125	XXX	349
	DMR-LRC-103-BL	11/16/99		6.20	728.00	XXX	0.00	XXX	159.00	0.099	XXX	2.17	XXX	0.683	XXX	252
4B			LARGE PIT LAKE													
	DMR-LRC-058	2/22/99		5.43	719	XXX	38.4	XXX	7.86	0.609	XXX	0.18	XXX	0.342	XXX	268
	DMR-LRC-101-BL	11/16/99		5.51	705	XXX	15.4	XXX	12.7	0.803	XXX	1.48	XXX	0.499	XXX	349
4C			ADJACENT PIT LAKE													
	DMR-LRC-102-BL	11/16/99		4.33	439	XXX	34.6	XXX	0.00	0.244	XXX	2.32	XXX	1.11	XXX	196

Table 5: Water Quality Data Collected in the Middleton Run Sub-Watershed of the Little Raccoon Creek Basin

SAMPLE #	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTOR	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
LRC #8			MIDDLETON RUN CONFLUENCE WITH LRC													
		*9/15/80		3.10	1600.00	0.63	437.00	1485.10	0.00	27.60	93.80	36.00	122.34	16.40	55.73	740.00
		*7/21/80		3.00	1200.00	0.92	288.00	1429.27	0.00	12.97	64.37	33.11	164.32	13.14	65.21	530.00
		*7/12/82		2.90	1650.00	0.38	427.00	875.28	0.00	23.00	47.15	41.00	84.04	17.00	34.85	760.00
		*11/2/83		2.90	1660.00	0.43	477.00	1106.42	0.00	22.00	51.03	44.00	102.06	22.00	51.03	890.00
		01/29/97		3.50	727.00	5.300	166.00	4745.89	0.00	7.80	223.00	19.70	563.22	6.60	188.69	293.00
	DMR LRC 03	02/27/98		3.10	1002.00	2.363	217.00	2766.03	0.00	17.40	221.79	26.00	331.41	8.10	103.25	427.00
	DMR LRC 11	03/24/98		3.20	959.00	3.200	219.00	3780.32	0.00	15.80	272.74	23.00	397.02	8.20	141.55	370.00
	OUBL029	10/14/98		3.27	1524.00	0.060	353.00	114.25	0.00	16.60	5.37	49.00	15.86	6.00	1.94	915.00
	DMR-LRC-087-BL	10/26/99		3.35	1440.00	0.049	265.00	70.04	0.00	2.71	0.72	33.60	8.88	15.80	4.18	798.00
1			ST. RT. 124 STRIP PIT OUTLET													
		07/14/98		7.30	479.00											
						DRY										
2			SALEM RD. SEEP													
	DMR LRC 45	07/15/98		2.93	1342.00	0.122	284.00	186.90	0.00	29.80	19.61	17.00	11.19	5.00	3.29	436.00
	DMR-LRC-075-BL	10/25/99		2.61	1750.00	0.015	314.00	25.92	0.00	22.30	1.84	21.00	1.73	8.40	0.69	651.00
3			CONFLUENCE OF TRIBUTARY 3													
	DMR LRC 46	07/15/98		2.87	3330.00	0.051	1308.00	360.55	0.00	88.00	24.26	180.00	49.62	48.10	13.26	2589.00
	DMR-LRC-077-BL	10/25/99		3.07	2720.00	0.00881	975.00	46.34	0.00	197.00	9.36	94.40	4.49	46.30	2.20	2264.00
3a			LAKE RICE													
	DMR-LRC-076-BL	10/25/99		2.61	2060.00	XXX	370.00	XXX	0.00	33.70	XXX	18.60	XXX	11.90	XXX	764.00
3b			SALEM RD. SEEP													
	DMR-LRC-077-BL	10/25/99		3.07	2720.00	0.00881	975.00	46.34	0.00	197.00	9.36	94.40	4.49	46.30	2.20	2264.00
4			MIDDLETON RUN MAINSTEM													
		07/15/98		2.94	1349.00											
5			CONFLUENCE OF TRIBUTARY 5													
	DMR LRC 47	07/15/98		3.42	920.00	0.204	145.00	159.56	0.00	0.67	0.74	22.00	24.21	11.10	12.21	409.00
	DMR-LRC-088-BL	10/26/99		3.39	1380.00	0.00755	312.00	12.71	0.00	0.21	0.01	40.70	1.66	23.60	0.96	812.00
5a			LAKE FARLEY													
	DMR-LRC-078-BL	10/25/99		2.81	1300.00	XXX	294.00	XXX	0.00	5.89	XXX	32.40	XXX	15.20	XXX	555.00

* U.S. Geological Survey: Water resources Investigations Report 85-4060, 1985

Table 5: Water Quality Data Collected in the Middleton Run Sub-Watershed of the Little Raccoon Creek Basin

SAMPLE #	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTOR	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL AI mg/l	AI LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
5b			SEEPAGE BELOW LAKE FARLEY													
	DMR-LRC-079-BL	10/25/99		2.70	2080.00	0.011	554.00	31.38	0.00	39.30	2.23	57.90	3.28	36.60	2.07	1367.00
6			HILLSIDE SEEP ALONG St. Rt. 124													
		07/15/98		2.81	1846.00											
						DRY										
7			HILLSIDE SEEP ALONG St. Rt. 124													
	DMR LRC 50	07/21/98		2.68	2240.00	0.0034	798.00	14.64	0.00	123.00	2.26	20.00	0.37	5.20	0.10	1097.00
		10/26/99				DRY										
8																
		07/14/98		5.66	117.00											
9			HIRAM WEST RD. PROJECT													
	DMR LRC 49	07/15/98		3.23	1506.00	0.0342	237.00	43.72	0.00	9.30	1.72	12.00	2.21	11.40	2.10	934.00
	DMR-LRC-080-BL	10/26/99		2.82	2360.00	0.0103	524.00	29.11	0.00	39.80	2.21	49.50	2.75	22.50	1.25	1235.00
9a			LOWER STORM- WATER POND													
	DMR-LRC-082-BL	10/26/99		6.88	1140.00	XXX	0.00	0.00	160.00	0.20	XXX	2.09	XXX	0.73	XXX	418.00
9b			DIFFUSE SEEPS BELOW 9a													
	DMR-LRC-081-BL	10/26/99		2.80	2680.00	0.00155	1018.00	8.51	0.00	259.00	2.17	54.20	0.45	22.90	0.19	1704.00
9c			DIFFUSE SEEPS ABOVE 9a													
	DMR-LRC-084-BL	10/26/99		2.87	2540.00	0.00079	422.00	1.81	0.00	45.30	0.19	33.50	0.14	24.90	0.11	2540.00
9d			LANDFILL DRAINAGE													
	DMR-LRC-083-BL	10/26/99		3.09	2280.00	0.00317	500.00	8.55	0.00	161.00	2.75	21.50	0.37	19.50	0.33	1358.00
10			CONFLUENCE OF TRIBUTARY 10													
		07/15/98		2.98	1017.00											
	DMR-LRC-085-BL	10/26/99		3.59	1030.00	0.00582	236.00	7.41	0.00	5.06	0.16	35.00	1.10	9.85	0.31	513.00
10a			JUST BELOW POND ON HIRAM WEST Rd.													
		10/26/99		5.89	643.00											
11			CONFLUENCE OF HIRAM WEST RD. DRAINAGE													
	DMR LRC 48	07/15/98		3.25	1108.00	0.0949	20.00	10.24	0.00	6.70	3.43	13.00	6.65	8.80	4.50	557.00
	DMR-LRC-089-BL	10/26/99		3.18	1610.00	0.0157	253.00	21.43	0.00	5.36	0.45	31.00	2.63	14.20	1.20	856.00

* U.S. Geological Survey: Water resources Investigations Report 85-4060, 1985

Table 5 Water Quality Data Collected in the Middleton Run Sub-Watershed of the Little Raccoon Creek Basin

SAMPLE#	SAMPLEID#	SAMPLEDATE	STEDESRIPTOR	pH	S COND umol/m	DISCHARGE ft ³ /sec	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Almg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
11a			MIDDLETON RUN DEEP MINE DRAINAGE													
	DMRLRG086EL	10/26/99		2.56	288000	0004	83200	1876	000	5010	1.13	7230	1.63	1220	0.28	120200

*US Geological Survey, Water resources Investigations Report 85-4080, 1985

Table 6: Water Quality Data Collected in Flint Run Sub-watershed of the Little Raccoon Creek Basin

SAMPLE SITE	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTOR	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
A			CONFLUENCE OF FLINT RUN													
		* 4/23/85		2.60	1650.00	2.40	596.00	7715.99	0.00	64.00	828.56	31.00	401.33	5.30	68.62	830.00
		*6/18/85		2.60	2490.00	1.30	1040.00	7293.07	0.00	150.00	1051.89	44.00	308.55	12.00	84.15	1400.00
		*9/24/85		2.70	3200.00	4.00	1290.00	27834.51	0.00	120.00	2589.26	NA	NA	17.00	366.81	1800.00
		*6/25/86		2.50	2900.00	0.50	997.00	2689.05	0.00	140.00	377.60	62.00	167.22	16.00	43.15	1500.00
		*8/28/86		2.50	2900.00	0.71	1310.00	5017.23	0.00	240.00	919.19	72.00	275.76	17.00	65.11	2100.00
		2/12/97		2.70	1015.00	4.00	187.00	4034.93	0.00	35.20	759.52	10.90	235.19	4.47	96.45	379.00
		3/25/98		3.30	707.00	4.98	137.00	3680.31	0.00	12.70	341.17	4.60	123.57	1.69	45.40	714.00
		OUBL-040 10/16/98		2.82	1908.00	0.41	363.00	802.83	0.00	38.70	85.59	20.00	44.23	10.90	24.11	1108.00
		DMR-OUBL-002 7/27/98		3.01	1600.00	0.678	284.00	1038.68	0.00	19.90	72.78	18.00	65.83	10.20	37.30	817.00
	DMR-LRC-010-BL 5/25/99		2.92	1070.00	2.32	177.00	2215.11	0.00	18.80	235.28	10.80	135.16	5.49	68.71	439.00	
	DMR-LRC-024-BL 6/23/99		2.74	1780.00	0.24	365.00	472.54	0.00	28.20	36.51	21.20	27.45	12.50	16.18	1029.00	
B			SMALL TRIBUTARY CROSSING CATTLE FIELD, JUST UPSTREAM FROM CONFLUENCE													
		7/27/98				DRY										
	DMR-LRC-003-BL 5/24/99		3.29	780.00	0.14	74.00	55.88	0.00	1.91	1.44	4.75	3.59	9.90	7.48	458.00	
C			SMALL TRIBUTARY JUST UPSTREAM FROM CATTLE CROSSING AND JUST BELOW PIPELINE													
		7/27/98		5.78	389.00	0.00245	4.00	0.05	0.00	2.54	0.03	0.60	0.01	5.20	0.07	165.00
	DMR-LRC-004-BL 5/24/99		3.13	629.00	0.285	81.10	124.68	0.00	3.74	5.75	8.26	12.70	8.33	12.81	328.00	
D			AT THE BEGINNING OF PIPELINE ALONG FENCE ROW													
		7/27/98				DRY										
	DMR-LRC-005-BL 5/24/99		3.38	558.00	0.0832	79.10	35.50	0.00	6.36	2.85	14.20	6.37	5.26	2.36	321.00	
E			TRIBUTARY CROSSING PIPELINE													
		7/27/98		4.78	106.00	0.0032	2.00	0.03	0.00	0.95	0.02	0.20	0.0035	0.82	0.01	40.00
	DMR-LRC-006-BL 5/24/99		4.30	137.00	0.2270	28.80	35.27	0.00	0.513	0.63	2.99	3.66	0.398	0.49	70.00	
F			TRIBUTARY CROSSING UPPER SECTION OF PIPELINE													
		7/27/98				DRY										
	DMR-LRC-007-BL 5/24/99		5.16	153.00	0.11	25.60	15.19	2.78	0.654	0.39	3.17	1.88	0.044	0.03	32.90	
G			TRIBUTARY ON SOUTHERN BANK OF FLINT RUN													
		7/27/98		4.59	234.00	0.0365	28.00	5.51	0.00	0.24	0.05	4.90	0.96	1.45	0.29	112.00
	DMR-LRC-008 5/24/99		4.87	248.00	0.35	29.50	55.70	2.22	0.659	1.24	4.13	7.80	1.26	2.38	139.00	

* U.S. Geological Survey: Water-Resources Investigation Report 88-4022

Table 6: Water Quality Data Collected in Flint Run Sub-watershed of the Little Raccoon Creek Basin

SAMPLE SITE	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTOR	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
H			TRIBUTARY AT DIVERGENCE OF PIPELINE AND FLINT RUN MAINSTREAM													
		7/27/98				DRY										
	DMR-LRC-009-BL	5/24/99		3.19	277.00	0.0289	44.00	6.86	0.00	2.90	0.45	4.23	0.66	1.59	0.25	177.00
I			SMALL TRIBUTARY CROSSING UPPER PIPELINE													
		7/27/98				DRY										
	DMR-LRC-011-BL	5/25/99		3.86	144.00	0.04469	28.30	6.82	0.00	0.65	0.16	4.31	1.04	0.87	0.21	90.60
J			SMALL TRIBUTARY DRAINING BELOW HOTHOUSE RIDGE													
	DMR-LRC-012-BL	5/25/99		3.24	805.00	0.03198	88.30	15.23	0.00	1.59	0.27	11.90	2.05	9.77	1.69	323.00
K			TRIBUTARY DRAINING LAKE LATROBE AND BROKEN ARO MINE LANDS													
	DMR-LRC-013-BL	5/25/99		3.09	1090.00	0.38	120.00	245.98	0.00	4.39	9.00	15.30	31.36	6.40	13.12	514.00
	DMR-LRC-096-BL	11/9/99		2.70	1700.00	0.15	200.00	163.99	0.00	10.60	8.69	18.90	15.50	12.80	10.50	971.00
L			OUTLET FOR HOTHOUSE LAKE													
	OUBL-007	7/28/98		3.31	1150.00	0.227	109.00	133.47	0.00	5.50	6.73	5.50	6.73	8.30	10.16	533.00
	OUBL-015	9/28/98		2.99	1624.00	0.205	190.00	210.11	0.00	10.00	11.06	9.10	10.06	11.10	12.27	767.00
	OUBL-047	11/8/98		3.20	1557.00	0.300	184.00	297.76	0.00	12.70	20.55	13.00	21.04	8.40	13.59	770.00
	OUBL-048	11/8/99		3.02	1362.00	0.300	194.00	313.95	0.00	12.80	20.71	14.00	22.66	8.30	13.43	773.00
	OUBL-067	2/14/99		3.10	888.00	1.292	685.00	4774.05	0.00	21.70	151.24	8.81	61.40	4.19	29.20	393.00
	DMR-FR-018-BL	4/25/99		2.94	1390.00	0.642	85.90	297.48	0.00	15.20	52.64	13.30	46.06	5.35	18.53	460.00
	DMR-FR-035-BL	6/15/99		2.64	1750.00	0.270	215.00	313.14	0.00	11.50	16.75	45.70	66.56	7.88	11.48	576.00
	DMR-LRC-O14-BL	5/25/99		2.69	1600.00	0.517	208.00	580.08	0.00	17.40	48.53	15.70	43.78	6.88	19.19	471.00
	DMR-FR-061-BL	8/2/99		2.65	1950.00	0.125	319.00	215.10	0.00	11.20	7.55	16.70	11.26	9.13	6.16	906.00
	DMR-LRC-094-BL	11/9/99		2.90	1550.00	0.333	226.00	405.96	0.00	18.30	32.87	16.20	29.10	9.11	16.36	710.00
L1			LAKE MILTON													
	DMR-LRC-090-BL	11/9/99		3.72	1050.00	XXX	49.60	XXX	0.00	0.598	XXX	6.86	XXX	10.00	XXX	569.00
L2			PIPING UNDERNEATH LAKE MILTON SPOIL DAM													
	DMR-LRC-091-BL	11/9/99		3.43	1080.00	0.213	48.40	55.61	0.00	0.672	0.77	6.95	7.99	10.20	11.72	579.00
L3			HOTHOUSE LAKE													
	DMR-LRC-092-BL	11/9/99		2.89	1550.00	XXX	232.00	XXX	0.00	19.900	XXX	16.60	XXX	9.22	XXX	718.00
L4			TRIBUTRAY DRAINING INTO HOTHOUSE LAKE													
	DMR-LRC-093-BL	11/9/99		2.90	1750.00	0.240	329.00	425.93	0.00	45.000	58.26	23.00	29.78	11.40	14.76	938.00

* U.S. Geological Survey: Water-Resources Investigation Report 88-4022

Table 6: Water Quality Data Collected in Flint Run Sub-watershed of the Little Raccoon Creek Basin

SAMPLE SITE	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTOR	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
L5			LAKE ADAMS DRAINAGE													
	DVR-LRC-097-BL	11/9/99		2.68	3400.00	0.0252	1979.00	269.02	0.00	438.000	59.54	106.00	14.41	23.00	3.13	2996.00
M			TRIBUTARY DRAINING FLINT RUN STUDY SITE													
	CUEL-005	7/28/98		2.80	4420.00	0.0392	2732.00	577.70	0.00	560.00	118.42	37.00	7.82	24.30	5.14	3559.00
	CUEL-014	9/28/98		2.74	4840.00	0.0130	2892.00	202.80	0.00	940.00	65.92	140.00	9.82	31.30	2.19	3961.00
	CUEL-046	11/8/98		3.10	4310.00	0.0240	2168.00	280.68	0.00	920.00	119.11	100.00	12.95	24.40	3.16	3773.00
	CUEL-069	2/14/99		2.89	3430.00	0.1830	1714.00	1691.98	0.00	565.00	557.74	73.00	72.06	17.10	16.88	2634.00
	DVR-FR-017-BL	4/25/99		2.71	4230.00	0.0450	714.00	173.32	0.00	746.00	181.09	108.00	26.22	22.30	5.41	3235.00
	DVR-LRC-015-BL	5/25/99		2.57	4750.00	0.0288	2409.00	374.25	0.00	835.00	129.72	94.80	14.73	22.50	3.50	3285.00
	DVR-FR-037-BL	6/15/99		2.58	5090.00	0.0128	2979.00	205.69	0.00	1063.00	73.40	138.00	9.53	26.30	1.82	4009.00
	DVR-FR-062-BL	8/2/99		2.40	6700.00	0.00214	3973.00	45.86	0.00	1417.00	16.36	171.00	1.97	28.90	0.33	4346.00
	DVR-LRC-095-BL	11/9/99		2.83	4160.00	0.0408	2811.00	618.66	0.00	1027.00	226.03	105.00	23.11	25.10	5.52	3811.00
N			SPRING SITE DRAINING INTO TRIBUTARY M													
	CUEL-006	7/28/98		2.52	6950.00	0.00605	6189.00	201.98	0.00	1310.00	42.75	43.00	1.40	57.00	1.86	6966.00
		9/28/98				DRY										
		11/8/98				DRY										
	CUEL-068	2/14/99		2.56	3510.00	0.02000	2442.00	263.46	0.00	690.00	74.44	89.30	9.63	28.00	3.02	3038.00
	DVR-FR-04-BL	4/25/99		2.44	4420.00	0.00758	592.00	24.21	0.00	719.00	29.40	175.00	7.16	30.80	1.26	3688.00
	DVR-LRC-016-BL	5/25/99		2.36	3920.00	0.00278	2120.00	31.79	0.00	468.00	7.02	129.00	1.93	22.70	0.34	2667.00
	DVR-FR-036-BL	6/15/99		2.09	7830.00	0.00114	5627.00	34.60	0.00	1231.00	7.57	281.00	1.73	52.80	0.32	4091.00
		8/2/99				DRY										
		11/9/99				DRY										

* U.S. Geological Survey: Water-Resources Investigation Report 88-4022

Table 7: Water Quality Data Collected in the Goose Run Sub-watershed of the Little Raccoon Creek Basin

GOOSE RUN SAMPLE SITES	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTOR	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Al mg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
LRC 15			CONFLUENCE OF GOOSE RUN													
		*11/01/83		2.80	1840.00	0.280	745.00	1125.25	0.00	94.00	141.98	66.00	99.69	5.40	8.16	1100.00
		2/19/97		3.80	690.00	0.70	125.00	472.00	0.00	25.30	95.53	10.40	39.27	1.16	4.38	277.00
		3/24/98		4.10	445.00	1.05	55.00	311.52	0.00	7.60	43.05	2.90	16.43	0.31	1.76	387.00
	OUBL008	8/26/98		3.92	514.00	1.545	43.00	358.37	0.00	3.48	29.00	5.70	47.50	1.70	14.17	215.00
	OUBL022	10/13/98		3.04	1647.00	0.13	447.00	315.87	0.00	39.00	27.56	33.00	23.32	2.94	2.08	950.00
	DMR-LRC-030-BL	6/24/99		2.94	1250.00	0.175	288.00	271.87	0.00	14.90	14.07	25.80	24.36	3.16	2.98	234.00
	DMR-LRC-059-BL	10/18/99		3.08	1310.00	0.255	273.00	375.52	0.00	19.70	27.10	23.60	32.46	3.69	5.08	646.00
2			CONFLUENCE OF TRIBUTARY 2													
	OUBL009	8/26/98		3.83	554.00	0.233	36.00	45.25	0.00	1.27	1.60	3.40	4.27	3.38	4.25	238.00
	DMR-LRC-060-BL	10/18/99		3.41	843.00	0.0674	88.20	32.07	0.00	2.50	0.91	8.64	3.14	4.72	1.72	328.00
2A			DIFFUSE SEEPS IN HEADWATERS OF TRIBUTARY 2													
	DMR-LRC-070-BL	10/20/99		4.87	129.00	0.00543	41.80	1.22	1.10	7.46	0.22	2.67	0.08	0.82	0.02	41.20
2B			ABANDONED DEEP-MINE DRAINAGE													
	DMR-LRC-071-BL	10/20/99		3.66	401.00	0.00766	21.20	0.88	0.00	1.34	0.06	2.29	0.09	1.34	0.06	132.00
2C			MEAD ACCESS ROAD SEEP													
	DMR-LRC-069-BL	10/20/99		3.33	687.00	0.0211	89.30	10.16	0.00	4.50	0.51	8.68	0.99	3.35	0.38	270.00
2D			PATTONSVILLE CHURCH DRAINAGE													
	DMR-LRC-072-BL	10/20/99		2.79	1520.00	0.006	401.00	12.98	0.00	81.00	2.62	12.80	0.41	7.77	0.25	611.00
2E			AREA DRAINING NORTH-WEST END OF MEAD RECLAIM													
	DMR-LRC-073-BL	10/20/99		6.20	281.00	0.019	0.33	0.03	56.10	1.31	0.14	3.10	0.32	0.186	0.02	60.10
2F			MEAD RECLAMATION SEEP													
	DMR-LRC-074-BL	10/20/99		4.40	1230.00	0.008	552.00	23.82	0.00	202.00	8.72	25.40	1.10	12.800	0.55	831.00
3			CONFLUENCE OF TRIBUTARY 3													
		2/19/97		4.90	477.00	0.50	48.00	129.46	0.00	15.40	41.54	3.88	10.46	2.84	7.66	228.00
		3/24/98		4.10	324.00	0.94	29.00	147.05	0.00	6.70	33.97	1.50	7.61	1.20	6.08	160.00
	OUBL010	8/26/98		3.44	1060.00	1.255	136.00	920.70	0.00	8.10	54.84	11.00	74.47	2.22	15.03	467.00
	DMR-LRC-061-BL	10/18/99		3.02	1610.00	0.152	397.00	325.51	0.00	32.00	26.24	33.80	27.71	2.64	2.16	818.00
3A			DEEP-MINE JKN-137													

* U.S. Geological Survey: Water Resources Investigation report 85-4060, 1985

Table 7: Water Quality Data Collected in the Goose Run Sub-watershed of the Little Raccoon Creek Basin

GOOSE RUN SAMPLE SITES	SAMPLE ID#	SAMPLE DATE	SITE DESCRIPTOR	pH	S. COND. umho/cm	DISCHARGE ft ³ /sec.	TOTAL ACIDITY mg/l as CaCO ₃	ACID LOADING lbs/DAY	TOTAL ALKALINITY mg/l as CaCO ₃	TOTAL IRON mg/l	IRON LOADING lbs/DAY	TOTAL Almg/l	Al LOADING lbs/DAY	TOTAL Mn mg/l	Mn LOADING lbs/DAY	SULFATE mg/l
3A	DVR-LRC-063-BL	10/19/99	DEEP-MINE JKN-137	7.01	228.00	0.00943	29.80	1.52	2.63	3.92	0.20	1.97	0.10	0.50	0.03	82.30
3B			CONFLUENCE OF GOOSE RUN Rd. SEEP													
	DVR-LRC-065-BL	10/19/99		2.81	2250.00	0.03520	1213.00	230.32	0.00	234.00	44.43	88.40	16.79	1.61	0.31	1704.00
3B1			GOOSE RUN Rd. SEEP													
	DVR-LRC-064-BL	10/19/99		2.69	2990.00	0.0389	1588.00	333.22	0.00	329.00	69.04	136.00	28.54	1.97	0.41	2280.00
3B2			UPSTREAM OF GOOSE RUN Rd. SEEP													
	DVR-LRC-066-BL	10/19/99		3.22	763.00	NO FLOW	140.00		0.00	14.60		12.80		0.71		291.00
3C			J.C.COBB Rd. SEEP													
	DVR-LRC-067-BL	10/19/99		2.67	1910.00	0.00342	597.00	11.01	0.00	44.70	0.82	48.50	0.89	1.64	0.03	881.00
3D			DEEP-MINE JKN-174													
	DVR-LRC-068-BL	10/19/99		5.77	296.00	0.04680	28.30	7.14	9.28	5.65	1.43	2.79	0.70	0.098	0.02	109.00
LRC 14			TARR CAMP CONFLUENCE													
		2/5/97		5.40	90.00	12.50	10.00	674.29	0.00	1.94	130.81	2.60	175.31	0.52	35.06	29.00
		3/24/98		6.50	103.00	6.05	0.00	0.00	8.00	0.38	12.40	0.80	26.11	0.31	10.12	38.00
	OUBL020	10/13/98		6.30	136.00	0.04	0.00	0.00	12.00	0.61	0.13	0.30	0.06	0.56	0.12	46.00
	DVR-LRC-062-BL	10/18/99		6.07	213.00	0.00261	0.00	0.00	36.20	2.49	0.04	2.33	0.03	1.12	0.02	33.80

* U.S. Geological Survey: Water Resources Investigation report 85-4060, 1985

APPENDIX 2: USGS BASELINE BIOLOGICAL DATA



United States Depart

U.S. GEOLOG



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Biologist
Ohio District

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U.S. Geological Survey
6480 Doubletree Avenue
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614-430-7778
614-430-7777 FAX

Chip Rice
PO Box 494
McArthur, OH 45651

March 28, 2000

Dear Sir:

The fish data and the Index of Biological Integrity (IBI) calculations have been viewed and verified by staff of the Ohio Environmental Protection Agency (OEPA), Division of Surface Water and Planning.

As expected, the differences between my calculations of the IBI and those through OEPA staff, are parallel. The OEPA values differ by 4. The higher value downstream of Dickason Run reflects habitat quality and quantity more than water quality.

The fish data are now complete and ready for your intended use. If you have any questions or comments, please contact me at the above address.

Sincerely,

John Tertuliani
Biologist

Enclosure

PROJECT DATA
Results from selected sites in Little Raccoon Creek

Fish community results from selected sites in Little Raccoon Creek, 1999

Fish community surveys were conducted at 2 stream sites in Little Raccoon Creek in 1999. Fish were collected by electrofishing with pulsed-DC current at each stream site. One electrofishing pass was conducted at each reach on the same day. Fish were identified, measured, weighed, and checked for external anomalies such as parasites, lesions, and skeletal deformities. The fish collected were in good health. The only anomaly observed was a blackside darter blinded in one eye. Most individuals were returned to the stream after processing. Additional surface-water and (or) water-quality data for these sites can be found in the continuous-record sections of the Ohio data reports. Family names are in uppercase, scientific names are in italics, and common names are in parentheses. (Each metric is calibrated for drainage area, in square miles; RM = River Mile; --, unknown value).

Station Name			Little Raccoon Creek above Dickason Run 99 mi ² RM 12.8		Little Raccoon Creek below Dickason Run 127 mi ² RM 12.5	
Latitude	(North)		39°00'43"		39°00'30"	
Longitude	(West)		82°27'06"		82°27'05"	
Collection Date			8/31/99		8/31/99	
FAMILY	SCIENTIFIC NAME	COMMON NAME	ABUNDANCE	BATCH WEIGHT (g)	ABUNDANCE	BATCH WEIGHT (g)
Petromyzontidae	<i>Lampetra aepyptera</i>	least brook lamprey	--	--	1	8.3
Cyprinidae	<i>Notropis stramineus</i>	sand shiner	--	--	1	1.7
	<i>Pimephales notatus</i>	bluntnose minnow	2	0.5	10	7.1
Catostomidae	<i>Moxostoma erythrurum</i>	golden redhorse	--	--	1	7.2
	<i>Hypentelium nigricans</i>	northern hogsucker	3	6.6	6	18.9
	<i>Catostomus commersoni</i>	white sucker	--	--	2	6.0
	<i>Minytrema melanops</i>	spotted sucker	--	--	1	3.7
Esocidae	<i>Esox americanus vermiculatus</i>	grass pickerel	--	--	1	17.4
Centrarchidae	<i>Ambloplites rupestris</i>	rock bass	1	1.5	--	--
	<i>Micropterus punctulatus</i>	spotted bass	2	6.6	17	36.9
	<i>Lepomis cyanellus</i>	green sunfish	18	109.6	16	100.0
	<i>Lepomis megalotis</i>	longear sunfish	1	29.0	3	206.6
Percidae	<i>Percina maculata</i>	blackside darter	5	6.0	10 ^a	23.5
	<i>Etheostoma nigrum</i>	johnny darter	5	2.3	4	1.8
NUMBER OF SPECIES			8	--	13	--
TOTAL NUMBER OF FISH			37	--	73	--

IBI RESULTS				
IBI METRIC	SAMPLE VALUE	IBI SCORE	SAMPLE VALUE	IBI SCORE
1. Total number of species	8	1	13	3
2. Number of darter species	2	1	2	1
3. Number of sunfish species	3	3	2	3
4. Number of sucker species	1	1	4	3
5. Number of intolerant species	0	1	0	1
6. Percent tolerant species	56%	1	38%	1
7. Percent omnivores	6%	5	16%	5
8. Percent insectivores	89%	5	58%	5
9. Percent top carnivores	5.6%	5	24.7%	5
10. Relative number of individuals minus tolerants	24	1	68	1
11. Percent simple lithophils	22%	3	27%	3
12. Percent DELT ^b anomalies	0%	5	0%	5
IBI TOTAL (Modified Iwb)			32 (4.3)	36 (5.9)

^aOne fish with anomaly (blinded in one eye)

^bDeformities, Eroded Fins, Lesions, and Tumors



United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Chip Rice
PO Box 494
McArthur, OH 45651

March 28, 2000

Dear Sir:

The macroinvertebrate data and the Invertebrate Community Index calculations have been viewed and verified by staff of the Ohio Environmental Protection Agency (OEPA), Division of Surface Water and Planning.

As expected, the differences between my calculations of the ICI and those through OEPA staff, are negligible. The most consistent change is in the Total Number of Taxa, metric 1. This metric is different by one at each station with the exception of Station 5 where it was different by two. The ICI values are different by two for each station except at Station 3. My earlier statements concerning Buffer Run and Mulga Run receive stronger support from the verified set of data. The macroinvertebrate data are now complete and ready for your intended use. The fish data are not verified, yet. You will receive a verified copy as soon as possible.

If you have any questions or comments, please contact me at the above address.

Sincerely,

John Tertuliani
Biologist

Enclosure

Table 1. Invertebrate Community Index values and scores for stations 1-6, Little Raccoon Creek, Vinton, Ohio, 1999

[A score of 6, 4, 2, or 0 is assigned to each metric value based on the deviation from reference conditions. Each metric is calibrated for drainage area, in square miles. RM = River Mile]

Metric	Metric value, (ICI score) by station					
	1 below Mulga Run 70 mi ² RM 24.2	2 below Flint Run 81 mi ² RM 20.7	3 below Buffer Run 84 mi ² RM 19.1	4 above Dickason Run 99 mi ² RM 12.8	5 below Dickason Run 127 mi ² RM 12.5	6 near Vinton, OH 148 mi ² RM 3.4
1. Total number of taxa	27 (4)	26 (4)	19 (2)	37 (4)	25 (4)	27 (4)
2. Number of mayfly taxa	0 (0)	0 (0)	0 (0)	4 (2)	1 (0)	6 (4)
3. Number of caddisfly taxa	3 (4)	2 (4)	4 (6)	4 (6)	3 (4)	7 (6)
4. Number of Diptera taxa	13 (2)	15 (4)	10 (2)	21 (6)	15 (4)	11 (2)
5. Percent mayflies	0 % (0)	0 % (0)	0 % (0)	1.6 % (2)	0.8 % (2)	6.8 % (2)
6. Percent caddisflies	52.6 % (6)	45.8 % (6)	9.3 % (4)	7.0 % (2)	0.6 % (2)	11.2 % (4)
7. Percent Tanytarsini midges	<1 % (2)	8 % (2)	10 % (2)	59 % (6)	71 % (6)	54 % (6)
8. Percent other Diptera and non-insect	37 % (4)	42 % (4)	71 % (0)	30 % (4)	26 % (6)	27 % (6)
9. Percent tolerant organisms	7 % (6)	<1 % (6)	0 % (6)	<1 % (6)	0 % (6)	<1 % (6)
10. Qualitative EPT taxa	6 (2)	5 (2)	5 (2)	9 (4)	8 (2)	17 (6)
Invertebrate Community Index	30	30	24	42	34	44

Little Raccoon Creek Water Quality Data

NAME	DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	WATER TEMPERATURE WATER (DEG C)	pH (STANDARD UNITS)	SPECIFIC CONDUCTANCE (US/CM)	OXYGEN DIS-SOLVED (MG/L)	ACIDITY (MG/L AS CACO3)	ALKALINITY WAT WH TOT INC FIELD (MG/L AS CACO3)
Station 1. Little Raccoon Creek below Mulga Run	7-27-99	1100	5.51	25.5	7.1	569	4.1	N/A	146
Station 2. Little Raccoon Creek below Flint Run	7-28-99	0900	5.44	24.5	7.0	597	4.7	N/A	91
Station 3. Little Raccoon Creek below Buffer Run	7-28-99	1130	5.40	24.5	7.0	651	5.2	N/A	77
Station 4. Little Raccoon Creek above Dickason Run	7-27-99	1700	6.15	27.0	7.3	764	5.1	N/A	39
Station 5. Little Raccoon Creek below Dickason Run	7-27-99	1430	6.31	25.5	7.3	766	6.3	N/A	29
Station 6. Little Raccoon Creek near Vinton, OH	7-28-99	1330	6.03	26.5	7.4	600	6.4	N/A	59

I. Below are the Qualitative Habitat Evaluation Index (QHEI) values from the USGS 1999 QHEI field sheets and a summary of the corresponding ICI and IBI values.

Sites/Metric	1-below Mulga Run	2- Below Flint Run	3- Below Buffer Run	4- Above Dickason Run	5- Below Dickason Run	6- Near Vinton, Ohio
	RM 24.2	RM20.7	RM19.1	RM12.8	RM12.5	RM3.4
QHEI	62	54	64	48	54	52
ICI	30	30	24	42	34	44
IBI	NA	NA	NA	36	40	NA

II. ICI, IBI, and QHEI values for OEPA (1995) sites that correspond with the USGS 1999 Little Raccoon Creek sites.

	RM 24.5 (below Mulga Run, site 1)	RM 11 (below Dickason, site 5)
ICI*	16	8
IBI*	36	37
QHEI	48	57

*These values are comparable to the USGS 1999 values *only* if methods utilized were similar, site locations were similar, and the same metrics were used in the computation of the ICI and IBI.

III. Ecoregion Biocriteria: Western Allegheny Plateau (WAP). (from OEPA 1995).

	WWH	EWB	MWH	LRW-AMD
QHEI	60	75	45	?
ICI	36	46	30	8
IBI- wading & headwater	44	50	24	18

WWH : Warmwater habitat

EWB: Exceptional warmwater habitat

MWH: Modified warmwater habitat

LRW-AMD: Limited resource water – acid mine drainage

APPENDIX 3: TREATMENT SYSTEM SELECTION PARAMETER

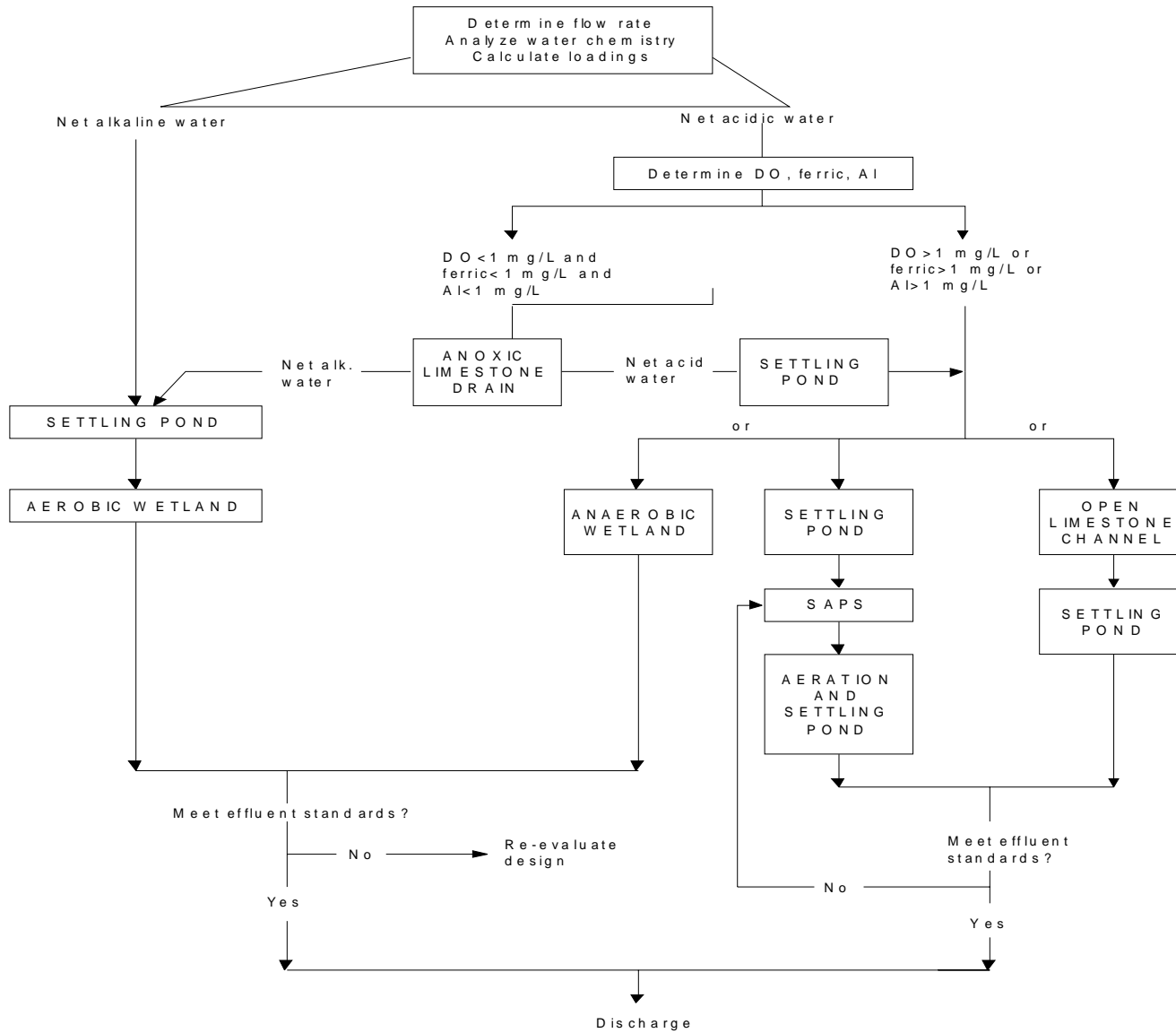
Site Location: _____
 Notes: _____

PARAMETER LIMITATIONS OF MITIGATION TECHNOLOGIES*

Number of Samplings:		Design Limits									Comments
Chemical Physical Parameters	Means, Values, Min/Max (h)	ALD	Aerobic Wetland	Anaerobic Wetland	SAP/ ASP	LSP	RAPS	OLC	Limest. Fines	Dosing Quick Lime/ Limestone	
Flow (gpm)		<500 (b)	(j)	(j)	(j)	<500 (b)	(j)	(a)	*	>4 cfs (m)	
D.O. (mg/l)		<2 (f)	*	>2 (e)	>2	<2 (f)	>2	*	*	*	
Lab pH		<5	>4	>3 (d)	NET ACIDIC	<5	NET ACIDIC	*	NET ACIDIC	*	
Acidity (mg/l)		<300 (g)	NET ALK. (l)	(j)		<300 (g)		*		NET ACIDIC	
Alkal. (mg/l)		*	*	*		*		*		*	NET ACIDIC
Tot. Fe (mg/l)		*	(j)	(j)	*	*	*	*	*	*	
Fe ⁺³ (mg/l)		<25	(j)	(j)	*	<25	*	*	*	*	
Fe ⁺² (mg/l)		*	<70 (c)	(j)	*	*	*	*	<100 (k)	<100 (k)	
Mn (mg/l)		*	*	*	*	*	*	*	*	*	
Al (mg/l)		<25	*	*	*	<25	*	*	*	*	
Sulfate (mg/l)		<2000	*	<2000	<2000	<2000	<2000	<2000	<2000	<2000	

- *= Not applicable or not available
- (a) Based on channel length and width restrictions and req'd contact time. 100% neutralization can be achieved with a 3-hr residence time; 90% with 1-hr
- (b) Little experience with flows greater than 500 gpm. Suitability for flows greater than 100 gpm based on low Fe, Mn, and Al levels.
- (c) Unless series of aeration unit - wetland cell combinations is provided.
- (d) >3 for anaerobic wetland unless limestone is added to the substrate, in which case, pH<3 if OK.
- (e) Organic layer strips for DO.
- (f) Unless the metals content is very low.
- (g) Unless discharge from it will pass through another treatment facility involving alkalinity addition.
- (h) Does not represent individual treatment locations. Representative of flows discharging from the site (three).
- (i) Seep locations only.
- (j) Restricted by available area at site.
- (k) If >5050 mg/l, may require post neutralization aeration and significant reaction retention.
- (l) Acidic if pre-treatment precipitation is required.
- (m) Drum Doser.

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 Michael Baker Jr., Inc.



PRELIMINARY FLOW SHEET FOR SELECTION OF PASSIVE TREATMENT SYSTEMS

Additional treatment may be required for Mn and heavy metals
 See text for further discussion and possible limitations
 (Modified after Hedin et al., 1994, with additions)

ATTACHMENT E

Photographs from Site Reconnaissance