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3R2N Aquatic Report: Allegheny River
Phase 3 - 2002

Aquatic Invertebrates

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Biological Assessment of Aquatic Invertebrate Communities of Streams Tributary to the Pools of Dams #2, #3, and #4 on the Allegheny River

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I.Abstract

Aquatic macroinvertebrate communities are sensitive indices of stream water quality and ecological health. In the second phase of a three-year effort to conduct invertebrate-based bioassessments of urban/suburban streams within Allegheny County, Pennsylvania, chemical and invertebrate samples were collected during the spring of 2002 at twenty-two streams stations. All of these stations were located near the mouths of streams tributary to the navigation pools of Allegheny River Dams 2, 3, and 4.

Chemically, the study streams tended to be alkaline, hard, and mineralized. The mean values for pH, alkalinity, hardness, and conductivity were 8.11, 94.0 mg/l as $CaCO_3$, 182.3 mg/l as $CaCO_3$, and 724 uhmos/cm, respectively. Calcium concentrations averaged 49 mg/l and sodium 65 mg/l. Concentrations of ammonia and other nutrients were elevated at a number of stations. These parameters are fingerprints of widespread influences of alkaline mill slag leachates, highway deicing salts, and sewage contamination, and, at some locations, acid mine drainage from bituminous coal mines.

More than 8,213 invertebrate organisms from seventy different taxa were collected, identified, and enumerated at the twenty-two stations. Condition scores were then developed from the invertebrate data for each station, where a score greater than 80% indicates that a stream is non-impaired, 60-79% slightly impaired, 40-59% moderately impaired, and less than 39% severely impaired. All but one of the stream stations examined were impaired to various degrees; 19.0% severely impaired, 47.6% moderately impaired, and 28.6% slightly impaired. While it is disappointing that there was only one small stream without measurable degradation (Riddle Run), it is still encouraging that 28.6% of the streams examined were only slightly impaired, and that 47.6 % were only moderately impaired. The diversity of aquatic life found in these streams exceeds what might have been expected from historical memories and impressions of these urban waterways as industrial waste conduits and/or open sewers. The streams sampled during the Phase 2 effort also tended to be in better condition than streams tributary to the Pittsburgh Pool (Emsworth Locks and Dam Pool) and the pools of Monongahela River Dams 2 and 3, which were previously sampled in 2001 during Phase 1 of the study. The average condition score of the Phase 1 streams was 45.1, and 42.8% were severely degraded, compared to an average Phase 2 condition score of 52.9 with only 19.0% severely degraded. The ten Phase 2 streams with the highest condition scores were Riddle Run (95.6), Buffalo Creek (75.3), Tawney Run (75.2), Blacks Run (71.0), Chartiers Run (64.1), Bull Creek (63.7), Pucketa Creek (61.8), Little Bull Creek (59.0), Bailey Run (56.3), and Plum Creek (53.5).

II. Introduction

A. Purpose of Study

The purpose of this study is to support the Three Rivers Second Nature (3R2N) initiative by performing invertebrate bioassessments of streams in Allegheny County, Pennsylvania. The assessments will be used to characterize and rank the water quality and health of the ecosystem of these streams. The general goals of the 3R2N initiative are to generate interest in protecting/restoring Allegheny County, Pennsylvania urban streams, including those that are buried and/or culverted, and their riparian corridors for multiple benefits.

B. Authority

The authority for U.S. Army Corps of Engineers participation in this study is Section 22 of the Water Resources Development Act of 1974 (Public Law 93-25 as amended). This statute authorizes the Corps of Engineers to assist states and local governments in the preparation of plans for the development, utilization, and conservation of water and related land resources, and for recovering cost shares of the program from non-federal entities.

C. Sponsors and Participants

The 3R2N initiative is a partnership between Carnegie Mellon University's STUDIO for Creative Inquiry and the Three Rivers Wet Weather Demonstration project (TRWW). This initiative is supported by the Allegheny County Health Department (ACHD) and the Allegheny County Sanitary Authority (ALCOSAN). The Allegheny County Health Department is the Section 22 Study cost-sharing signatory. The TRWW project was established in 1997 to assist fifty-one communities in Allegheny County, PA, currently under regulatory scrutiny to eliminate Combined Sewer Overflows (CSOs). The program has expanded to assist all eighty-three communities in the ALCOSAN service area by funding wet weather remediation projects.

Other members in the 3R2N Advisory Board and partnership include the Pittsburgh Water and Sewer Authority, Pittsburgh City Planning, The University of Pittsburgh, Chatham College, the Rocky Mountain Institute, and others. 3R2N has funding for five years from the Heinz Endowments and the Pittsburgh Foundation.

D. Tasks

This report was prepared by Michael Koryak, and Linda J. Stafford with the assistance of Rosemary J. Reilly and Paul Magnuson, all from the U.S. Army Corps of Engineers Pittsburgh District's Water Management Section. The basic tasks to be performed by the U.S. Army Corps of Engineers, Pittsburgh District, in support of the 3R2N effort, are to conduct rapid biological invertebrate-based assessments of at least sixty-eighta stream locations within, or which drain into, waters of Allegheny County, PA. This data will then be used to characterize the quality of the study streams.

In addition to their intrinsic values and importance as food for fish and other forms of aquatic life and often non-aquatic life, benthic macroinvertebrate communities are also highly responsive indices of water quality. Macroinvertebrate quality evaluations are based on the principal that the invertebrate communities of non-degraded streams are composed of many different types of organisms, including pollution intolerant taxa such as mayflies, stoneflies, and caddisflies (Ephemeroptera, Plecoptera, and Trichoptera, or EPT organisms). The invertebrate communities of polluted streams, on the other hand, are dominated by a small number of pollution tolerant taxa such as sludge worms and bloodworms (Annelida and Chironomidae, or AC organisms). Between the extremes are numerous organisms with intermediate tolerances.

E. Reasons for Bioassessment

Bioassessments may be used within a planning and management framework to prioritize water problems for more stringent assessments and to document "environmental recovery" following control action. Some of the advantages of using biosurveys for this type of monitoring are:

1. Biological communities reflect overall ecological integrity (i.e., chemical, physical, and biological integrity). Therefore, biosurvey results directly assess the status of a waterbody relative to the primary goal of the Clean Water Act.

2. Biological communities integrate the effects of different pollutant stressors and thus provide a holistic measure of their aggregate impact. These communities also integrate stresses over time and provide an ecological measure of fluctuating environmental conditions. Assessing integrated variable pollutant inputs offers a particularly useful approach for monitoring non-point source impacts and the effectiveness of certain Best Management Practices.

3. Routine monitoring of biological communities can be relatively inexpensive, particularly when compared to the cost of assessing toxic pollutants, either chemically or with toxicity tests.

4. The status of biological communities is of direct interest to the public as a measure of a pollution free environment, while reductions in chemical pollutant loadings are not as readily understood by the layperson as positive environmental results.

5. Where criteria for specific ambient impacts do not exist, biological communities may be the only practical means of evaluation.

The advantages of using benthic macroinvertebrates for bioassessments are:

1. Macroinvertebrate communities are good indicators of localized conditions. Because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life, they are particularly well suited for assessing site-specific impacts (upstream-downstream studies).

2. Macroinvertebrate communities integrate the effects of short-term environmental variations. Most species have a complex life cycle of approximately one year or more. Sensitive life stages will respond quickly to stress, the overall community will respond more slowly.

3. Degraded conditions can often be detected by an experienced biologist with only a cursory examination of the macroinvertebrate community. Macroinvertebrates are relatively easy to identify to family; many "intolerant" taxa can be identified to lower taxonomic levels with ease.

4. Sampling is relatively easy, requires few people and inexpensive gear, and has no detrimental effect on the resident biota.

5. Benthic macroinvertebrates serve as a primary food source for many recreational and commercially important fish.

6. Benthic macroinvertebrates are abundant in most streams. Many small streams (first and second order), which naturally support a diverse macroinvertebrate fauna, only support limited fish fauna.

7. Most state water quality agencies that routinely collect biosurvey data focus on macroinvertebrates. Many states already have background macroinvertebrate data (OEPA, 1998).

F. Water Quality in Urban/ Suburban Areas

As the bioassessments will be utilized to characterize water quality and other aquatic ecosystem health parameters of Allegheny County streams, it is appropriate to provide some general and specific background on the water quality of streams which drain urban/suburban environments. The type and concentrations of compounds found in certain bodies of water are closely linked to land use in surrounding areas. In fact, water in urban settings seems to have a characteristic chemical makeup or "signature" that is different than that found in agricultural or other settings. The chemical makeup correlates with the chemicals used in this setting or watershed.

The U.S. Geological Survey's National Water Quality Assessment (NAWQA) sampling of streams and shallow ground water in urban areas shows that:

1. Concentrations of total phosphorous are generally higher in urban streams than in other settings, commonly exceeding the U.S. Environmental Protection Agency's desired goal to control excessive plant and algae growth.

2. Insecticides occur at higher frequencies, and usually at higher concentrations in urban streams than in agricultural streams. Most common are diazinon, carbaryl, chlorpyrifos, and malathion.

3. Urban streams have the highest frequencies of occurrence of DDT (dichlorodiphenyltrichloroethane), chlordane, and dieldrin in fish and sediment, and the highest concentrations of chlordane and dieldrin. DDT is an insecticide that was commonly used in the United States until the early 1970s to control mosquitoes and other insects. Chlordane and aldrin (the parent compound that breaks down to dieldrin) were used widely until the late 1980s to control termites. Despite downward trends in some areas, these persistent organochlorine insecticides are still found at elevated levels in bed sediment and fish in urban streams throughout the United States.

4. Volatile organic compounds (VOCs), used in plastics, cleaning solvents, gasoline, and industrial operations, occur widely in urban ground water throughout the United States. At least one VOC was detected in 47% of wells sampled in urban areas. The four most frequently detected of the sixty measured VOC compounds are the industrial solvents trichloroethene, tetrachloroethene, the gas additive methyl tert-butyl ether (MTBE), and trichloromethane (also known as chloroform), which is a solvent and a byproduct of the disinfection of drinking water.

5. Concentrations of selected trace elements are also elevated in populated urban settings, most likely caused by emissions from industrial and municipal activities and the widespread use of motor vehicles. For example, streambed-sediment and reservoir-sediment samples collected from the Chattahoochee River Basin and analyzed for total lead and zinc concentrations indicate that population density, which is strongly related to traffic density, is a predictor of lead and zinc concentrations in the environment (Hirsch et al, 2001).

Locally, streams draining urban industrial portions of the Upper Ohio River Valley can suffer from a plethora of insults including: a legacy of polluted drainage from past mining and industrial activities; leakage of sanitary wastes from old and poorly maintained sewer systems; combined storm/sanitary sewer overflows (CSOs); shock loads of deicing chemicals from airports and highways following winter thaws; filling, channelization and culverting; dry-weather desiccation from extensive drainage activities; and sudden and violent storm surges from impervious urban surfaces that tend to down cut channels and degrade habitat. However, of these many urban/suburban insults, the influence of mineralized (largely $CaSO_4$) alkaline leachates emerged in this study as a major and previously unappreciated, unique chemical "signature" of local urban drainage (Koryak et al 2002).

Cyclic sequences of Pennsylvanian sandstone, shale, and claystone, with thin beds of limestone and coal, are exposed in the study area. Local drainage from these formations is typically slightly acidic and moderately mineralized, yielding $CaSO_4$ dominated waters. Sams and Beer (2000) characterized the median SO_4 concentration of streams in the upper Ohio River drainage basin that are not underlain by coal at about 20 mg/l, with SO_4 yields of about ten tons/km^2/yr. Much higher median annual concentrations and yields can occur, however, in areas where coal is present and has been mined.

In addition to minerals associated with the underlying Pennsylvanian geologic formations, various anthrogenic materials also influence the chemical composition of local urban runoff. These include extensive exposed cement surfaces, which can leach alkaline calcium salts. Also, as a consequence of the industrial history of the region, steel mill slags were, and continue to be, frequently utilized as aggregates in cement and bituminous asphalt construction, as well as placement of highway shoulder berms, driveway and parking lot fills, and as a railroad grade ballast. Slag leachates are typically calcium sulfate dominated and often extremely alkaline (U.S. Army Corps of Engineers, 1989 and 2000, and Koryak et al 2002). A commonly used alternative to slag for fills and aggregate in the region is crushed limestone ($CaCO_3$). All of these contribute to a strong alkaline and $CaSO_4$ dominated chemical fingerprint for urban drainage.

Another significant chemical signature of small local urban/suburban streams with a high percentage of impervious areas in their watersheds is deicing salts. The study area is located in a highly dissected portion of the unglaciated Appalachian Plateaus Physiographic Province. Normal total annual precipitation is thirty-seven inches, and the monthly normal is highest in July (3.6 inches) and lowest in February (2.4 inches). Average annual snowfall is forty-four inches, and snow cover is subject to melting throughout the winter season. In other words, the study area is located in a very hilly “ice belt”, where repeated and copious applications of deicing salts in the winter would be anticipated. Koryak et al (2001) demonstrated that winter season urban deicing salt runoff events in this region can produce salinity concentrations that can result in osmoregulatory stress to susceptible freshwater organisms.

G. Station Locations

Candidate streams to be sampled were tentatively selected and prioritized by the 3R2N team, of which thirty-three were sampled during Phase 1 of this study in 2001, and twenty-two were sampled in Phase 2 during 2002. While it is anticipated that this cursory list might be revised as the study progresses, at least sixty-eight streams will be assessed. Streams selected for all three phases of the study are listed in table 1. Detailed descriptions of the twenty-two stations sampled in the Year 2002 phase of the study are provided in table 2. Photographs of each Phase 2 sampling station reach are shown in Appendix D.

Station sampling reaches were located as near as possible to the mouths of the study streams, in areas upstream of backwater influences of the navigation dams, and with at least one stony riffle in each sampling reach. At a number of stations, finding suitable unculverted reaches upstream of backwater from the navigation pools forced us to locate stations at considerable distances upstream from the mouth of the study streams. Because of these criteria, the 3R2N bioassessment stations were not located in precisely the same stream reaches as the 3R2N tributary bacteriological stations, which were sampled in a separate study effort. It is important in this study to make the distinction between streams with similar names, Chartiers Creek sampled in 2001 and Chartiers Run sampled in 2002, and Sandy Creek (Curry Hollow) sampled in 2001 and Sandy Creek sampled in 2002.

H. Methods

The benthic invertebrate analyses were conducted following protocol developed by the U.S. Environmental Protection Agency, as refined by the Ohio Environmental Protection Agency (OEPA), for stream quality Rapid Biological Assessments (RBAs), with appropriate modifications and adjustments to local conditions. Sensitive EPT (Ephemeroptera, Plecoptera, and Tricoptera) organisms were identified to genus, and sometimes to species level, and tolerant AC (Annelida and Chironomidae) organisms to family taxonomic levels. Hilsenoff Family Biotic Indices (FBIs) and other metrics, as well as a condition score, were developed for each station. Additional information on the selection of metrics is discussed in section IV, *Results and Discussion*, of this report.

To eliminate possible seasonal interference when comparing different stations or different years of data for the same station, collection of benthic invertebrate samples during the spring season (April-June) is preferred. Sampling early in the year also has the advantage of usually documenting the highest invertebrate diversity and productivity that will occur in a stream during the year.

The total biological sampling effort at each station was ten minutes (two samples, five minutes each). Station reach lengths and widths were measured and are reported in table 2, along with related percentages of riffle/run verses pool segments at each station. Expediency drove the choice of sampling methodology. Hester-Dendy in situ sampling was not considered feasible due to the high probability of disturbance. Because so many of the streams sampled were very small and narrow with embedded substrates, rather than a kick net, Surber samples with one-foot widths were used with an upstream movement kick net methodology, and hand, rather than foot disturbances at all stations to collect invertebrates. Areas of the stream substrate which were sampled at each station were estimated for each station, but numbers of organisms collected per sampling time period is probably a much better measure for comparison of relative standing crop.

Companion field measurements of water temperature, field pH, dissolved oxygen concentration, and specific conductance were measured at each station, and samples were collected for laboratory analyses. A list of the chemical parameters examined is presented in table 3.

I. Summary of Phase 1 Results

Aquatic macroinvertebrate communities are sensitive indices of stream water quality and ecological health. In the first phase of a three-year effort to conduct invertebrate-based bioassessments of urban/suburban streams within Allegheny County, Pennsylvania, chemical and invertebrate samples were collected during the spring of 2001 at thirty-five stations on thirty-three different streams. All of these stations were located near the mouths of streams tributary to the navigation pools of Emsworth Locks and Dam, Monongahela River Locks and Dam 2, and Monongahela River Locks and Dam 3.

Chemically, the Phase 1 study streams tended to be alkaline, hard, and mineralized. The mean values for pH, alkalinity, acidity, hardness, and conductivity were 7.79, 130.7 mg/l as $CaCO_3$, 8.9 mg/l as $CaCO_3$, 390.8 mg/l as $CaCO_3$, and 1215 uhmos/cm, respectively. Calcium concentrations averaged 109 mg/l and sodium 100 mg/l. Concentrations of ammonia and metals (especially iron and aluminum) were elevated at a number of stations. These parameters are fingerprints of widespread influences of alkaline mill slag leachates, highway deicing salts, and sewage contamination, and, at some locations, acid mine drainage from bituminous coal mines.

A total of 18,883 invertebrate organisms from sixty-seven different taxa were collected, identified, and enumerated at the thirty-five Phase 1 stations. Condition scores were then developed from the invertebrate data for each station, where a score greater than 80% indicates that a stream is non-impaired, 60-79% slightly impaired, 40-59% moderately impaired, and less than 39% severely impaired. All of the thirty-five stream stations examined were impaired to various degrees; 42.8% severely impaired, 37.2% moderately impaired, and 20% slightly impaired. While it is disappointing that there were no streams without measurable degradation, it is still encouraging that 20% of the streams examined were only slightly impaired, and that 37.2% were moderately impaired. The diversity of aquatic life found in these streams during the first phase of the 3R2N bioassessment exceeds what might have been expected from historical memories and impressions of these urban waterways as industrial waste conduits and/or open sewers. While no attempt was made to collect fish, they were incidentally collected during the invertebrate sampling at seven stations, and incidentally observed at eleven other stations. Based on these observations, initiation of a baseline sampling effort to characterize the fishery resources of study streams was recommended for Phase 2 of this study in 2002. The seven Phase 1 streams that were only slightly impaired, and their condition scores, were: 1) Pine Creek, 71.3%; 2) Mingo Creek, 66.2%; 3) Dry Run, 66.2%; 4) Sandy Creek, 63.7%; 5) West Run, 62.0%; 6) Chartiers Creek, 61.3%; 7) and Guyasuta Run, 60.0%.

III. Results and Discussion

The results of chemical field measurements and laboratory analyses of samples collected during the 2002 phase of the bioassessment effort are presented in Appendix A. The raw invertebrate data collected during this phase is presented in Appendix B. Appendix C contains incidental field observations and notes made at the various stations during the field effort. These incidental observations include notes on vertebrates (i.e. fish, salamanders, and snakes, etc.) either incidentally collected or observed during the invertebrate sampling; the occurrence of obvious sewage problems evident by observations or odors; evidence of acid mine drainage or slag leachate impacts; and information provided by the public.

A. Chemical Results and Discussion

The chemical data in Appendix A characterizes the urban/suburban streams sampled during Phase 2 of this study as very alkaline, hard, and mineralized. Field pH values ranged from 7.46 to 9.05, and averaged 8.11. The lowest pH was in Falling Springs Run and the most elevated pH was in Little Pucketa Creek. The Little Pucketa Creek field pH measured on April 17, 2002 slightly exceeded the Commonwealth of Pennsylvania maximum pH criteria of 9.0. Total alkalinities ranged from 37.4 to 253.7 mg/l as $CaCO_3$, and averaged 94.0 mg/l as $CaCO_3$. The lowest alkalinity was measured in Chartiers Run and the highest in Guys Run. Total hardness values ranged from 79.9 to 415.7mg/l as $CaCO_3$, and averaged 182.3 mg/l as $CaCO_3$. The lowest hardness was measured in Chartiers Run and the highest in Shade Run. Field conductivities ranged from 275 to 1624 umhos/cm, and averaged 724 umhos/cm. The highest conductivity was measured in Guys Run and the lowest occurred in Chartiers Run. Besides Guys Run, conductivities in excess of 1,000 umhos/cm were also documented in two other Phase 2 streams, Little Pucketa Creek and Tawney Run.

These pH alkalinity, conductivity, and hardness values would be considered very high in local nonurbanized streams, and are part of the local urban drainage chemical fingerprint. They are exceptionally elevated considering that the samples were collected during spring flows when they might be expected to be seasonally low. Summer low-flow surveys of these streams would have probably resulted in much higher values.

Calcium concentrations ranged from 22 to 120 mg/l, and averaged 49 mg/l. Sodium concentrations ranged from 12 to 280 mg/l, and averaged 65 mg/l. The average calcium to sodium ratio was very low (0.75:1), indicating residual chemical influences from previous winter highway deicing activities over extensive portions of the drainage basins of these streams. Previous studies of highly urbanized local streams showed that Ca/Na ratios during dry weather could be less than one, whereas local streams with few paved road surfaces in their drainage basins could have Ca/Na ratios of over four (Koryak et al., 2001).

Elevated ammonia concentrations at some streams are indicative of impacts from sewage. Ammonia as N concentrations of 0.5 mg/l or more were measured in Shade Run, Indian Creek, Little Deer Creek, and Guys Run. Nitrate/nitrite concentrations as N of over 2.0 mg/l were measured in Shade Run, Sandy Creek, Quigley Creek, and Indian Creek. Kjeldahl nitrogen concentrations as N of over 0.4 mg/l were measured in Sandy Creek, Indian Creek, and Chartiers Run. Total phosphorus concentrations as P of over 0.1 mg/l were measured in Shade Run and Falling Springs Run.

Because of an anomaly which occurred on the day Powers Run was sampled (April 24, 2002), Powers Run data was not included in the above discussion of nutrient concentrations. This stream was extremely muddy at the time of sampling (turbidity 1220 NTU). Since there had not been any recent rain, and other local streams were not turbid on this date, some significant upstream disturbance was obviously occurring. Fire trucks were later observed coming down Powers Run Road, and it is probable that the extreme turbidity observed was related to fire fighting activities in the headwaters of Powers Run, with flushing through the storm sewers to Powers Run. Elevated nutrients and metals concentrations measured in Powers Run were also likely related to the headwaters incident. The ammonia concentration was 0.14 mg/l as N and the Kjeldahl nitrogen concentration was 2.86 mg/l as N. Total metals concentrations in Powers Run during the incident were exceptionally high. The concentration of iron was 35,000 ug/l, aluminum 22,000 ug/l, manganese 1,300 ug/l, zinc 250 ug/l, lead 66 ug/l, copper 49 ug/l, nickel 40 ug/l, chromium 29 ug/l, arsenic 13 ug/l, and cadmium 3 ug/l. This Powers Run incident serves as an example of the vulnerability of small urban/suburban streams to a wide variety of episodic stresses and injuries.

Excluding Powers Run, the concentrations of total iron in the Phase 2 study streams ranged from L 30 to 670 ug/l, and averaged 167 ug/l. Total manganese and aluminum concentrations were also unremarkable, averaging only 61 ug/l and 98 ug/l, respectively. However, iron staining of rocks in the streambeds of Guys Run, Little Deer Creek, and Pucketa Creek was apparent, suggesting that at times these streams are adversely influenced by metal enriched acid mine drainage from old bituminous coal mining operations. Again excluding Powers Run, detectable concentrations of trace toxic heavy metals were found for only one metal in one study stream, 20 ug/l of zinc in Indian Creek.

In summary, while there are chemical quality problems in the Phase 2 study streams tributary to pools of Allegheny River Dams 2, 3, and 4, generally, across a wide array of parameters, the Phase 2 streams appear to be of much higher quality than the more urbanized, industrialized, and mineral extraction influenced streams examined during Phase 1.

B. Biological Results

1. Selection of Metrics and Reference Stations: In the development of the condition scores to rank the health of streams sampled, the choice of metrics to be used is critical. The Hilsenhoff Family Biotic Index (FBI), as well as most other metrics used by investigators who conduct aquatic invertebrate based rapid biological assessments, was developed to reflect the responses of invertebrate communities to sewage pollution and agricultural enrichment of streams. Sewage is certainly a problem in many Allegheny County streams, and is of great interest to 3R2N and its partners. However, the unique chemical fingerprints and highly unusual aquatic invertebrate communities of the local urban/suburban industrialized study area suggest that other metrics also be considered. The selection of alternate metrics that can be used to simultaneously quantify the influence of mixes of sewage, deicing salt runoff, acid mine drainage, and mineralized and highly alkaline urban/industrial leachates, is challenging. To meet this challenge, we have introduced three new metrics: 1) percent EPT organisms exclusive of Baetidae mayflies; 2) total number of organisms collected; and 3) percent non-crustacean organisms.

Mayflies are sensitive water quality indicators, but not all mayfly nymphs are equally sensitive to the same pollution parameters. All local mayfly genera and species appear to be very sensitive to acid mine drainage, and typically none are found in streams with ambient pH values suppressed below pH 6 (Koryak, Stafford, Reilly, and Sykora, 1998). Relative to other mayflies, however, Baetidae nymphs are somewhat tolerant of organic pollution. In most cases this variable tolerance does not significantly influence or unbalance invertebrate community assessments, and Baetidae are typically included as EPT organisms. Locally, the situation is much different, and a number of mineralized and extremely alkaline streams are swarming with Baetidae mayfly nymphs, overwhelmingly *Baetis flavistriga*. While this group is sensitive to acidic conditions, and relatively tolerant of organic pollution, they are apparently highly tolerant of very alkaline waters and can dominate the invertebrate communities of such stressed waters. Therefore, we feel that a percent EPT organisms exclusive of Baetidae metric is appropriate for assessing and ranking of local urban streams (Koryak et al 2003). Chambers and Messinger (2001) apparently came to the same conclusion and used such a metric to assess the urban/industrial waters of the Kanawha River Basin.

In reference to the second of the three new metrics, organic pollution usually results in low diversity, but large numbers of A/C organisms. Therefore, large total numbers of organisms are typically equated with degradation. In our study area, however, low numbers of all organisms in very stressed streams was a major problem. In one stream downstream of an acid mine drainage discharge, Coal Bluff Run, there was no macroscopic life. Therefore, it is appropriate in this study to introduce a metric that places a positive value on standing crop.

The third new metric is percent of the crustacean *Gammerus*. Like Baetidae mayflies, *Gammerus* are not normally considered to be highly pollution tolerant organisms. But as with Baetidae, they can dominate the community of very alkaline local urban drainages (Koryak et al 2003). At one station sampled in 2001, Tassey Hollow, *Gammerus minus* was the only invertebrate collected. The collection rate there was over 130 individuals per minute. Therefore, a negatively rated Gammerus metric is also an appropriate metric to assess the health of local urban streams. In this analysis, the percent of all non-crustacean organisms was used as a metric.

Review of data from other recent ambitious urban watershed invertebrate monitoring efforts (such as Kenner and Ayers (2002) in New York and northern New Jersey, and Ourso (2001) in Anchorage) does not reveal the same pattern of urban signature species which were found in Allegheny County, Pennsylvania. The urban signature species found locally might be a response to unique local conditions, such as perhaps widespread alkaline leachate from steel mill slag in the local urban/industrial environment (Koryak et al., 2002). The high alkalinity and crustacean dominated urban/industrial drainage within Allegheny County is in some respects similar to the *Gammarus* dominated invertebrate communities of many spring fed headwater streams, and also larger alkaline limestone spring fed streams, in the Mid-Atlantic region.

The metrics used to develop the condition scores for the examined streams were 1) taxa richness as a percent of the reference station, 2) total number of organisms as a percent of the reference station, 3) % EPT organisms, 4) % non-AC organisms, 5) % EPT organisms exclusive of Baetidae mayflies, 6) % non-crustacean organisms and, 7) modified Hilsenoff Family Biotic Index as a percent of the reference station. Other metrics, such as Shannon-Weaver Diversity Indices, were developed but not utilized for scoring in this initial phase of the study. Alternate scoring metrics may be considered in later phases of the study when data from more sites will be available.

The selection of reference stations is another important decision that can influence the results of invertebrate RBA scores. Comparison with a non-impaired, high quality reference stream in the same ecoregion is necessary. In this study, however, in order to generate reasonable standards and realistic goals, rather than holding up a pristine stream of the unglaciated Appalachian Plateaus as a standard, it would be appropriate to consider the urban/suburban environment of the Allegheny County portion of the upper Ohio River drainage basin as a distinct ecoregion, and to utilize a stream of this ecoregion as a reference. Because Pine Creek is classified as "Approved Trout Waters" by the Pennsylvania Fish and Boat Commission, and had a relatively healthy invertebrate community, Pine Creek was selected as an urban/suburban stream reference station.

2. Condition Score Ranking: Invertebrate community metrics and condition scores for the twenty-two stream stations examined in the year 2002, Phase 2 of the study are shown, compared, and ranked on table 4. Figure 1 is a bar graph ranking of the condition scores of the study streams. A score greater than 80% indicates that a stream is non-impaired, 60-79% slightly impaired, 40-59% moderately impaired, and less than 40% severely impaired. Of the fifty-seven streams sampled in both Phases of this study, only one very small Phase 2 Allegheny County stream has been examined which was not measurably impaired, Riddle Run which drains an area of only 1.63 square miles. Of

the remaining Phase 2 streams, 19% were severely impaired, 47.6% moderately impaired, and 28.6% were slightly impaired. The mean condition score for Phase 2 streams was 52.9, compared to 45.1 for the more densely urbanized and industrialized Phase 1 streams. Figure 2 is a comparison of the invertebrate condition scores of Allegheny River tributaries with streams tributary to the Monongahela River in Allegheny County. The scores for these stations are also ranked in Table 5. Both the figure and the table reveal a pattern where the quality of streams tributary to the Allegheny River tends to be higher than that of the more urban/industrialized streams tributary to the Monongahela River.

Note in table 4 that while metrics were developed for Guys Run, because of the unusual and anomalous benthic invertebrate community observed in Guys Run, the authors choose not to rate this stream. No mine drainage associated elevated acidity or metals concentrations were measured in Guys Run in April 2002. In fact, rather than acidity, Guys Run had the highest alkalinity of any Phase 1 or Phase 2 study stream (253.7 mg/l as $CaCO_3$), and its conductivity was the highest of any Phase 2 stream (1,624 umhos/cm). However, immediately upstream of the old Harman coal mine audit where Guys Run was sampled, the substrate of the stream was stained red with iron oxides. The benthic macroinvertebrate community of Guys Run was dominated (74.5%) by stoneflies (Plecoptera) which are weighed in this assessment methodology as a pollution intolerant group. However the stoneflies found in Guys Run were 78.8% *Amphinemura sp*., and 16.6% *Leuctra sp*., genera which are tolerant of mine drainage pollution. The dominance of Plecoptera in this stream inflates several metrics and significantly exaggerates the Guys Run condition score. Rather than revise the metrics to account for anomalies at this single stream, it was considered more prudent to simply leave Guys Run unrated.

While none of the streams sampled in the Phase 2 - 2002 study effort had low pH values or elevated acidity concentrations, at several locations in addition to Guys Run there was evidence that metal pollution problems related to acid mine drainage (AMD) from bituminous coal mines existed within their watersheds. A grossly iron degraded AMD seep enters Chartiers Run immediately downstream of the station reach sampled. Staining of the substrate by iron was apparent along Little Deer Creek and Pucketa Creek. While the stream order, habitat, and water chemistry of Guys Run appears to be suitable to support fish life, electrofishing demonstrated a complete absence of fish in Guys Run.

The ten Phase 2 streams with the highest condition scores were Riddle Run (95.6), Buffalo Creek (75.3), Tawney Run (75.2), Blacks Run (71.0), Chartiers Run (64.1), Bull Creek (63.7), Pucketa Creek (61.8), Little Bull Creek (59.0), Bailey Run (56.3) and Plum Creek (53.5). Severely impaired Phase 2 streams were Falling Springs Run (23.9), Indian Creek (24.8), Quigley Creek (30.1) and Powers Run (31.8).

3. Interpretation of Condition Scores: Comparisons with the results of other urban stream studies contribute to the interpretation of the results of this Allegheny County, Pennsylvania bioassessment of urban streams. Probably the most powerful and pertinent data comes from nearby urban communities in Ohio.

Yoder and Rankin (1996) performed bioassessments of 110 sites in urban and suburban locations in Ohio. They used both fish and invertebrate assessments relative to non-impaired high quality streams. Forty-six sites (42%) reflected poor or very poor performances. Of the sites classified as being impacted by urban land use and pollution sources, only two sites attained the applicable biocriterion. Poor or very poor performance was reflected by the majority of the urban impacted sites (85%). More than 40% of the suburban sites were impaired with many of these reflecting the impact of new developments for housing and commercial uses. The severity of biological impairments within urban areas was also influenced by stream size, as measured by watershed area, with the most severe effects occurring in watershed areas less than twenty square miles.

They concluded that combined sewer overflows (CSOs) are a major source of impairment in urban watersheds. Besides contributing raw sewage, CSOs can also include industrial wastewater that is discharged into the sewer system. Also, in many urban settings in Ohio, concentrations of chemicals in bottom sediments are frequently elevated compared to concentrations measured at site-specific control or regional reference sites. Contaminated sediments generally result from releases that enter the aquatic environment during regular and episodic releases from point sources (including CSOs and storm sewers) and/or periodic runoff events from urban non-point sources. A correspondence between sediment concentrations of heavy metals and declining aquatic community performance was demonstrated.

In the interpretation of the results of this investigation of Allegheny County, PA streams, it is important to maintain the perspective that the study was intended to be only an initial and very cursory baseline assessment of the quality of local urban streams, and that there were very significant temporal and spatial limitations to the effort. Identification of higher quality reaches of these streams, or of specific sources of sanitary sewage, CSO, mine drainage, slag leachate or other insults to the study streams, would require a larger sampling station network than was employed in this initial cursory assessment. The number of stations necessary would largely be a function of the size of the drainage area of the individual study streams, the complexity of land use patterns within each drainage basin and the goals of the investigation. Also, while the results of invertebrate community sampling tends to integrate stresses over time, there are still seasonal impacts to water quality and biological communities. These include, but are not limited to, cold weather highway deicing salt runoff and warm weather anoxia and elevated ammonia concentrations, which would best be documented by seasonal sampling.

4. Incidental Observations and Trends: Among the incidental observations listed in Appendix C is the presence of various vertebrates in the study streams. While no attempt was made to collect fish during the invertebrate survey, some fish were nonetheless incidentally captured in the invertebrate sampling nets at seven stations, and observed at an additional seven stations (total fourteen of twenty-two stations). Darters were captured at five stations, creek chubs at three, blacknose dace and shiners at two and a stoneroller at one. Observed fish were mostly large carp and schools of shiners and small unidentified fishes. Subsequent electrofishing surveys of the streams document the presence of numerous other species of fish (Koryak et al., 3R2N 2002 Report).

Other vertebrates captured were a northern dusky salamander in Sandy Creek and a queen snake in the invertebrate sampling nets in Bailey Run. Muskrat and beaver signs were apparent at some stations. While no record was kept of birds observed, a number of kingfishers, Louisiana waterthrushes, warbling vireos, yellow warblers, mallard ducks and other water-associated birds were seen and/or heard. While casual, these incidental observations indicate that the small urban streams of the study area can potentially support a variety of interesting and valuable fish and wildlife species.

IV. Conclusions

Aquatic macroinvertebrate communities are sensitive indices of stream water quality and ecological health. In the second phase of a three year effort to conduct invertebrate-based bioassessments of urban/suburban streams within Allegheny County, PA, chemical and invertebrate samples were collected during the spring of 2002 at twenty-two streams stations. All of these stations were located near the mouths of streams tributary to the navigation pools of Allegheny River Dams 2, 3, and 4.

Chemically, the study streams tended to be alkaline, hard, and mineralized. The mean values for pH, alkalinity, hardness, and conductivity were 8.11, 94.0 mg/l as $CaCO_3$, 182.3 mg/l as $CaCO_3$, and 724 uhmos/cm, respectively. Calcium concentrations averaged 49 mg/l and sodium 65 mg/l. Concentrations of ammonia and other nutrients were elevated at a number of stations. These parameters are fingerprints of widespread influences of alkaline mill slag leachates, highway deicing salts, and sewage contamination, and, at some locations, acid mine drainage from bituminous coal mines.

More than 8,213 invertebrate organisms from sixty-seven different taxa were collected, identified, and enumerated at the twenty-two stations. Condition scores were then developed from the invertebrate data for each station, where a score greater than 80% indicates that a stream is non-impaired, 60-79% slightly impaired, 40-59% moderately impaired, and less than 39% severely impaired. All but one of the stream stations examined were impaired to various degrees; 19.0% severely impaired, 47.6% moderately impaired, and 28.6% slightly impaired. While it is disappointing that there was only one small stream without measurable degradation (Riddle Run), it is still encouraging that 28.6% of the streams examined were only slightly impaired, and that 47.6 % were only moderately impaired. The diversity of aquatic life found in these streams exceeds what might have been expected from historical memories and impressions of these urban waterways as industrial waste conduits and/ or open sewers. The streams sampled during the Phase 2 effort also tended to be in better condition than streams tributary to the Pittsburgh (Emsworth Locks and Dam) Pool and the pools of Monongahela River Dams 2 and 3, which were previously sampled in 2001 during Phase 1 of the study. The average condition score of the Phase 1 streams was 45.1, and 42.8% were severely degraded, compared to an average Phase 2 score of 52.9 with only 19.0% severely degraded. The ten Phase 2 streams with the highest condition scores were Riddle Run (95.6), Buffalo Creek (75.3), Tawney Run (75.2), Blacks Run (71.0), Chartiers Run (64.1), Bull Creek (63.7), Pucketa Creek (61.8), Little Bull Creek (59.0), Bailey Run (56.3), and Plum Creek (53.5).

V. Recommendations

A. Additional Invertebrate Sampling Stations

3R2N has expressed an interest in potentially expanding the original limited objectives of the program, which was to conduct initial biological assessments of the quality of the urban/suburban streams of Allegheny County, PA. In addition to assessing and ranking the quality of these streams near their points of confluence with the Allegheny, Monongahela, and Ohio Rivers (as was performed for fifty-five streams in Phases 1 and 2 of the effort), in later phases of the study they believe that there would be considerable value in also assessing the quality of reaches of these streams at other additional locations within their respective drainage basins. They would like the program to be able to both identify higher quality tributaries and/or stream reaches within the watersheds of these streams, and to document locations where serious degradation occurs. The purpose for documenting specific sources of stress and their impacts to the biological communities would be to identify and prioritize potential remediation actions. Therefore, it is recommended that the 3R2N team meet to develop a plan for conducting additional bioassessments in later phases of this study.

Implementation of a study to achieve these goals would probably involve, at a minimum, establishing stations on: 1) various headwater reaches of each stream; 2) all perennial tributaries of the study streams; 3) locations upstream and downstream of known potential problem sources, such as CSOs, slag dumps and coal mine and chlorinated WWTP discharges and 4) allowing the flexibility to sample at other locations where unanticipated sources of pollution might be discovered in the investigative process. The approximate total number of stations necessary to achieve these expanded goals for all study streams would have to be determined by a 3R2N team planning effort. Probably, at a minimum, it would require the establishment of a network of about two-hundred and fifty stations to reasonably approach satisfaction of the expanded objectives. Another implementation approach would be to select a smaller number of candidate streams for more intensive watershed level assessments.

B. Fish Data Collection

Incidental observations during the spring 2001 aquatic invertebrate assessment field surveys of local urban/suburban streams demonstrated that many of the streams now support resident fish life. Also, even when resident fish communities of local degraded streams are depauperate, reaches with access can nonetheless be used by transient species from the nearby navigation system (Koryak et al., 2001, 591-598). Like invertebrates, fish can be used to assess stream quality. In addition, fish are familiar organisms, which are of great interest to the general public, and their status is more easily understood by layman as an index of quality. Therefore, in the Phase 1, 2001 report, it was recommended that the 3R2N bioassessment be augmented with fish data. This recommendation was implemented in 2002. Thirty-five streams with little or no baseline fish data were selected for analyses in Phase 2 and then sampled by short-reach, single pass, backpack electrofishing. The results of this effort are presented in a separate 3R2N Phase 2 companion report.

C. Data Analysis

As the database grows in subsequent study phases, biological community metrics which were used to analyze the results should be refined, and other analyses should also be employed. One example of an additional analytical approach would be to look for correlations between bioassessment condition scores and the percentage of impervious urban surface cover within each study watershed. Three Rivers Second Nature is now in the process of building a GIS database for the study area, which will include impervious land use areas in the watersheds of the study streams. When both the bioassessment and GIS work have been completed, there will be an excellent opportunity to intensify the analysis and interpretation of the data.

In regard to the chemical data collected, it would be tempting to try to correlate invertebrate condition scores developed during this study to the companion chemical data which was collected at each station along with the invertebrate samples. However the single companion chemical data set per station is limited because it does not reflect the high degree of fluctuation and aquatic life limiting extremes of the chemical parameters that would be expected to occur in response to seasonal and hydrologic variations in these complex urban watersheds. Therefore, except where obviously high concentrations of pollutants were detected, it is cautioned that considerable prudence be exercised in the interpretation of the companion chemical data. This data was collected only to provide a rough background characterization of the water chemistries of the study streams and, along with the invertebrate data, to provide direction for more intense monitoring activities in the future, as deemed appropriate.

D. Information Sharing

Opportunities to share the results of this study with the general public, local governments, and the scientific community should be pursued. One such unique opportunity to share this information occurred in 2002 when both a paper and a poster presentation on the Phase 1 results were presented at the fiftieth annual meeting of the North America Benthological Society, held in Pittsburgh in May of 2002. The focus of this society is stream and river science and ecology, with an emphasis on macroinvertebrates. Approximately 1,000 scientists and students attended the 2002 Pittsburgh meeting, which was hosted by the Pennsylvania Department of Environmental Protection, the Pennsylvania Fish and Boat Commission, Carnegie Museum, Duquesne University, and Pittsburgh Voyager. Abstracts of both presentations were published in the Bulletin of the North American Benthological Society (Spring 2002, Volume 19, Number 1).

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VII. Tables and Figures

Table 1
3R2N Aquatic Invertebrate Biological Assessment - List of Streams to be Sampled During Years 2001, 2002 and 2003

PHASE 1 YEAR 2001		PHASE 2 YEAR 2002	PHASE 3 YEAR 2003
Tributaries to the Pittsburgh Pool (Emsworth L/D Pool)	Tributaries to the Monongahela River (L/D #2 Pool RM 11-35)	Tributaries to the Allegheny River (L/D #2, Pool RM 5.5-28)	Tributaries to the Ohio River (RM 6.2-15.5)
1) Saw Mill Run	1) Turtle Creek	1) Shades Run	1) Loweries Run
2) Chartiers Creek	2) Thompson Run (Turtle Creek)	2) Squaw Run	2) Little Sewickley Creek
3 Girtys Run	3) Thompson Run (Duquesne)	3) Quigley Creek	3) Flaugherty Run
4) Pine Creek	4) Crooked Run	4) Indian Creek	4) Big Sewickley Creek
5) Sipes Run	5) Sandy Creek	6) Powers Run	5) Toms Run
6) Guyasuta Run	6) Pine Run	7) Plum Creek	6) McCabe Run
7) Panther Hollow (Fourmile Run)	7) Peters Creek	8)Guys Run	7) Narrows Run
8) Becks Run	8) Wylie Run	9) Falling Spring Run	8) Montour Run
9) Glass Run	9) Fallen Timber Run	10) Deer Creek	9) Kilbuck Run
10) Streets Run	10) Lobbs Run	11) Little Deer Creek	10) Shouse Run
11) West Run	11)Perry Mill Run	12) Blacks Run	11) Thorn Run
12) Nine Mile Run	12) Kelley Run	13) Tawney Run	12) Moon Run
13) Homestead Run	13) Bunola Run	14) Riddle Run	
14) Tassey Hollow	14) Coal Bluff Run	15) Pucketa Creek	
	15) Mingo Creek	16) Little Pucketa Creek	
	16) Dry Run	17) Crawford Run	
	17) Pigeon Creek	18) Bailey Run	
	18) Becketts Run	19) Bull Creek	
	19) Sunfish Run	20) Little Bull Creek	
		21) Chartiers Run	
		22) Buffalo Creek	

Table 2

3R2N Biological Sampling Station, Phase 2 April 2002

STREAM NAME		**Shades Run**	**Squaw Run**	**Sandy Creek**	**Quigley Creek**	**Indian Creek**	**Powers Run**	**Plum Creek**	**Guys Run**
TRIBUTARY TO *		Allegheny River, Left Bank, River Mile 8.35	Allegheny River, Right Bank, River Mile 8.7	Allegheny River, Left Bank, River Mile 9.6	Allegheny River, Left Bank, River Mile 10.25	Allegheny River, Left Bank, River Mile 11.1	Allegheny River, Right Bank, River Mile 11.3	Allegheny River, Left Bank, River Mile 11.4	Allegheny River, Right Bank, River Mile 11.9
TOTAL DRAINAGE AREA **(mi^2)		0.61	8.56	3.37	1.10	0.89	0.89	20.6	2.05
STATION LOCATION		Allegheny River Blvd. Bridge in Penn Hills, PA	Freeport Road Bridge in O'Hara Twp., PA	Allegheny River Blvd. Bridge in Penn Hills, PA	Allegheny River Blvd. Bridge in Penn Hills, PA	Verona, PA	Off Powers Run Road in O'Hara Twp., PA	Off Hunters Road in Verona/ Oakmont, PA	Off Guys Run Road Upstream of Harmar Mine Site and Ice Harbor, in Harmarsville, PA
STATION NUMBER		0079	0122	0080	0082	0084	0120	0086	0118
STREAM WIDTH ALONG STATION REACH (ft)	MAXIMUM	7.8	19.2	17.3	10.5	5.5	11.3	33.4	13
	MINIMUM	3.5	11.3	13.1	2.1	2.6	3.5	20.9	11.2
	MEAN	5.8	15.5	14.9	6.2	4.4	9.6	28.1	12.1
LENGTH OF STATION (ft), HABITAT, AND SAMPLING TIME	LENGTH	94	105	105	98	55	132	164	120
	RIFFLE/RUN (%)	92	70	93	90	78	80	86	80
	POOL (%)	8	30	7	10	22	20	14	20
	TIME (MIN)	10	10	10	10	10	10	10	10
STATION COORDINATES	LATITUDE	40 28 52	40 29 19	40 29 06	40 29 27	40 30 12	40 30 36	40 30 41	40 32 10
	LONGITUDE	79 53 03	79 52 42	79 51 21	79 50 54	79 50 31	79 51 19	79 50 29	79 50 58

Table 2 (cont.)

3R2N Biological Sampling Stations, Phase 2 April 2002

STREAM NAME		Falling Springs Run	Deer Creek	Upper Deer Creek	Little Deer Creek	Blacks Run	Tawney Run	Riddle Run	Pucketa Creek
TRIBUTARY TO *		Allegheny River, Left Bank, River Mile 12.3	Allegheny River, Right Bank, River Mile 13.2	Deer Creek	Deer Creek	Allegheny River, Left Bank, River Mile14.6	Allegheny River, Right Bank, River Mile 15.7	Allegheny River, Right Bank, River Mile 17.1	Allegheny River, Left Bank, River Mile 17.9
TOTAL DRAINAGE AREA **(mi^2)		0.14	51.5	27.0	14.0	0.63	2.61	1.63	36.5 (Total + Little Pucketa)
STATION LOCATION		Above Oakmont Water Treatment Plant in Oakmont/ Plum, PA	Off Route 910 in Harmarville, PA	On Deer Creek Upstream of Confluence of Little Deer Creek and Commercial and Industrial Development, at USGS Station in Indiana Twp.	Off Rich Hill Road, Immediately Upstream of the Confluence With Deer Creek near Harmarville, PA	Near Allegheny River Lock and Dam #3 in Plum Twp., PA	Off Old Freeport Road in Springdale, PA	Off Riddle Run Rd. in Springdale Twp., PA	Upstream of the Confluence of Little Pucketa Creek in Plum/Lower Burrell, PA
STATION NUMBER		0088	0116	0112	0114	0090	0110	0108	0092
STREAM WIDTH ALONG STATION REACH (ft)	MAXIMUM	6.0	35.4	45.6	33.0	11.5	15.0	11.5	54.4
	MINIMUM	2.0	31.6	38	13.0	4.3	7.1	5.1	35.0
	MEAN	2.9	33.9	40.3	23.4	7.7	11.6	8.7	45.2
LENGTH OF STATION (ft), HABITAT, AND SAMPLING TIME	LENGTH	129	76	116	78	123	106	125	110
	RIFFLE/RUN (%)	70	80	60	75	75	80	90	60
	POOL (%)	30	20	40	25	25	20	10	40
	TIME (MIN)	10	10	10	10	10	10	10	10
STATION COORDINATES	LATITUDE	40 31 48	40 32 34	40 34 57	40 33 31	40 32 00	40 32 19	40 32 44	40 33 05
	LONGITUDE	79 50 09	79 50 29	79 51 41	79 50 20	79 48 47	79 47 36	79 46 17	79 45 09

Table 2 (cont.)

3R2N Biological Sampling Stations, Phase 2 April 2002

STREAM NAME		Little Pucketa Creek	Crawford Run	Bailey Run	Bull Creek	Little Bull Creek	Chartiers Run	Buffalo Creek
TRIBUTARY TO *		Pucketa Creek	Allegheny River, Right Bank, River Mile 20.2	Allegheny River, Right Bank, River Mile 20.4	Allegheny River, Right Bank, River Mile 21.7	Bull Creek	Allegheny River, Left Bank, River Mile 23.5	Allegheny River, Right Bank, River Mile 28.5
TOTAL DRAINAGE AREA **(mi^2)		10.7	1.80	4.17	49.5 (total including Little Bull Creek)	11.6	10.8	171
STATION LOCATION		Upstream of the Confluence with Pucketa Creek in New Kensington, PA	Off Old Freeport Road in East Deer Twp (Creighton), PA	Off Old Freeport Road in East Deer Twp (Creighton), PA	At Route 28 culvert, immediately upstream of the Confluence of Little Bull Creek in Harrison, PA	Immediately Upstream of the confluence with Bull Creek in Harrison, PA	At Edgecliff in Lower Burrell, PA, Upstream of the Acid Mine Drainage Discharge	At Brick Kilns Near Laneville/ Freeport, PA
STATION NUMBER		0094	0106	0104	0100	0098	0096	0102
STREAM WIDTH ALONG STATION REACH (ft)	MAXIMUM	27.0	10.6	13.5	36.2	24.7	29.0	133
	MINIMUM	15.4	5.5	8.2	21.9	16.8	17.7	125
	MEAN	21.3	8.2	10.1	32.1	21.6	23.2	129
LENGTH OF STATION (ft), HABITAT, AND SAMPLING TIME	LENGTH	104	126	130	91	96	87	76
	RIFFLE/RUN (%)	90	60	80	85	90	70	85
	POOL (%)	10	40	20	15	10	30	15
	TIME (MIN)	10	10	10	10	10	10	10
STATION COORDINATES	LATITUDE	40 33 31	40 35 13	40 35 17	40 36 40	40 36 37	40 35 58	40 40 57
	LONGITUDE	79 45 34	79 46 37	79 46 39	79 45 28	79 45 17	79 43 27	79 41 25

Table 3

3R2N Field and Laboratory Parameters Measured at Each Station During the Phase 2 Bioassesment Surveys of Arpil 2002

FIELD PARAMETERS	LABORATORY PARAMETERS
1) Water Temperature	**METALS**
2) pH	1) Total Aluminum
3) Dissolved Oxygen	2) Total Antimony
4) Specific Conductivity	3) Total Arsenic
	4) Total Barium
	5) Total Beryllium
	6) Total Cadmium
	7) Total Calcium
	8) Total Chromium
	9) Total Copper
	10) Total Iron
	11) Total Lead
	12) Total Manganese
	13) Total Magnesium
	14) Total Mercury
	15) Total Nickel
	16) Total Potassium
	17) Total Selenium
	18) Total Silver
	19) Total Sodium
	20) Total Zinc
	NUTRIENTS
	1) Total Kjeldahl
	2) Total Nitrate and Nitrite, Nitrogen as N
	3) Total Ammonia Nitrogen as N
	4) Total Phosphorous as P
	OTHER PARAMETERS MEASURED
	1) Specific Conductivity @ 25° C
	2) pH
	3) Phenolphthalein Alkalinity as $CaCO_3$
	4) Hydroxide Alkalinity as $CaCO_3$
	5) Bicarbonate Alkalinity as $CaCO_3$
	6) Carbonate Alkalinity as $CaCO_3$
	7) Total Acidity
	8) Total Hardness
	9) Turbidity
	10) Apparent Color

Table 4

3R2N Aquatic Invertebrate Rapid Biological Assessment Comparative Scoring Phase 2, Tentative

Rank	STREAM	#Taxa % Ref	# Organisms % Ref	% EPT	% Not AC	% # EPT-Baetis	% Non-crustaceans	MODIFIED FBI*	Cond Score
21.0	FALLING SPRINGS RUN	22.7	16.9	0.0	4.0	0.0	100.0	1.78	23.9
20.0	INDIAN CREEK	22.7	2.5	0.0	33.3	0.0	90.0	7.60	24.8
19.0	QUIGLEY CREEK	40.9	7.3	9.3	45.3	9.3	68.6	7.53	30.1
18.0	POWERS RUN	40.9	21.7	8.9	10.9	8.9	99.6	9.53	31.8
17.0	LITTLE DEER CREEK	45.4	15.6	30.3	34.0	30.3	100.0	8.59	42.6
16.0	CRAWFORD RUN	77.3	18.3	19.9	25.0	19.9	98.6	8.50	43.2
15.0	SHADE RUN	45.4	100	5.9	99.0	5.9	7.1	4.15	43.9
14.0	LITTLE PUCKETA CREEK	68.2	26.2	10.0	56.2	10.0	95.8	6.59	44.4
13.0	SQUAW RUN	68.2	9.3	23.6	80.9	23.6	90.0	5.52	49.3
12.0	DEER CREEK (LOWER)	68.2	8.4	36.4	78.8	36.4	77.8	6.01	51.0
11.0	SANDY CREEK	77.3	6.1	38.0	73.2	38.0	74.6	6.00	51.2
10.0	PLUM CREEK	95.4	63.1	27.9	38.1	27.9	96.5	5.33	53.5
9.0	BAILEY RUN	100	17.4	25.7	68.9	25.7	100.0	6.93	56.3
8.0	LITTLE BULL CREEK	100	20.6	37.4	60.1	37.4	98.8	7.03	59.0
7.0	PUCKETA CREEK	95.4	14.4	50.0	63.5	48.2	99.4	6.54	61.8
6.0	BULL CREEK	86.4	16.7	52.8	75.1	52.3	99.0	6.05	63.7
5.0	CHARTIERS RUN	90.9	15.3	55.0	69.6	55.0	98.9	6.60	64.1
4.0	BLACKS RUN	81.8	13.9	68.3	93.9	68.3	100.0	4.88	71.0
3.0	TAWNEY RUN	100	48.8	63.1	76.8	62.4	99.8	6.33	75.2
2.0	BUFFALO CREEK	100	62.9	48.1	80.7	62.8	97.5	5.85	75.3
1.0	RIDDLE RUN	95.4	100	90.8	96.8	90.8	100.0	5.81	95.6
NOT RATED	GUYS RUN	100	59	79.3	82.9	79.2	99.7	6.48	83.4

* FBI was not used as a metric in these condition scores

** Because the benthic community of Guys Run was so highly unusual and anomalous, it would not be appropriate to rate and rank Guys Run with the same methods used to evaluate other local streams.

Table 5
Rank of Invertebrate Biological Condition Scores of Allegheny County, PA
Tributaries to the Monongahela and Alegheny Rivers

Rank	Stream Name	River (tributary to)	Condition Score(%)	Degree of Impairment
1	Riddle Run	Allegheny	95.6	Non-impaired
2	Buffalo Creek	Allegheny	75.3	Slight
3	Tawney Run	Allegheny	75.2	Slight
4	Pine Creek (reference station)	Allegheny	71.3	Slight
5	Blacks Run	Allegheny	71.0	Slight
6	Mingo Creek	Monongahela	68.2	Slight
7	Dry Run	Monongahela	66.2	Slight
8	Chartiers Run	Allegheny	64.1	Slight
9	Bull Creek	Allegheny	63.7	Slight
10	Sandy Creek (Curry Hollow)	Monongahela	63.7	Slight
11	West Run	Monongahela	62.0	Slight
12	Pucketa Creek	Allegheny	61.8	Slight
13	Guyasuta Run	Allegheny	60.0	Slight
14	Little Bull Creek	Allegheny	59.0	Moderate
15	Pigeon Creek	Monongahela	58.6	Moderate
16	Becks Run	Monongahela	58.2	Moderate
17	Bailey Run	Allegheny	56.3	Moderate
18	Homestead Run (aka Whitaker Run)	Monongahela	55.9	Moderate
19	Plum Creek	Allegheny	53.5	Moderate
20	Lobbs Run	Monongahela	51.6	Moderate
21	Sandy Creek	Allegheny	51.2	Moderate
22	Deer Creek (lower)	Allegheny	51.0	Moderate
23	Sipes Run	Allegheny	50.9	Moderate
24	Fallen Timber Run	Monongahela	50.8	Moderate
25	Perry Mill Run	Monongahela	50.3	Moderate
26	Kelley Run	Monongahela	50.2	Moderate
27	Squaw Run	Allegheny	49.3	Moderate
28	Peters Creek (US)	Monongahela	48.9	Moderate
29	Girtys Run	Allegheny	47.3	Moderate
30	Peters Creek (DS)	Monongahela	45.0	Moderate
31	Little Pucketa Creek	Allegheny	44.4	Moderate
32	Shade Run	Allegheny	43.9	Moderate
33	Crawford Run	Allegheny	43.2	Moderate
34	Thompson Run (Turtle Creek)	Monongahela	43.0	Moderate
35	Little Deer Creek	Allegheny	42.6	Moderate
36	Wylie Run	Monongahela	41.3	Severe
37	Bunola Run	Monongahela	39.4	Severe
38	Glass Run	Monongahela	39.1	Severe
39	Panther Hollow/Fourmile Run	Monongahela	38.5	Severe
40	Coal Bluff Run (US)	Monongahela	37.9	Severe
41	Streets Run	Monongahela	36.6	Severe
42	Becketts Run	Monongahela	34.7	Severe
43	Tassey Hollow	Monongahela	34.2	Severe
44	Turtle Creek	Monongahela	33.1	Severe
45	Powers Run	Allegheny	31.8	Severe
46	Nine Mile Run	Monongahela	31.3	Severe
47	Crooked Creek	Monongahela	31.0	Severe
48	Quigley Creek	Allegheny	30.1	Severe
49	Pine Run	Monongahela	27.9	Severe
50	Thompson Run (Duquesne)	Monongahela	26.6	Severe
51	Sunfish Run	Monongahela	26.2	Severe
52	Indian Creek	Allegheny	24.8	Severe
53	Falling Springs Run	Allegheny	23.9	Severe
54	Coal Bluff Run (DS)	Monongahela	0.0	Severe

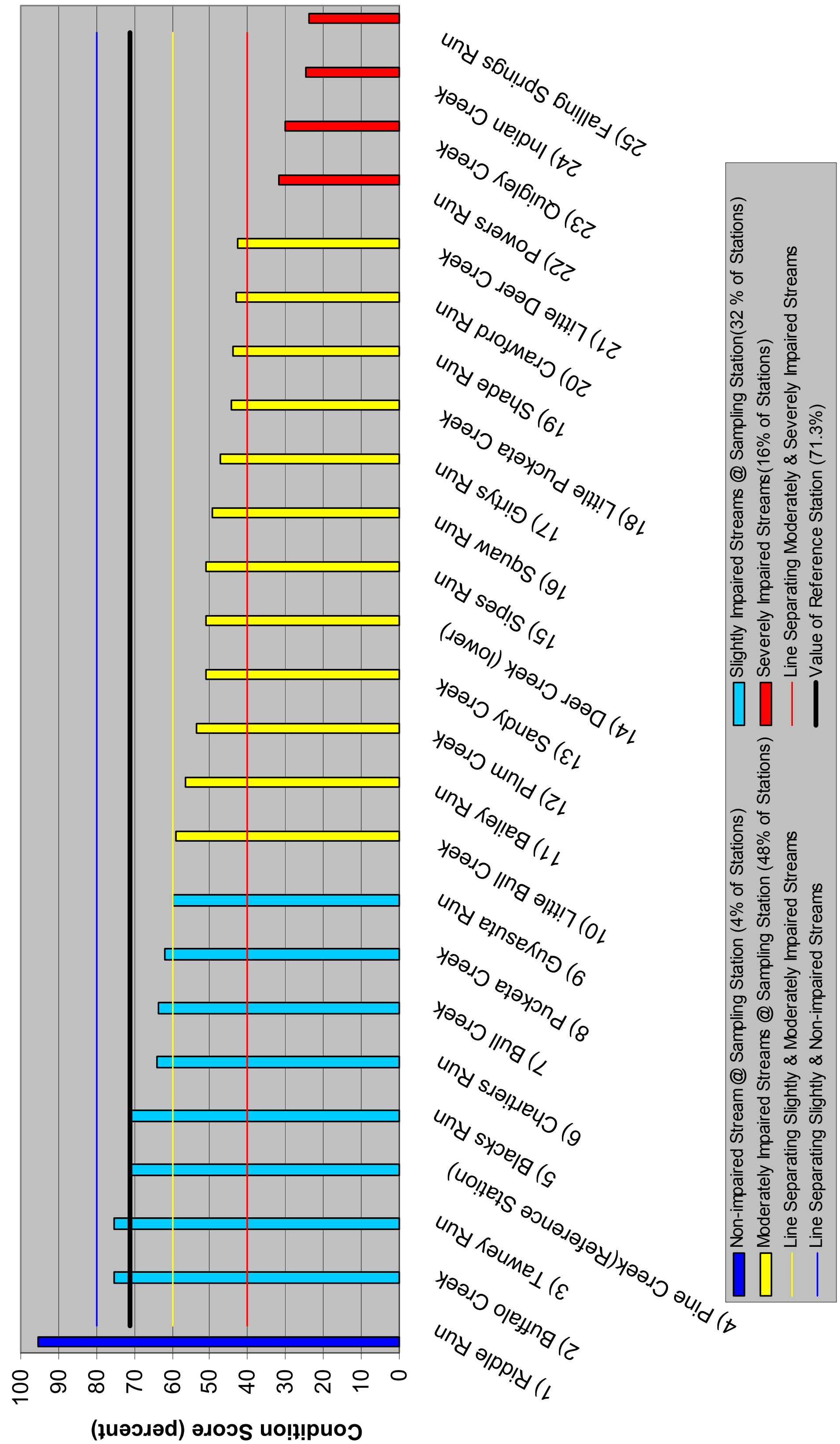


Fig. 1. Results of Aquatic Invertebrate Bioassessments, Bar Graph Showing Condition Scores @ Sampling Stations in the Allegheny Drainage Basin

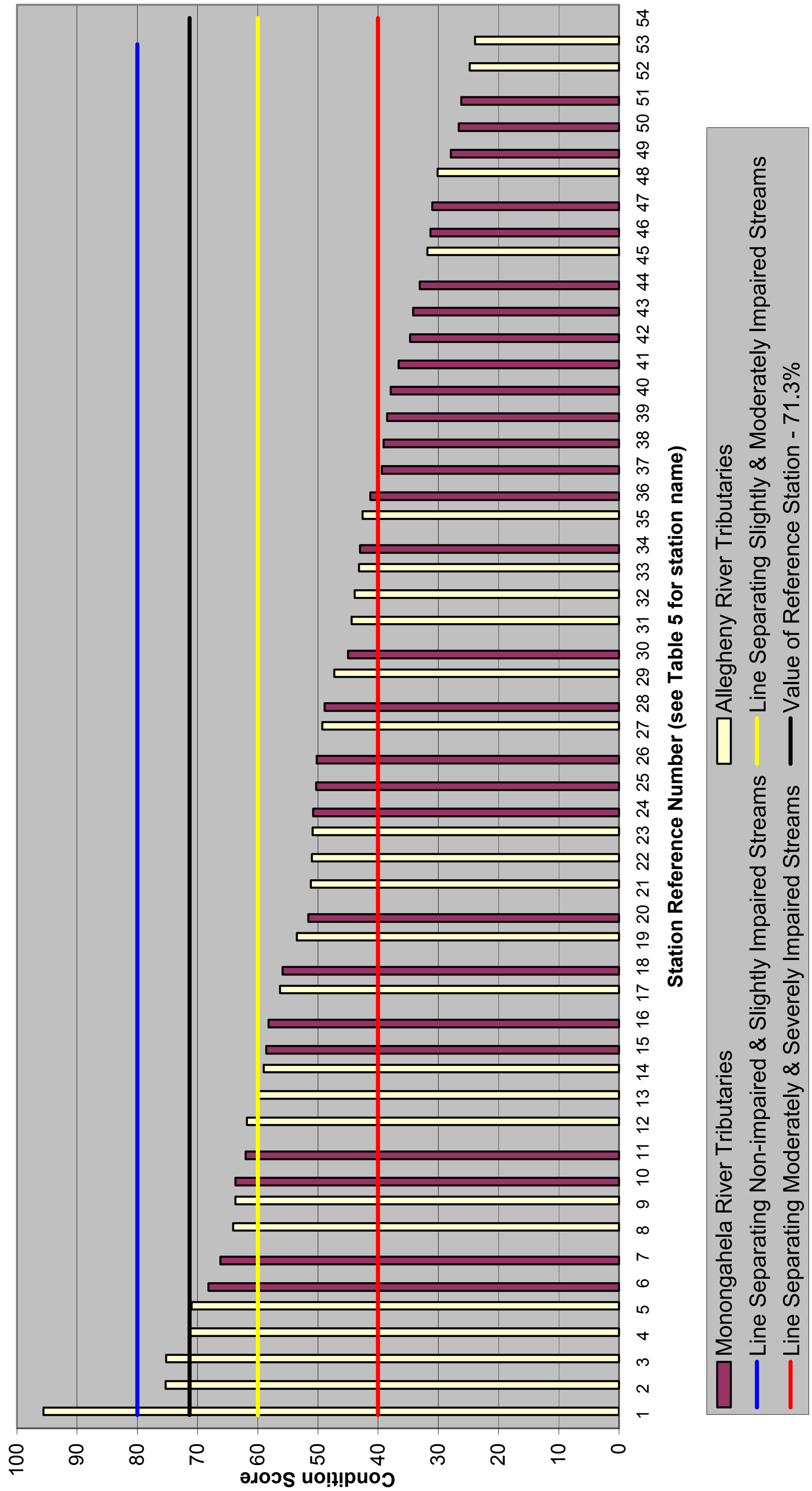


Fig. 2. Comparison of Invertebrate Biological Assesment Condition Scores of Allegheny County, PA Tributaries to the Monongahela and Allegheny Rivers

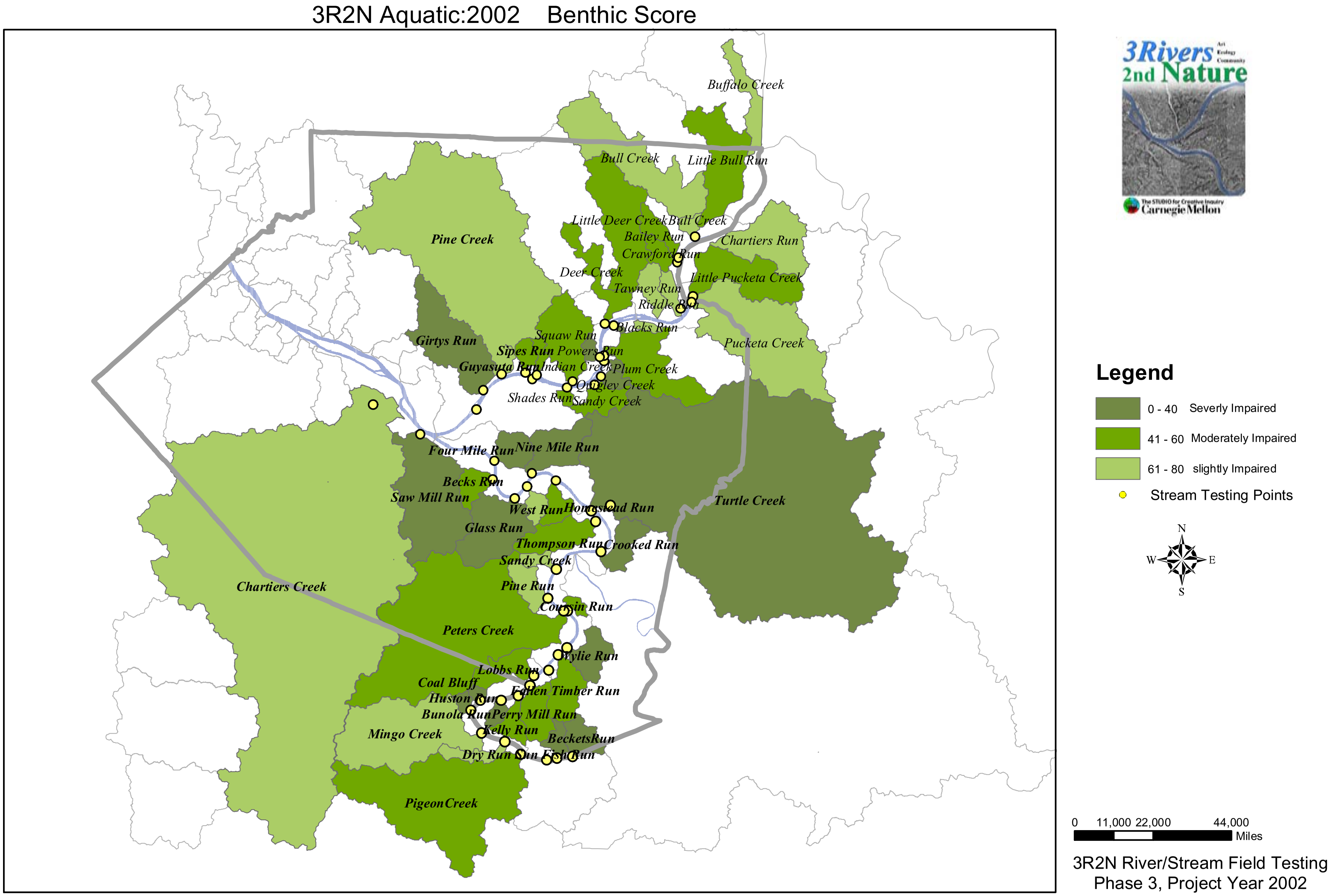


Fig. 3. 3R2N Map Showing Condition Scores and Stream Testing Points for Allegheny County, PA Tributaries to the Monongahela and Allegheny Rivers

VIII. Appendices

Appendix A. Results of Chemical Field Measurement and Laboratory Analysis of Samples Collected During the Bio-assesment Surveys

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Water Temp. Deg C 00010	Turbidity NTU 00076	Color PT-CO Units 00080	ORP MV 00090	Conductivity Field 00094	Conductivity @25 C 00095	Dissolved Oxygen mg/l 00299	Field pH pH Units 00400
TRS 1 0079	SHADES RUN	4/16/2002	0930	000	11.67	0.691	5	306	1243	1134	11.42	7.54
TRS 1 0080	SANDY CREEK	4/16/2002	1100	000	16.05	0.649	2.5	277	928	937	12.34	8.27
TRS 1 0082	QUIGLEY CREEK	4/16/2002	1135	000	15	0.951	7.5	262	688	625	11.21	8.5
TRS 1 0084	INDIAN CREEK	4/16/2002	1320	000	14.4	6.12	12.5	139	745	677	11.39	7.76
TRS 1 0086	PLUM CREEK	4/16/2002	1410	000	20.42	1.35	7.5	151	895	789	10.42	8.25
TRS 1 0088	FALLING SPRINGS RUN	4/17/2002	0900	000	13.62	1.25	12.5	202	587	540	9.39	7.46
TRS 1 0090	BLACKS RUN	4/17/2002	1000	000	14.6	0.635	5	218	643	603	10.31	7.92
TRS 1 0092	PUCKETA CREEK	4/17/2002	1200	000	17.45	3.22	20	164	409	372	10.95	7.74

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Laboratory pH, pH units 00403	Total Alkalinity as CaCO3 mg/l 00410	P.Alkalinity as CaCO3 mg/l 00415	Bicarb. Alkalinity CaCO3 mg/l 00425	00430	Total Acidity as CaCO3 mg/l 00435	Total NH3-N as N mg/l 00610
TRS 1 0079	SHADES RUN	4/16/2002	0930	000	7.73	125				3.9	0.05
TRS 1 0080	SANDY CREEK	4/16/2002	1100	000	8.2	74.6				1	L0.01
TRS 1 0082	QUIGLEY CREEK	4/16/2002	1135	000	8.21	74.8				1	0.02
TRS 1 0084	INDIAN CREEK	4/16/2002	1320	000	7.73	68.8				3.9	0.05
TRS 1 0086	PLUM CREEK	4/16/2002	1410	000	8.16	86.2				1.9	0.01
TRS 1 0088	FALLING SPRINGS RUN	4/17/2002	0900	000	7.47	80.5				4.9	0.02
TRS 1 0090	BLACKS RUN	4/17/2002	1000	000	7.75	121.2				3.9	0.04
TRS 1 0092	PUCKETA CREEK	4/17/2002	1200	000	7.74	69.1				2.9	0.02
TRS 1 0094	LITTLE PUCKETA CREEK	4/17/2002	1300	000	8.9	59.7	20.8	18	41.7	0	0.02

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Total Kjeldahl Nitrogen mg/l 00625	Total NO3+Nitrate as N 00630	Total Phosphorus as P mg/l 00665	Total Hardness as CaCO3 00900	Total Calcium mg/l 00916	Total Magnesium mg/l 00927	Total Sodium mg/l 00929	Total Potassium mg/l 00937	Total Arsenic ug/l 01002
TRS 1 0079	SHADES RUN	4/16/2002	0930	000	0.32	2.74	0.11	415.7	120	25	94	4	L4
TRS 1 0080	SANDY CREEK	4/16/2002	1100	000	0.4	2	L0.01	139.1	79	16	80	3.3	L4
TRS 1 0082	QUIGLEY CREEK	4/16/2002	1135	000	0.32	2.7	0.04	197.6	56	12	61	2.9	L4
TRS 1 0084	INDIAN CREEK	4/16/2002	1320	000	0.4	3.48	0.04	194.7	55	14	69	2.9	L4
TRS 1 0086	PLUM CREEK	4/16/2002	1410	000	0.28	0.8	L0.01	283.7	77	18	71	3	L4
TRS 1 0088	FALLING SPRINGS RUN	4/17/2002	0900	000	0.37	0.74	0.11	161.8	43	12	46	7.9	L4
TRS 1 0090	BLACKS RUN	4/17/2002	1000	000	0.26	0.76	L0.01	192.5	53	12	57	2.5	L4
TRS 1 0092	PUCKETA CREEK	4/17/2002	1200	000	0.21	0.44	L0.01	149.5	39	9	25	1.7	L4
TRS 1 0094	LITTLE PUCKETA CREEK	4/17/2002	1300	000	0.25	0.25	L0.01	141.3	35	8.4	32	1.9	L4

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Total Barium ug/l 01007	Total Baryllium ug/l 01012	Total Cadmium ug/l 01027	Total Chromium ug/l 01034	Total Copper ug/l 01042	Total Iron ug/l 01045	Total Lead ug/l 01051	Total Manganese ug/l 01055
TRS 1 0079	SHADES RUN	4/16/2002	0930	000	53	L2	L1	L3	L5	190	L3	14
TRS 1 0080	SANDY CREEK	4/16/2002	1100	000	44	L2	L1	L3	L5	40	L3	26
TRS 1 0082	QUIGLEY CREEK	4/16/2002	1135	000	46	L2	L1	L3	L5	L30	L3	L10
TRS 1 0084	INDIAN CREEK	4/16/2002	1320	000	48	L2	L1	L3	L5	190	L3	77
TRS 1 0086	PLUM CREEK	4/16/2002	1410	000	78	L2	L1	L3	L5	100	L3	110
TRS 1 0088	FALLING SPRINGS RUN	4/17/2002	0900	000	53	L2	L1	L3	L5	50	L3	3
TRS 1 0090	BLACKS RUN	4/17/2002	1000	000	53	L2	L1	L3	L5	40	L3	L3
TRS 1 0092	PUCKETA CREEK	4/17/2002	1200	000	38	L2	L1	L3	L5	330	L3	60
TRS 1 0094	LITTLE PUCKETA CREEK	4/17/2002	1300	000	36	L2	L1	L3	L5	120	L3	17

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Total Nickel ug/l 01067	Total Silver ug/l 01077	Total Zinc ug/l 01092	Total Antimony ug/l 01097	Total Aluminum ug/l 01105	Total Selenium ug/l 01147	Mercury T. ug/l 71900
TRS 1 0079	SHADES RUN	4/16/2002	0930	000	L10	L2	L10	L5	100	L10	L0.2
TRS 1 0080	SANDY CREEK	4/16/2002	1100	000	L10	L2	L10	L5	L50	L10	L0.2
TRS 1 0082	QUIGLEY CREEK	4/16/2002	1135	000	L10	L2	L10	L5	L50	L10	L0.2
TRS 1 0084	INDIAN CREEK	4/16/2002	1320	000	L10	L2	20	L5	100	L10	L0.2
TRS 1 0086	PLUM CREEK	4/16/2002	1410	000	L10	L2	L10	L5	210	L10	L0.2
TRS 1 0088	FALLING SPRINGS RUN	4/17/2002	0900	000	L10	L2	L10	L5	L50	L10	L0.2
TRS 1 0090	BLACKS RUN	4/17/2002	1000	000	L10	L2	L10	L5	L50	L10	L0.2
TRS 1 0092	PUCKETA CREEK	4/17/2002	1200	000	L10	L2	L10	L5	250	L10	L0.2
TRS 1 0094	LITTLE PUCKETA CREEK	4/17/2002	1300	000	L10	L2	L10	L5	60	L10	L0.2

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH		Water Temperature Deg C	Turbidity NTU	Color PT-CO Units	ORP MV	Conductivity @25 C uhmos/c	Dissolved Oxygen mg/l	Field pH pH Units
					00403	00410	00415	00425	00430	00435	00610	00625
TRS 1 0096	CHARTIERS RUN	4/17/2002	1410	000	18.1	2.37	10	188	275	264	10.68	8.54
TRS 1 0098	LITTLE BULL RUN	4/24/2002	1000	000	8.2	0.837	2.5	120	467	439	13.51	7.91
TRS 1 0100	BULL CREEK	4/24/2002	1030	000	8.79	4.72	25	146	548	477	12.7	7.57
TRS 1 0102	BUFFALO CREEK	4/24/2002	1215	000	10.26	1.52	5	123	309	274	13.57	8.15
TRS 1 0104	BAILEY RUN	4/17/2002	1515	000	17.73	0.836	7.5	116	499	421	11.83	7.82
TRS 1 0106	CRAWFORD RUN	4/18/2002	0905	000	13.83	0.92	10	178	693	650	12.18	7.89
TRS 1 0108	RIDDLE RUN	4/18/2002	1030	000	15.56	0.786	5	176	447	414	11.53	8.24
TRS 1 0110	TAWNEY RUN	4/18/2002	1100	000	16.2	0.809	7.5	185	1535	491	11.1	8.3
TRS 1 0112	DEER CREEK (UPPER)	4/18/2002	1330	000	18.3	1.66	12.5	182	487	489	11.42	8.42
TRS 1 0114	LITTLE DEER CREEK	4/18/2002	1415	000	19.58	1.51	10	193	989	907	10.37	8.37
TRS 1 0116	DEER CREEK	4/18/2002	1500	000	20.2	1.82	10	192	786	746	10.63	8.08

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Laboratory pH, pH units 00403	Total Alkalinity as CaCO3 mg/l 00410	P.Alkalinity as CaCO3 mg/l 00415	Bicarb.Alkalinity CaCO3 mg/l 00425	Carb.Alkalinity as CaCO3 mg/l 00430	Total Acidity as CaCO3 mg/l 00435	Total NH3-N as N 00610	Total Kjeldahl Nitrogen mg/l 00625
TRS 1 0096	CHARTIERS RUN	4/17/2002	1410	000	8.09	37.4				1.9	0.02	0.41
TRS 1 0098	LITTLE BULL RUN	4/24/2002	1000	000	7.7	57.4				2.9	L0.01	0.23
TRS 1 0100	BULL CREEK	4/24/2002	1030	000	7.52	60.2				3.9	0.04	0.31
TRS 1 0102	BUFFALO CREEK	4/24/2002	1215	000	7.71	34.9				2	0.02	0.3
TRS 1 0104	BAILEY RUN	4/17/2002	1515	000	9.02	132.6	36	60.6	72	0	0.01	0.29
TRS 1 0106	CRAWFORD RUN	4/18/2002	0905	000	7.57	157.2				4.9	L0.01	0.32
TRS 1 0108	RIDDLE RUN	4/18/2002	1030	000	7.92	68.2				3.9	0.02	0.23
TRS 1 0110	TAWNEY RUN	4/18/2002	1100	000	8.3	100.4				0	0.03	0.2
TRS 1 0112	DEER CREEK (UPPER)	4/18/2002	1330	000	8.3	75.8				0	0.05	0.25
TRS 1 0114	LITTLE DEER CREEK	4/18/2002	1415	000	8.65	144				0	0.06	0.27
TRS 1 0116	DEER CREEK	4/18/2002	1500	000	8.03	138.2				2.9	0.04	0.28

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Total Nitrite as N, mg/l 00630	Total Phosphorus S as P, mg/l 00665	Total Hardness as CaCO3 mg/l 00900	Total Calcium mg/l 00916	Total Magnesium mg/l 00927	Total Sodium mg/l 00929	Total Potassium mg/l 00937	Total Arsenic ug/l 01002
TRS 1 0096	CHARTIERS RUN	4/17/2002	1410	000	0.39	0.02	79.9	22	6.3	19	1.8	L4
TRS 1 0098	LITTLE BULL RUN	4/24/2002	1000	000	0.7	L0.01	196.7	37	12	37	2.3	L4
TRS 1 0100	BULL CREEK	4/24/2002	1030	000	0.78	L0.01	144	37	12	55	2.3	L4
TRS 1 0102	BUFFALO CREEK	4/24/2002	1215	000	1.14	L0.01	117.2	29	9.5	12	2.9	L4
TRS 1 0104	BAILEY RUN	4/17/2002	1515	000	0.15	L0.01	155.6	37	11	35	2.2	L4
TRS 1 0106	CRAWFORD RUN	4/18/2002	0905	000	0.71	L0.01	221.2	51	15	66	3.3	L4
TRS 1 0108	RIDDLE RUN	4/18/2002	1030	000	0.56	L0.01	168.9	46	9.9	21	3	L4
TRS 1 0110	TAWNEY RUN	4/18/2002	1100	000	0.24	L0.01	199.7	52	13	35	2.5	L4
TRS 1 0112	DEER CREEK (UPPER)	4/18/2002	1330	000	0.44	L0.01	147.4	36	9.5	40	2.1	L4
TRS 1 0114	LITTLE DEER CREEK	4/18/2002	1415	000	0.31	L0.01	188.4	45	15	140	3.3	L4
TRS 1 0116	DEER CREEK	4/18/2002	1500	000	0.3	L0.01	163.8	44	12	99	2.7	L4

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Total Barium ug/l 01007	Total Baryllium ug/l 01012	Total Cadmium ug/l 01027	Total Chromium ug/l 01034	Total Copper ug/l 01042	Total Iron ug/l 01045	Total Lead ug/l 01051	Total Manganese ug/l 01055
TRS 1 0096	CHARTIERS RUN	4/17/2002	1410	000	27	L2	L1	L3	L5	220	L3	27
TRS 1 0098	LITTLE BULL RUN	4/24/2002	1000	000	41	L2	L1	L3	L5	120	L3	44
TRS 1 0100	BULL CREEK	4/24/2002	1030	000	43	L2	L1	L3	L5	670	L3	110
TRS 1 0102	BUFFALO CREEK	4/24/2002	1215	000	57	L2	L1	L3	L5	150	L3	46
TRS 1 0104	BAILEY RUN	4/17/2002	1515	000	33	L2	L1	L3	L5	240	L3	38
TRS 1 0106	CRAWFORD RUN	4/18/2002	0905	000	48	L2	L1	L3	L5	90	L3	22
TRS 1 0108	RIDDLE RUN	4/18/2002	1030	000	26	L2	L1	L3	L5	60	L3	5
TRS 1 0110	TAWNEY RUN	4/18/2002	1100	000	35	L2	L1	L3	L5	60	L3	34
TRS 1 0112	DEER CREEK (UPPER)	4/18/2002	1330	000	40	L2	L1	L3	L5	100	L3	23
TRS 1 0114	LITTLE DEER CREEK	4/18/2002	1415	000	33	L2	L1	L3	L5	320	L3	66
TRS 1 0116	DEER CREEK	4/18/2002	1500	000	38	L2	L1	L3	L5	350	L3	71

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Mercury T. ug/l 01067	Total Selenium ug/l 01077	Total Aluminum ug/l 01092	Total Antimony ug/l 01097	Total Zinc ug/l 01105	Total Silver ug/l 01147	Total Nickel ug/l 71900
TRS 1 0096	CHARTIERS RUN	4/17/2002	1410	000	L10	L2	L10	L5	100	L10	L0.2
TRS 1 0098	LITTLE BULL RUN	4/24/2002	1000	000	L10	L2	L10	L5	70	L10	L0.2
TRS 1 0100	BULL CREEK	4/24/2002	1030	000	L10	L2	L10	L5	70	L10	L0.2
TRS 1 0102	BUFFALO CREEK	4/24/2002	1215	000	L10	L2	L10	L5	70	L10	L0.2
TRS 1 0104	BAILEY RUN	4/17/2002	1515	000	L10	L2	L10	L5	170	L10	L0.2
TRS 1 0106	CRAWFORD RUN	4/18/2002	0905	000	L10	L2	L10	L5	120	L10	L0.2
TRS 1 0108	RIDDLE RUN	4/18/2002	1030	000	L10	L2	L10	L5	L50	L10	L0.2
TRS 1 0110	TAWNEY RUN	4/18/2002	1100	000	L10	L2	L10	L5	110	L10	L0.2
TRS 1 0112	DEER CREEK (UPPER)	4/18/2002	1330	000	L10	L2	L10	L5	L50	L10	L0.2
TRS 1 0114	LITTLE DEER CREEK	4/18/2002	1415	000	L10	L2	L10	L5	200	L10	L0.2
TRS 1 0116	DEER CREEK	4/18/2002	1500	000	L10	L2	L10	L5	120	L10	L0.2

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Water Temperature Deg C 00403	Turbidity NTU 00410	Color PT/CO Units 00415	Sp ORP MV 00425	Conductivity Field uhmos/cm 00430	Conductivity @25 C uhmos/cm 00435	Dissolved Oxygen mg/l 00610	Field pH pH Units 00625
TRS 1 0118	GUYS RUN	4/18/2002	1230	000	19.05	1.27	7.5	192	1624	1475	10.25	8.42
TRS 1 0120	POWERS RUN	4/24/2002	1440	000	14.18	1220	1600	168	653	484	12.75	7.82
TRS 1 0122	SQUAW RUN	4/24/2002	1330	000	13.92	1.7	5	160	775	703	14.2	8.62

CODE	DESCRIPTION	DATE	TIME	DEPTH	Laboratory pH pH Units 00403	Total Alkalinity as CaCO3 mg/l 00410	P.Alkalinity CaCO3 mg/l 00415	Bicarb.Alkalinity CaCO3 mg/l 00425	Carb.Alkalinity mg/l 00430	Total Acidity as CaCO3 mg/l 00435	Total NH3-N as N mg/l 00610	Total Kjeldahl Nitrogen mg/l 00625
TRS 1 0118	GUYS RUN	4/18/2002	1230	000	8.52	253.7	18.8	216.2	37.6	0	0.07	0.32
TRS 1 0120	POWERS RUN	4/24/2002	1440	000	7.53	54.5				2.9	0.14	2.86
TRS 1 0122	SQUAW RUN	4/24/2002	1330	000	8.6	88	7.6	72.7	15.3	0	0.02	0.34

3R2N Water Quality Data

CODE	DESCRIPTION	DATE	TIME	DEPTH	Total NO3- Nitrate as N mg/l 00630	Total Phosphorus as P mg/l 00665	Total Hardness as CaCO3 mg/l 00900	Total Calcium mg/l 00916	Total Magnesium mg/l 00927	Total Sodium mg/l 00929	Total Potassium mg/l 00937	Total Arsenic ug/l 01002
TRS 1 0118	GUYS RUN	4/18/2002	1230	000	0.46	L0.01	196.4	44	19	280	4.9	L4
TRS 1 0120	POWERS RUN	4/24/2002	1440	000	0.97	0.7	133.1	42	12	58	7.6	13
TRS 1 0122	SQUAW RUN	4/24/2002	1330	000	0.63	L0.01	203.6	59	13	74	2.7	L4

CODE	DESCRIPTION	DATE	TIME	DEPTH	Total Barium ug/l 01007	Total Baryllium ug/l 01012	Total Cadmium ug/l 01027	Total Chromium ug/l 01034	Total Copper ug/l 01042	Total Iron ug/l 01045	Total Lead ug/l 01051	Total Manganese ug/l 0105
TRS 1 0118	GUYS RUN	4/18/2002	1230	000	22	L2	L1	L3	L5	150	L3	1
TRS 1 0120	POWERS RUN	4/24/2002	1440	000	250	L2	3	29	49	35000	66	130
TRS 1 0122	SQUAW RUN	4/24/2002	1330	000	51	L2	L1	L3	L5	60	L3	1

3R2N Water Quality Data

					Total Nickel ug/l	Total Silver ug/l	Total Zinc ug/l	Total Antimony ug/l	Total Aluminum ug/l	Total Selenium ug/l	Mecury T ug/l
CODE	**DESCRIPTION**	**DATE**	**TIME**	**DEPTH**	01067	01077	01092	01097	01105	01147	71900
TRS 1 0118	GUYS RUN	4/18/2002	1230	000	L10	L2	L10	L5	L50	L10	L0.2
TRS 1 0120	POWERS RUN	4/24/2002	1440	000	40	L2	250	L5	22000	L10	L0.2
TRS 1 0122	SQUAW RUN	4/24/2002	1330	000	L10	L2	L10	L5	60	L10	L0.2

VIII. Appendices

Appendix B. Results of Rapid Invertebrate Biological Assessment Sampling

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Shades Run	Squaw Run	Sandy Creek	Quigley Creek	Indian Creek	Powers Run
Phylum Class Order Suborder Family Genus						
Arthropoda						
Insecta						
Ephemeroptera						
Baetidae						
Baetis sp.						
Heptageniidae						
Stenonema sp.						
Stenonema vicarium						
Epeorus sp.						
Stenacron sp.			**1**			
Ephemerellidae						
Eurylophella sp.						
Ephemerella sp.						
Caenidae						
Caenis sp.						
Plecoptera						
Peltoperlidae						
Peltoperla sp.						
Perlodidae						
Isoperla sp.						**1**
Chloroperlidae						
Alloperla sp.		**1**				
Leuctridae						
Leuctra sp.						
Nemouridae						
Amphinemura sp.	**1**	**1**	**1**			**1**
Trichoptera						
Hydropsychidae						
Cheumatopsych e sp.		**13**				
Diplectrona sp.	**23**		**21**	**7**		**19**
Hydropsyche sp.		**7**	**1**			
Hydropsyche morosa		**4**				
Philopotamidae						
Dolophilodes sp.						
Wormalidia sp.	**4**					
Hydroptilidae						
Hydroptila sp.						
Uenoidae						
Neophylax sp.	**49**					
Rhyacophilidae						
Rhyacophila sp.			**1**			
Polycentropodidae						
Neureclipsis sp.						
Polycentropus sp.	**1**		**2**	**1**		**2**

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Shade Run	Squaw Run	Sandy Creek	Quigley Creek	Indian Creek	Powers Run
Phylumn Class Order Suborder Family Genus						
Megaloptera						
Corydalidae						
Nigronia sp.						
Silidae						
Sialis sp.						**1**
Odonata						
Zygoptera						
Calopterygidae						
Calopteryx sp						
Anisoptera						
Gomphidae						
Ophogomphus sp.						
Lanthus sp.						
Hemiptera						
Gerridae		**P**	**P**			**P**
Veliidae						**P**
Diptera		**2**				
Chironomidae	**14**	**20**	**15**	**45**	**19**	**229**
Simuliidae						
Simulium sp.		**6**				**2**
Empididae						
Hemerodromi a sp.			**1**			
Chelifera sp.			**1**			
Clinocera sp.						
Ceratopogonidae						
Tipulidae			**1**			
Tipula sp.	**1**			**2**	**6**	
Hexatoma sp.						
Antocha sp.		**1**	**1**			**1**
Tabanidae						
Chrysops sp.						
Tabanus sp.						
Psychodidae						
Psychoda sp.						
Pericoma sp.						
Stratiomyidae						
Nematelus sp.						
Coleoptera		1				
Elmidae						
Dubiraphia sp.						
Stenelmis sp.		30				
Optioservus sp.		2				

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Shade Run	Squaw Run	Sandy Creek	Quigley Creek	Indian Crek	Powers Run
Phylumn Class Order Suborder Family Genus						
Coleoptera (cont)						
Psephenidae						
Psephenus sp.		**10**				
Ectopria sp.	**1**		**1**			
Crustacea						
Amphipoda						
Gammaridae						
Gammarus sp.	**1186**	**11**	**12**	**20**	**3**	
Isopoda						
Asellidae						
Caecidotea sp.	**43**		**6**	**7**		
Decapoda						
Cambaridae	**P**					
Orconectes obscurus						**1**
Cambarus Bartoni		**P**				
Mollusca						
Bivalvia						
Sphaeriidae						
Corbiculidae						
Gastropoda						
Physidae			**1**	**1**	**1**	
Lymnaedae						
Ancylidae						
Annelida						
Oligochaeta		**1**	**4**	**2**	**1**	
Tubificidae						
Hirudinea						
Nematoda						
Turbellaria						
Planaria			**1**			
Collembola				**1**		
Acariformes						
Hydrachnidae						
Total Number Taxa	**10**	**15**	**17**	**9**	**5**	**9**
Total Number of Organisms	**1323**	**110**	**71**	**86**	**30**	**257**
Total Number of EPT Taxa*	**5**	**5**	**6**	**2**	**0**	**4**
Total Number of EPT Organism	**78**	**26**	**27**	**8**	**0**	**23**
Percent ETP Organisms	**5.9**	**23.64**	**38.03**	**9.3**	**0.0**	**8.95**
Percent A & C Organisms**	**1.06**	**19.09**	**19**	**47**	**66.67**	**89.11**

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Plum Creek	Guys Run	Falling Springs Run	Deer Creek (Lower)	Little Deer Creek	Blacks Run
Phylum Class Order Suborder Family Genus						
Arthropoda						
Insecta						
Ephemeroptera						
Baetidae						
Baetis sp.		**1**				
Heptageniidae						
Stenonema sp.						
Stenonema vicarium						
Epeorus sp.		**6**				**10**
Stenacron sp.						
Ephemerellidae						
Eurylophella sp.						
Ephemerella sp.						
Caenidae						
Caenis sp.	**1**			**2**		
Siphlonuridae						
Ameletus sp.						**17**
Plecoptera						
Peltoperlidae						
Peltoperla sp.		**1**				
Perlodidae						
Isoperla sp.		**4**				
Chloroperlidae						**2**
Alloperla sp.		**19**				
Leuctridae						
Leuctra sp.		**86**				
Nemouridae						
Amphinemura sp.	**8**	**409**			**33**	**70**
Trichoptera						
Hydropsychidae						
Cheumatopsych e sp.	**126**	**2**		**11**	**7**	
Diplectrona sp.	**3**	**16**		**1**	**1**	**7**
Hydropsyche sp.	**3**	**6**		**2**	**8**	
Hydropsyche morosa	**67**			**20**	**7**	
Philopotamidae						
Dolophilodes sp.						
Wormalidia sp.						
Hydroptilidae						
Hydroptila sp.						
Uenoidae						
Neophylax sp.						**4**
Rhyacophilidae						
Rhyacophila sp.						
Polycentropodidae						
Neureclipsis sp.						
Polycentropus sp.		**3**				

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Plum Creek	Guys Run	Falling Springs Run	Deer Creek (Lower)	Little Deer Creek	Blacks Run
Phylum Class Order Suborder Family Genus						
Trichoptera (cont)						
Lepidostomatidae						
Lepidostoma sp.						**2**
Megaloptera						
Corydalidae						
Nigronia sp.		**5**		**1**	**2**	**1**
Silidae						
Sialis sp.		**1**				
Odonata						
Zygoptera						
Calopterygidae						
Calopteryx sp						
Anisoptera						
Gomphidae						
Ophogomphus sp.						
Lanthus sp.						
Hemiptera						
Gerridae					**P**	
Veliidae						
Diptera		**2**			**1**	**2 -2 species**
Chironomidae	**457**	**113**	**35**	**20**	**122**	**8**
Simuliidae						
Simulium sp.		**5**			**2**	**25**
Empididae						
Hemerodromi a sp.	17			**2**		
Chelifera sp.	4					
Clinocera sp.		**2**				
Ceratopogonidae		**1**				
Tipulidae	**1**	**2**		**1**		6
Tipula sp.	**3**	**1**	**2**			**1**
Tipula sp. 2						**2**
Hexatoma sp.		**1**				
Antocha sp.	**5**	**1**		**2**	**2**	
Tabanidae						
Chrysops sp.						
Tabanus sp.						**2**
Psychodidae						
Psychoda sp.						
Pericoma sp.						**1**
Stratiomyidae						
Nematelus sp.						
Coleoptera						**1**
Elmidae						
Dubiraphia sp.						
Stenelmis sp.	**7**	**1**		**13**		
Optioservus sp.						

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Plum Creek	Guys Run	Falling Springs Run	Deer Creek (Lower)	Little Deer Creek	Blacks Run
Phylum Class Order Suborder Family GenUs						
Coleoptera (cont)						
Psephenidae						
Psephenus sp.	**9**			**1**		
Ectopria sp.	**1**					
Crustacea						
Amphipoda						
Gammaridae						
Gammarus sp.	**15**			**21**		
Isopoda						
Asellidae						
Caecidotea sp.	**11**	**2**		**1**		
Decapoda						
Cambaridae						
Orconectes obscurus						
Cambarus Bartoni						
Mollusca						
Bivalvia						
Sphaeriidae						
Corbiculidae						
Gastropoda						
Physidae						
Lymnaedae						
Ancylidae						
Annelida						
Oligochaeta	**5**	**6**	**157**	**1**		**2**
Tubificidae						
Hirudinea						
Nematoda	**1**					
Turbellaria	**1**					
Planaria			**1**			
Collembola		**1**	**5**			**1**
Acariformes						
Hydrachnidae	**1**					
Total Number Taxa	**21**	**26**	**5**	**15**	**10**	**20**
Total Number of Organisms	**746**	**697**	**200**	**99**	**185**	**164**
Total Number of EPT Taxa*	**6**	**11**	**0**	**5**	**5**	**7**
Total Number of EPT Organism	**208**	**553**	**0**	**36**	**56**	**112**
Percent EPT Organisms	**27.88**	**79.34**	**0.0**	**36.36**	**30.27**	**68.29**
Percent A & C Organisms**	**61.93**	**17.07**	**96.0**	**21.21**	**65.95**	**6.1**

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Tawney Run	Riddle Run	Pucketa Creek	Little Pucketa Creek	Crawford Run	Bailey Run
Phylum Class Order Suborder Family Genus						
Arthropoda						
Insecta						
Ephemeroptera						
Baetidae						
Baetis sp.	4		2			
Heptageniidae						
Stenonema sp.						
Stenonema vicarium			3			1
Epeorus sp.	7	3			1	
Stenacron sp.			4	1		
Ephemerellidae						
Eurylophella sp.	4		1	1		3
Ephemerella sp.	8					2
Caenidae						
Caenis sp.			2	11		
Siphlonuridae						
Ameletus sp.		1				
Oligoneuriidae						
Isonychia sp.			3			
Plecoptera						
Peltoperlidae						
Peltoperla sp.						
Perlodidae						
Isoperla sp.	2	11	1			1
Chloroperlidae						
Alloperla sp.					3	1
Leuctridae						
Leuctra sp.	11	2				
Nemouridae						
Amphinemura sp.	169	1056	9	12	8	9
Trichoptera						
Hydropsychidae						
Cheumatopsych e sp.	50	28	43	8	7	16
Diplectrona sp.	55	13	2		14	2
Hydropsyche sp.	40	4	3		6	11
Hydropsyche morosa	1		11			3
Philopotamidae						
Dolophilodes sp.						
Wormalidia sp.		1				
Lepoceridae						
Ceraclea sp.						
Hydroptilidae						
Hydroptila sp.						1
Uenoidae						
Neophylax sp.	5	119				1
Rhyacophilidae						
Rhyacophila sp.	2	7			4	
Polycentropodidae						
Neureclipsis sp.						1
Polycentropus sp.	2					1

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Tawney Run	Riddle Run	Pucketa Creek	Little Pucketa Creek	Crawford Run	Bailey Run
Phylum Class Order Suborder Family Genus						
Trichoptera (cont)						
Lepidostomatidae						
Lepidostoma sp.						
Philopotamidae						
Chimarra sp.	**4**					
Megaloptera						
Corydalidae						
Nigronia sp.	**2**					**2**
Silidae						
Sialis sp.	**2**					
Odonata						
Zygoptera						
Calopterygidae						
Calopteryx sp					**1**	**1**
Anisoptera						
Gomphidae						
Ophogomphus sp.						
Lanthus sp.						**1**
Hemiptera						
Gerridae						**P**
Veliidae						
Diptera	**2**					
Chironomidae	**130**	**43**	**59**	**138**	**154**	64
Chironominae						
Simuliidae						
Simulium sp.	**2**	**28**	**4**	**4**	**3**	**75**
Empididae						
Hemerodromia sp.	**2**	**19**		**2**		**2**
Chelifera sp.	**2**					
Clinocera sp.	**3**					
Ceratopogonidae						
Tipulidae			**1**			
Tipula sp.			**2**			
Hexatoma sp.						
Antocha sp.						
Tabanidae						
Chrysops sp.						
Tabanus sp.	**1**					
Psychodidae						
Psychoda sp.						
Pericoma sp.						
Stratiomyidae						
Nematelus sp.		**1**			**1**	
Coleoptera		**1**			**1**	
Elmidae	**1**					
Dubiraphia sp.	**2**					
Stenelmis sp.	**13**		**2**	**125**		**1**
Optioservus sp.	**12**	**6**	**1**	**2**		

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

Phylum Class Order Suborder Family Genus	Tawney Run	Riddle Run	Pucketa Creek	Little Pucketa Creek	Crawford Run	Bailey Run
Coleoptera (cont)						
Psephenidae						
Psephenus sp.	**28**	**19**	**12**	**6**	**1**	**7**
Ectopria sp.		**7**				
Crustacea						
Amphipoda						
Gammaridae						
Gammarus sp.			**1**	**2**		
Isopoda						
Asellidae						
Caecidotea sp.	**1**			**11**	**2**	
Decapoda						
Cambaridae						
Orconectes obscurus						
Cambarus Bartoni		**P**		**1**	**1**	
Mollusca						
Bivalvia						
Sphaeriidae						
Corbiculidae						
Gastropoda						
Physidae	4				**1**	
Lymnaedae		**1**				
Ancylidae						
Annelida						
Oligochaeta	**4**	**1**	**3**	**7**	**7**	
Tubificidae						
Hirudinea						
Nematoda						
Turbellaria						
Planaria						
Collembola	**2**					
Acariformes						
Hydrachnidae						
Total Number Taxa	**33**	**21**	**21**	**15**	**17**	**22**
Total Number of Organisms	**577**	**1371**	**170**	**331**	**216**	**206**
Total Number of EPT Taxa*	**15**	**11**	**12**	**5**	**7**	**14**
Total Number of EPT Organism	**364**	**1245**	**85**	**33**	**43**	**53**
Percent EPT Organisms	**63.08**	**90.81**	**50.0**	**9.97**	**19.91**	**25.73**
Percent A & C Organisms**	**23.22**	**3.21**	**36.47**	**43.81**	**75.0**	**31.07**

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Bull Creek	Little Bull Creek	Chartiers Run	Buffalo Creek		
Phylum Class Order Suborder Family Genus						
Arthropoda						
Insecta						
Ephemeroptera						
Baetidae						
Baetis sp.				**1**		
Heptageniidae						
Stenonema sp.				**32**		
Stenonema vicarium						
Epeorus sp.	**1**					
Stenacron sp.		**1**	**1**	**18**		
Ephemerellidae						
Eurylophella sp.			**1**			
Ephemerella sp.				**1**		
Caenidae						
Caenis sp.	**5**	**9**	**3**	**100**		
Siphlonuridae						
Ameletus sp.						
Oligoneuriidae						
Isonychia sp.	**1**	**4**				
Plecoptera						
Peltoperlidae						
Peltoperla sp.						
Perlodidae						
Isoperla sp.				**1**		
Chloroperlidae		**1**				
Alloperla sp.						
Leuctridae						
Leuctra sp.		**1**				
Nemouridae						
Amphinemura sp.	**4**	**2**	**1**	**51**		
Trichoptera						
Hydropsychidae						
Cheumatopsyche sp.	**45**	**47**	**45**	**84**		
Diplectrona sp.			4			
Hydropsyche sp.	**14**	**8**		**19**		
Hydropsyche morosa	**6**	**12**		**40**		
Philopotamidae						
Dolophilodes sp.						
Wormalidia sp.						
Hydroptilidae						
Hydroptila sp.		**1**		**1**		
Uenoidae						
Neophylax sp.				**1**		
Rhyacophilidae						
Rhyacophila sp.		**1**		**10**		
Polycentropodidae						
Neureclipsis sp.						
Polycentropus sp.						

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Bull Creek	Little Bull Creek	Chartiers Run	Buffalo Creek		
Phylum Class Order Suborder Family Genus						
Trichoptera (cont)						
Lepidostomatidae						
Lepidostoma sp.						
Philopotamidae						
Chimarra sp.	**28**	**3**		**3**		
Megaloptera						
Corydalidae						
Nigronia sp.	**1**	**2**				
Silidae						
Sialis sp.						
Odonata						
Zygoptera						
Calopterygidae						
Calopteryx sp						
Coenagrionidae						
Argia sp.				**5**		
Anisoptera						
Gomphidae						
Ophogomphus sp.			**1**			
Lanthus sp.						
Hemiptera						
Gerridae						
Veliidae						
Diptera	**1**	**3**	**2- 2 species**	**2**		
Chironomidae	**49**	**97**	**67**	**144**		
Chironominae						
Simuliidae						
Simulium sp.		**3**		**26**		
Empididae						
Hemerodromi a sp.	**1**	**5**		**2**		
Chelifera sp.						
Clinocera sp.						
Ceratopogonidae						
Tipulidae			**1**			
Tipula sp.	**1**			**4**		
Hexatoma sp.						
Antocha sp.		**2**		**1**		
Tabanidae						
Chrysops sp.						
Tabanus sp.			**1**			
Psychodidae						
Psychoda sp.						
Pericoma sp.				**1**		
Stratiomyidae						
Nematelus sp.						
Coleoptera						
Elmidae						
Dubiraphia sp.			**1**	**1**		
Stenelmis sp.	**18**	**19**	**21**	**77**		
Optioservus sp.	**1**	**6**		**6**		

Results of April 2002 Rapid Invertebrate (Ten Minute Sampling Station) Biological Assessments

	Bull Creek	Little Bull Creek	Chartiers Run	Buffalo Creek		
Phylum Class Order Suborder Family Genus						
Coleoptera (cont)						
Psephenidae						
Psephenus sp.	**18**	**11**	**18**	**99**		
Ectopria sp.		**1**				
Crustacea						
Amphipoda						
Gammaridae						
Gammarus sp.	**1**	**3**	**1**	**14**		
Isopoda						
Asellidae						
Caecidotea sp.			**1**	**4**		
Decapoda						
Cambaridae						
Orconectes obscurus	**1**			**1**		
Cambarus Bartoni						
Mollusca						
Bivalvia						
Sphaeriidae						
Corbiculidae				**P**		
Gastropoda						
Physidae			**1**	**2**		
Lymnaedae			**1**			
Ancylidae			**1**	**1**		
Annelida						
Oligochaeta			**9**	**1**		
Tubificidae						
Hirudinea						
Nematoda						
Turbellaria						
Planaria	**1**					
Collembola						
Acariformes						
Hydrachnidae						
Total Number Taxa	**19**	**23**	**21**	**32**		
Total Number of Organisms	**197**	**243**	**181**	**753**		
Total Number of EPT Taxa*	**8**	**12**	**6**	**14**		
Organisms	**104**	**91**	**55**	**362**		
Percent EPT Organisms	**52.79**	**37.45**	**30.39**	**48.07**		
Percent A & C Organisms**	**24.87**	**39.92**	**41.99**	**19.26**		

* EPT = Ephemeroptera, Plecoptera, and Trichoptera (mayflies, stoneflies, and caddisflies)
** AC = Annelida and Chironomidae (segmented worms and midges)
P = Present

VII. Appendices

Appendix C. Biological Sampling Incidental Field Observations

3 Rivers 2nd Nature Biological Field Observations, Phase 2- April 2002

1. Shade Run	16 April 02, 0930 hours Spring wildflowers, lots of bloodroot and some white trillium.
2. Squaw Run	24 April 02, 1330 hours One darter and one blacknose dace were collected in nets. A significant caddisfly emergence was in progress.
3. Sandy Creek	16 April 02 1100 hours One Creek chub and one adult northern dusky salamander were collected in nets.
4. Quigley Creek	16 April 02, 1135 hours
5. Indian Creek	16 April 02, 1320 hours
6. Plum Creek	16 April 02, 1410 hours Four darters were collected in the nets and numerous other small fish were observed.
7. Powers Run	24 April 02, 1440 hours The stream was extremely muddy at the time of sampling. Since there had not been any recent rain, and other local streams were not highly turbid on this date, some significant upstream disturbance was obvious. Fire trucks were observed coming down Powers Run Road and it is likely that the extreme turbidity was related to fire fighting activities in the headwaters of the stream. For the first time in 2002 field season, small water striders, along with the larger variety were observed in Powers Run.
8. Guys Run	18-April 02, 1230 hours Some moderate iron staining of rocks in the stream were apparent.
9. Falling Springs Run	17 April 02, 0900 hours.
10. Deer Creek	16 April 02, 1500 hours One bluntnose minnow and numerous shiners were collected in the net.
11. Upper Deer Creek	18 April 02, 1330 hours Numerous small and a few intermediate size fish were observed. Sampled on the Thursday after the opening day of trout season. Some trout fisherman were on the stream, as well as a woman taking her Labrador Retriever for a swim- not a good mix of usages.

12. Little Deer Creek	18 April 02, 1415 hours Small fish observed. The rocks in the riffle appear to be moderately stained by iron.
13. Blacks Run	17 April 02, 1000 hours Spectacular spring wildflower display, spring beauties, bloodroot, trout-lilies, trillium, Dutchmans-breeches, and Solomons-seal were all abundant at this location, especially on the slopes facing the Allegheny River. A Louisiana waterthrush was also heard on Blacks Run, and there was a mayfly emergence in progress. We moved this station about 100 yards upstream of the road grade because of apparent backwater influences from the Allegheny River. The upper 54 foot- long section of the sample where the slope of the stream was higher was much more productive than the lower portion.
14. Tawney Run	18 April 02, 1100 hours Small fish were observed in the stream. Reliant Energy personnel who walked down to talk to us, informed us that they formerly discharged to Tawney Run, and since that discharge was terminated, they thought the stream was looking better. The name of this stream on the 1920 bridge crossing is Shoops Run.
15. Riddle Run	18 April 02, 1030 hours Lots of nice stoneflies including some large ones.
16. Pucketta Creek	17 April 02, 1200 hours Moderate iron staining on rocks in the stream. We captured three darters in the nets, and observed schools of shiners, large carp, and some suckers.
17. Little Pucketa Creek	17 April 02, 1300 hours Sewage odors and thick algal growth on the substrate.
18. Crawford Run	18 April 02, 0905 hours This station is shiner soup. We captured 62 Notropis sp. in the nets, as well as three blacknose dace, two creek chub, and one fantail darter.
19. Bailey Run	17 April 02, 1515 hours Shiners and other fish were observed in the stream, as well as one queen snake.
20. Bull Creek	24 April 02, 1030 hours Numerous small fish and a few larger ones observed. The larger

fish might have been stocked trout, and one trout fisherman was angling at the station.

21. Little Bull Creek

24 April 02, 1000 hours
Two creek chubs, two greenside darters and one stoneroller were captured in the nets.

22. Chartiers Run

17 April 02, 1410 hours
There were numerous shiners and large carp in this stream.

23. Buffalo Creek

24 April 02, 1215 hours
This station is located at a broad shoal with emergent aquatic plants, mostly Justicia americana. We collected part of the sample from the Justicia because some researchers have observed the association of mayflies with the upright stems of the plant. The stream was a little high, swift, and difficult to sample even in the shoal. Asian clam shells littered the substrate. There were numerous fish and lots of ducks and geese at this location.

VIII. Appendices

Appendix D. Photographs of Bioassessment Stations Sampled

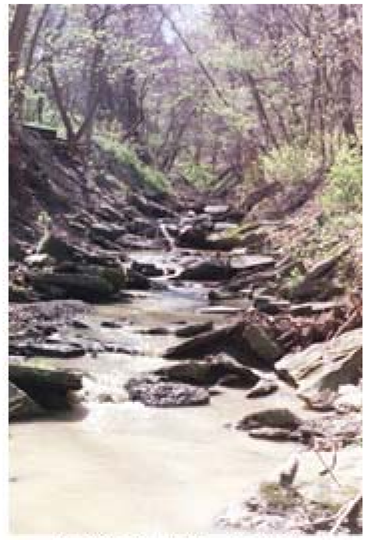
Shade Run

Squaw Run

Sandy Creek

Quigley Creek

Indian Creek



Power Run

Plum Creek

Guys Run

Falling Springs Run

Deer Creek (below Little Deer)

Deer Creek (above Little Deer)

Little Deer Creek

Blacks Run

Tawney Run

Riddle Run

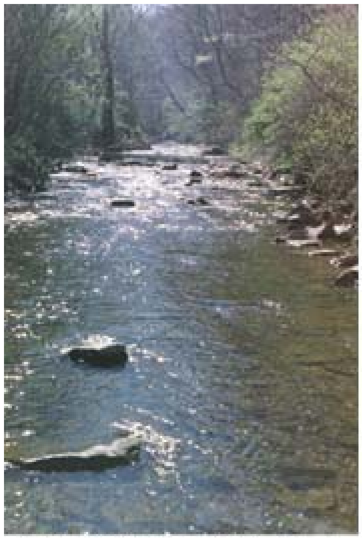
Pucketa Creek

Little Pucketa Creek

Crawford Run

Bailey Run

Bull Creek


Little Bull Creek


Chartiers Run


Buffalo Creek