WEST VIRGINIA
Division of Environmental Protection

An Ecological Assessment of the

Lower Kanawha River Watershed

OFFICE OF WATER RESOURCES
MISSION STATEMENT

To enhance and preserve the physical, chemical and biological integrity of surface and ground waters, considering nature and health, safety, recreational and economic needs of humanity.

WV OWR

VISION STATEMENT

The Office of Water Resources provides leadership on all water issues through effective programs that improve water quality and public safety statewide.

An Ecological Assessment of the Lower Kanawha River Watershed 1997

Report Number – 05050008-1997

prepared by:

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SUMMARY

The Lower Kanawha River watershed is one of 32 watersheds in West Virginia. The Kanawha River was divided into upper and lower sections, as were several other large river basins. The lower section includes the mainstem Kanawha River downstream from the Elk River and all tributaries of this section excluding the Coal River (addressed in a separate report). Major tributaries of the Lower Kanawha River included in this report are Thirteenmile Creek, Eighteenmile Creek, Hurricane Creek, Pocatalico River, Davis Creek and Twomile Creek.

Assessment teams visited 120 sites in the Lower Kanawha River Watershed during May and June of 1997. Of the 452 named streams in this watershed, 91 were sampled. In addition, 8 unnamed streams were visited. No mainstem Kanawha River sites were visited during this study. It is sampled quarterly under a separate monitoring program.

Assessments included measurements of physical attributes of the streams and riparian zones, observations of activities and disturbances in the surrounding area, water quality data, and benthic macroinvertebrate collections. Historically this area has been impaired by agricultural, industrial, and timbering related activities. Mining has occurred on many tributaries of the Lower Kanawha River.

This watershed is primarily within the Permian Hills and Monongahela Transition Zone sub-ecoregions of the Western Allegheny Plateau ecoregion. The headwaters of Davis Creek are in the Cumberland Mountains of the Central Appalachian ecoregion

AN ECOLOGICAL ASSESSMENT OF THE LOWER KANAWHA RIVER WATERSHED

Sedimentation caused by runoff from crowded pastures, bare fields, construction, logging and innumerable dirt roads probably degrade streams more than any other factor. Other factors causing problems are gray water discharges and failing septic systems from residential areas, some industrial and wastewater treatment plant discharges, polluted water draining from landfills, and coal mining. At least 67 National Pollutant Discharge Elimination System (NPDES) permits were in effect in this watershed. Most of these permits were issued to facilities involved in the petro-chemical industry or municipal sewage treatment plants.

The majority of named streams (361 out of 452 or 80 %) in the watershed were not sampled during this study. Approximately 32 % (35 of 109) of the sampled streams with riffle/run habitat had impaired benthic communities. Fifty-eight sites out of 120 had fecal coliform bacteria concentrations greater than the criterion (400 colonies/100ml) established by the Environmental Quality Board.

The Watershed Assessment Program (WAP) has the following recommendations for the Lower Kanawha River watershed and other watersheds in West Virginia:

- Continue the programs to educate farmers on the benefits of reducing cattle access to streams.
- Develop a program to restore instream habitat destroyed by construction of interstates and other highways.
- Re-sample Saltlick Creek (WVK-16-J-3) at a site with more productive habitat to determine if there are additional problems on this stream.
- Sample the unnamed tributary of Harmond Creek to determine if it is the

source of the AMD impacting Harmond Creek.

- Conduct additional sampling on Cabbage Fork to document the recovery from impacts of an oil tank spill.
- Sample above and below the developments on Trace Fork (WVK-41) to determine the extent of the impact these developments have on the stream.
- Sample at several additional sites to accurately determine the source and nature of the stressors to those sites.
- Develop a program to address the failing septic systems and other discharges of sewage into the watershed's streams.

ACKNOWLEDGMENTS

Funding for this watershed assessment was provided by the US Environmental Protection Agency's (EPA) 319 and 104(b)(3) programs and by the West Virginia Division of Environmental Protection.

Janice Smithson, Jeffrey Bailey, Alvan Gale, Christine Moore, Perry Casto, Charles Surbaugh, Michael Puckett, John Wirts, and Douglas Wood collected the samples and assessed the sites. Marshall University students under the supervision of Dr. Donald Tarter and Jeffrey Bailey, processed the benthic macroinvertebrate samples. Janice Smithson, Jeffrey Bailey, and John Wirts identified the macroinvertebrates. Charles Surbaugh and Michael Puckett entered the raw data into the database. John Wirts summarized the data, created the tables and figures, and prepared the initial draft of this report. Patrick Campbell, Michael Arcuri, Janice Smithson, and Steve Stutler provided help in reviewing the various drafts of this report and bringing it to completion. James Hudson edited this report and applied finishing touches to the layout and design.

WHY DO WE ASSESS WATERSHEDS? – A HISTORICAL PERSPECTIVE

In 1959, the West Virginia Legislature created the State Water Commission, predecessor of the Office of Water Resources (OWR). The OWR has since been charged with balancing the human needs of economic development and water consumption with the restoration and maintenance of water quality in the state.

At the federal level, the U.S. Congress enacted the Clean Water Act of 1972 (the Act) plus its subsequent amendments to restore the quality of our nation's waters. For the past 25 years, the Act's National Pollutant Discharge Elimination System (NPDES) has resulted in reductions of pollutants piped to surface waters. There is broad consensus that because NPDES permits have reduced the amount of contaminants in point sources, the water quality of our nation's streams has improved significantly.

Under the federal law, each state was given the option of managing NPDES permits within its borders or leaving the federal government in that role. West Virginia assumed primacy over NPDES permits in 1982. At that time the state's Water Resources Board (presently the Environmental Quality Board [EQB]) began developing water quality criteria (see box on following page) for each type of use designated for the state's waters. In addition, the West Virginia Division of Environmental Protection's (DEP) water protection activities are guided by the EQB's anti-degradation policy, which charges the OWR with maintaining surface waters at sufficient quality to support existing uses, whether or not the uses are specifically designated by the EQB.

Even with significant progress, by the early 1990s many streams still did not support their designated uses. Consequently, environmental managers began examining pollutants flushing off the landscape from a broad array of hard to control sources. Recognizing the negative impacts of these nonpoint sources (NPS) of pollution, which do not originate at clearly identifiable pipes or other outlets, was a conceptual step that served as a catalyst for today's holistic watershed approach to improving water quality.

WATER QUALITY CRITERIA - The levels of water quality parameters or stream conditions that are required to be maintained by the Code of State Regulations, Title 46, Series 1 (Requirements Governing Water Quality Standards).

DESIGNATED USES - For each water body, those uses specified in the Water Quality Standards, whether or not those uses are being attained. Unless otherwise designated by the rules, all waters of the State are designated for:

- **the propagation and maintenance of fish and other aquatic life, and**
- **water contact recreation.**

Other types of designated uses include:

- **public water supply,**
- **agriculture and wildlife uses, and**
- **industrial uses.**

Several DEP units, including the Watershed Assessment Program (the Program) are currently implementing a variety of watershed projects. Located within the OWR, the Program's scientists are charged with evaluating the condition of streams in West Virginia. The Program is guided, in part, by the Interagency Watershed Management Steering Committee (see box on next page).

The Program uses the U.S. Geological Survey's (USGS) scheme of hydrologic units to divide the state into 32 watersheds (Figure 2). Some of these watershed units are entire stream basins bounded by natural hydrologic divides (e.g., Gauley River watershed). Three other types of watershed units were devised for manageability: (1) clusters of small tributaries that drain directly into a larger mainstem stream (e.g., Potomac River direct drains watershed); (2) the West

Virginia parts of interstate basins (e.g., Tug Fork watershed); and (3) portions of basins which are too large to manage as a whole (e.g., Lower Kanawha River Watershed). A goal of the Program is to assess each watershed unit every 5 years, an interval coinciding with the reissuance of National Pollutant Discharge Elimination System (NPDES) permits.

<u>THE INTERAGENCY WATERSHED MANAGEMENT STEERING COMMITTEE</u> consists of representatives from each agency that participates in the Watershed Management Framework. Its function is to coordinate the operations of the existing water quality programs and activities within West Virginia to better achieve shared water resource management goals and objectives.

The Watershed Basin Coordinator serves as the day to day contact for the committee. The responsibilities of this position are to organize and facilitate the Steering Committee meetings, maintain the watershed management schedule, assist with public outreach, and to be the primary contact for watershed management related issues.

GENERAL WATERSHED ASSESSMENT STRATEGY

A watershed can be envisioned as an aquatic "tree", a system of upwardly branching, successively smaller streams. An ideal assessment would document changes in the quantity and quality of water flowing down every stream, at all water levels, in all seasons, from headwater reaches to the end of the watershed. Land uses throughout the watershed would also be quantified. Obviously this approach would require more time and resources than are available to any agency. The Program, therefore, assesses the health of a watershed by evaluating the health of as many of its streams as time, budget, and personnel allow.

The Program has determined that approximately 600 sites will be evaluated each year. The number of streams sampled per basin is dependent upon the size of the basin; larger watersheds will be subjected to a greater percentage of assessments.

Assessments are made on all streams identified as "severely impaired" in the US EPA's Water Body System database and on all 303(d) streams. Other sites sampled were identified by the public at town meetings and by Environmental Enforcement inspectors. Consideration was also given to sites having the potential for serving as reference sites. The remainder of the site allotment included less impaired and/or unassessed streams. The locations of these final sites were selected so that a balanced spatial coverage of the watershed was achieved.

A new element for sample site selection was introduced in 1997. EPA statisticians using protocols established for EPA's Regional Environmental Monitoring and Assessment Program (REMAP) randomly select approximately thirty-five sites within each watershed. These sites are included within the 600-sites/year total, but are analyzed separately from the remaining stations. The remainder of the sites will be selected in the manner described in the preceding paragraph. The random sites will provide sufficient information to obtain a general characterization of the watershed and will be useful for 305(b) reporting. A separate report detailing the results of the random sampling will be issued annually.

With the exception of the randomized sites, most of the streams are assessed at the mouth or at the highway access point closest to the mouth. Larger streams, particularly the watershed mainstem, are evaluated at multiple locations. If inaccessible or unsuitable sites are dropped from the list, they are replaced with previously determined alternate sites.

The Program has scheduled the study of each watershed for a specific year of a 5-year cycle. Advantages of this preset timetable include: a) synchronizing study dates with permit cycles, b) facilitating the addition of stakeholders to the information gathering process, c) ensuring assessment of all watersheds, d) improving the OWR's ability to plan and e) buffering the assessment process against domination by special interests.

FIGURE 1: GENERALIZED WATERSHED

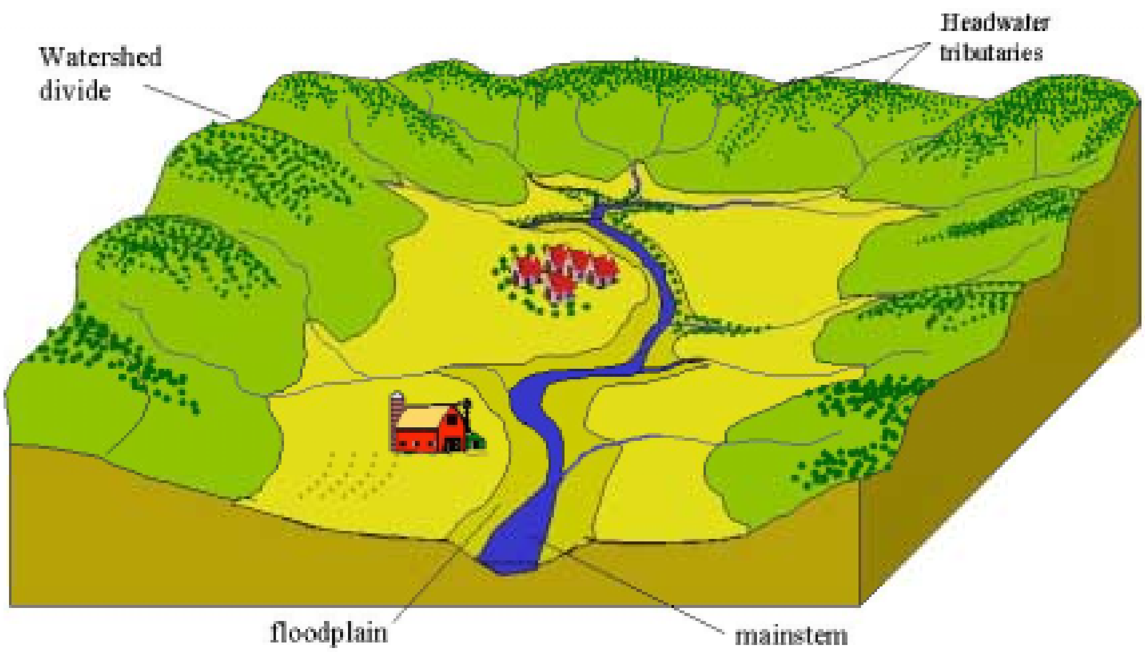
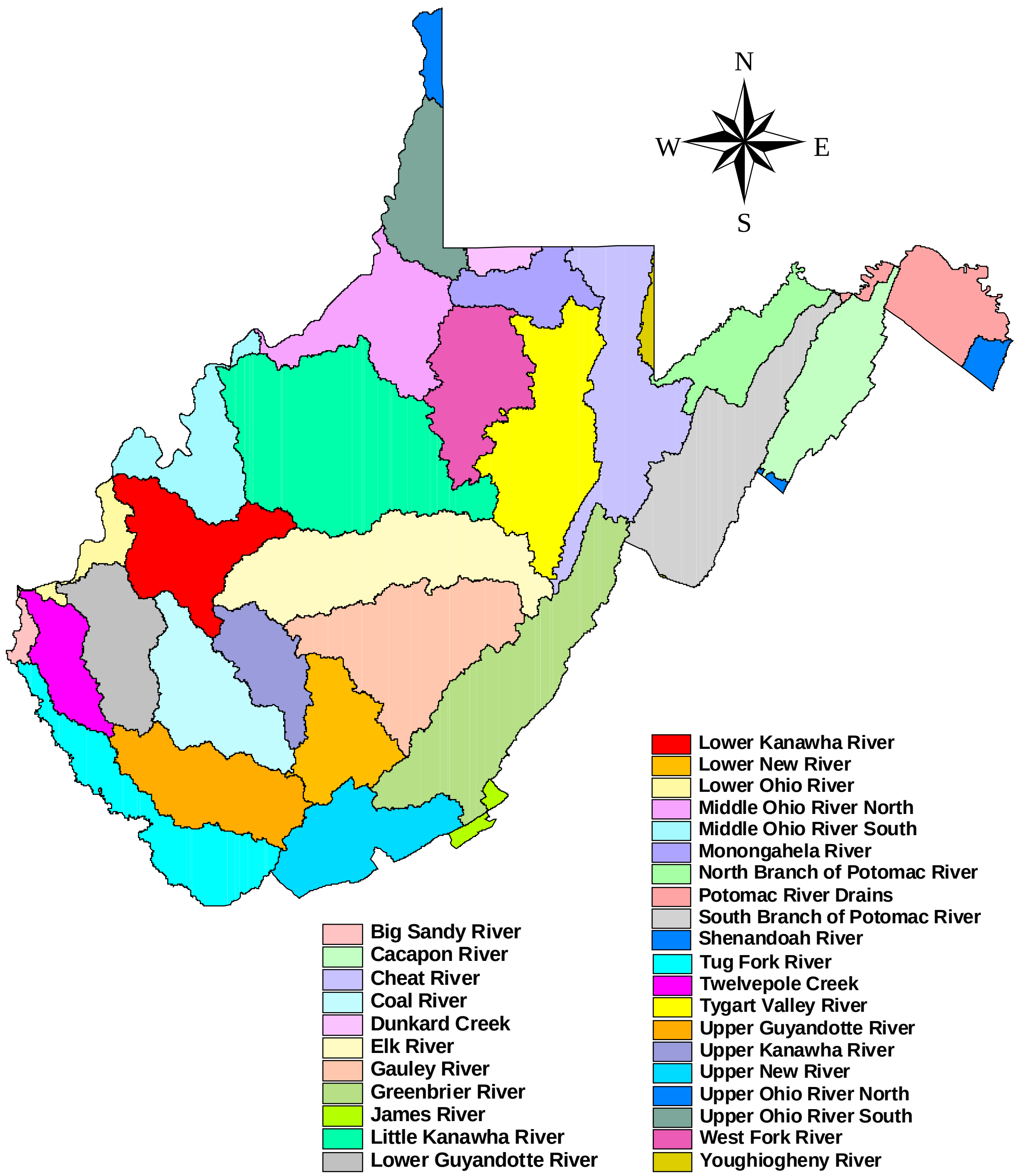


FIGURE 2: WEST VIRGINIA WATERSHEDS

AN ECOLOGICAL ASSESSMENT OF THE LOWER KANAWHA RIVER WATERSHED



In broad terms, OWR conducts assessments on the streams and the Interagency Watershed Management Steering Committee sets priorities for more detailed study or restoration in each watershed in 5 phases:

Phase 1 - For an initial cursory view assessment teams measure or estimate about 50 indicator parameters in as many of each watershed's streams as possible.

Phase 2 - Combining pre-existing information, new Phase 1 data, and stakeholders' reports the Program produces a list of streams of concern.

Phase 3 - From the list of streams of concern, the Interagency Watershed Management Steering Committee develops a smaller list of priority streams for more detailed study.

Phase 4 - Depending on the situation, Program teams or other agencies (e.g., USGS or consultants) intensively study the priority streams.

Phase 5 - The Office of Water Resources issues recommendations for improvement; assists EPA in development of total maximum daily loads (see box on following page), if applicable; and, makes data available to any interested party such as local watershed associations, educators, consultants, and citizen monitoring teams.

This document, which reports Phase 1 findings, has been prepared for a variety of users, including elected officials, environmental consultants, educators and natural resources managers, local watershed associations, and any other interested stakeholder.

<u>TOTAL MAXIMUM DAILY LOAD AND THE 303(d) LIST</u> - The term "total maximum daily load" (TMDL) originates in the federal Clean Water Act, which requires that degraded streams be restored to their designated uses.

Every two years, a list of water quality limited streams (called the 303(d) list after the Clean Water Act section number wherein the list is described) is prepared. Prior to adding a stream to the list, technology-based pollution controls must have been implemented or the conclusion must have been reached that even after implementing such controls the stream would not support its designated uses. West Virginia's 303(d) lists include streams affected by a number of stressors including mine drainage, acid deposition (rain), metals and siltation.

Mathematically, a TMDL is the sum of the allocations of a particular pollutant (from point and nonpoint sources) into a particular stream, plus a margin of safety. Restoration of a 303(d) stream begins by calculating a TMDL, which involves several steps:

- **Define when a water quality problem is occurring, the critical condition, (e.g., at base flow, during the hottest part of the day or throughout the winter ski season),**
- **Calculate how much of a particular contaminant must be reduced in a stream in order to meet the appropriate water quality criterion,**
- **Calculate the total maximum daily load from flow values during the problem period and the concentration allowed by the criterion,**
- **Divide the total load allocation between point and nonpoint sources (e.g., 70% point and 30% nonpoint) and**
- **Recommend pollution reduction controls to meet designated uses (e.g., install best management practices, reduce permit limits or prohibit discharges during problem periods). A TMDL cannot be approved, unless the proposed controls are reasonable and implementable.**

The Program was designed in part to determine whether a stream belongs on the 303(d) list. In some cases this determination can be made readily. For example, a stream degraded by acid mine drainage (AMD). However, the determination is more difficult to make for most streams because of a lack of data or data that are conflicting, of questionable quality or too old. Any stream which would not support its designated uses, even after technology based controls were applied, would be considered for listing.

The Program's Phase 1 screening process provides information for making decisions on listing. A broader interagency process, the West Virginia Watershed Management approach, enables diverse stakeholders to collectively decide which streams should be studied more intensively.

THE LOWER KANAWHA RIVER WATERSHED

The Lower Kanawha River watershed is one of 32 watersheds in West Virginia as defined by the U.S. Geological Survey. The Kanawha River was divided into upper and lower sections, as were several other large river basins. The lower section, HUC # 05050008 (see sidebar), includes the mainstem Kanawha River downstream from the Elk River and all tributaries of this section excluding the Coal River which is addressed in a separate report. Major tributaries included in this section are Thirteenmile Creek, Eighteenmile Creek, Hurricane Creek, Pocatalico River, Davis Creek, and Twomile Creek. The streams of the Kanawha River included in this study are listed in Table 3 in Appendix A.

HYDROLOGIC UNIT CODES (HUC)

The U.S. Geological Survey has developed a Hydrologic Unit Code (HUC) used to identify watersheds throughout the United States. These numbers have replaced the older "map code" system of identifying watersheds.

HUC numbers consist of eight digits. The first two indicate the region the watershed is located in. West Virginia watersheds are located in one of two regions: 02 (Mid-Atlantic) is used to designate those watersheds which drain to the Atlantic Ocean. 05 is used to designate those streams which flow to the Gulf of Mexico via the Ohio River.

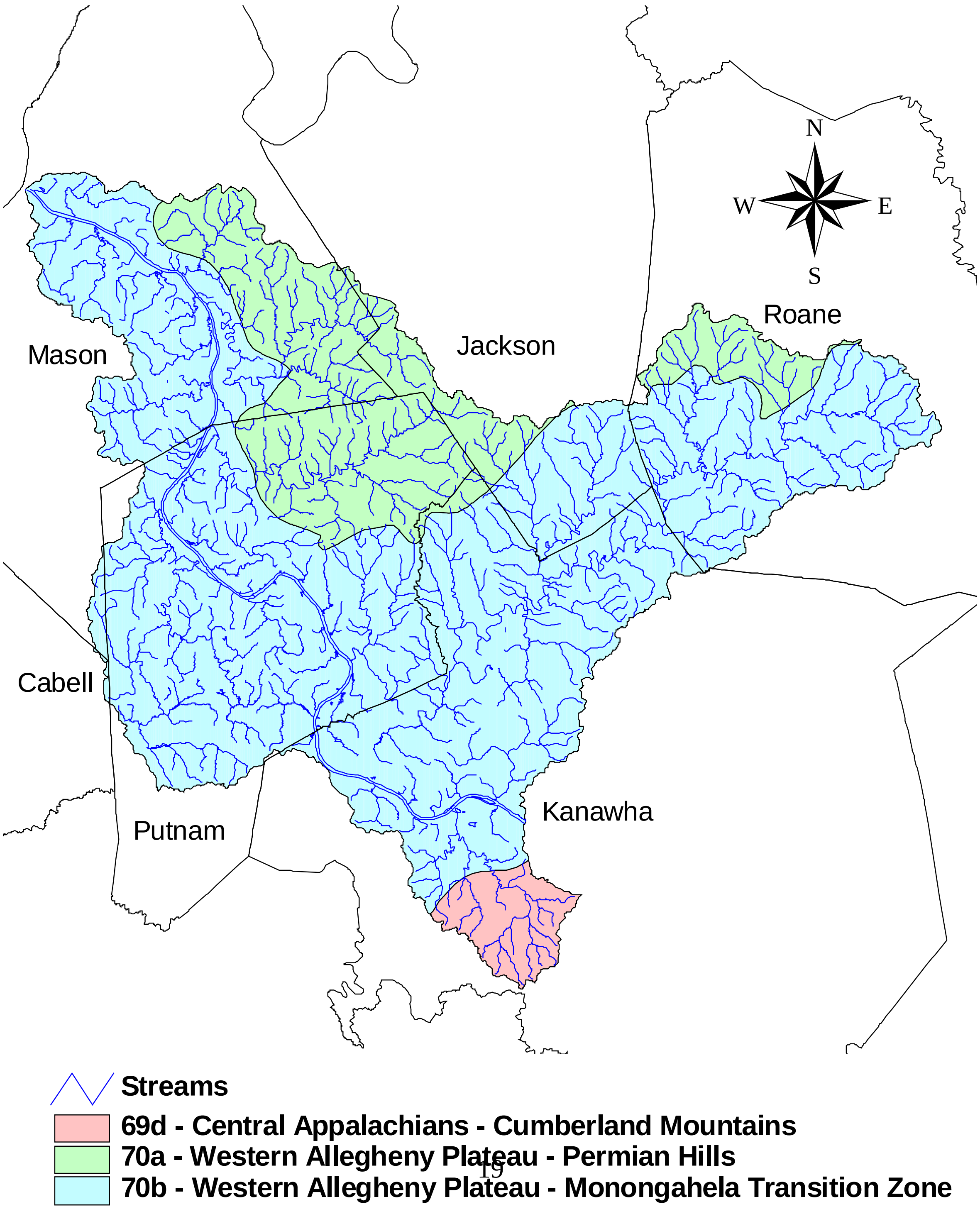
The next two digits indicate the subregion. All streams that flow into the Ohio at its beginnings in Pittsburgh are in sub-region 02. Those watersheds that flow into the Ohio between Pittsburgh and the mouth of the Kanawha at Point Pleasant are in sub-region 03. The Kanawha River watershed is sub-region 05. The Mud River and Big Sandy/Tug Fork watersheds are sub-region 07. Twelvepole Creek and the scattering of creeks between Point Pleasant and the mouth of Mud River are sub-region 09. For the Mid-Atlantic Region the Potomac River drainage is sub-region 07. The James River watershed (in Pendleton and Monroe Counties) is sub-region 08. The remaining four digits indicate the accounting and catalog units for the individual watersheds.

This watershed area lies primarily within two sub-ecoregions of the Western Allegheny Plateau ecoregion (Omernik, 1997). Permian sandstone, siltstone, shale, limestone and coal of the Dunkard Formation underlie the Permian Hills ecoregion (70a). The original vegetation of this ecoregion was primarily Appalachian oak forest. Today, forests are common. Most of the acreage is too steep to be farmed or is reverting to woodland. Nevertheless, there are some farms growing corn and hay on the ridges and some pastures remain on the hill slopes. Grazing and cultivation have caused slope erosion and upland topsoil is often thin or non-existent. Some coal mining and oil and gas production occur within this ecoregion.

The Monongahela Transition Zone ecoregion (70b) is generally less rugged, less forested and warmer than the Permian Hills ecoregion. Typically interbedded limestone, shale, sandstone and coal of the Monongahela group underlie this ecoregion. The natural vegetation was mixed mesophytic forest in contrast to the Appalachian oak forest of the Permian Hills. Urban, suburban and industrial development dominates some local areas, especially the narrow river valleys that serve as transportation corridors. Bituminous coal mining and some oil and gas production occur in this ecoregion. Acid mine drainage, siltation, and industrial pollution have degraded streams in much of this ecoregion. Two sites on headwater tributaries of Davis Creek are in the Central Appalachian ecoregion.

An unusual topographic feature is the Kanawha Valley. This alluvial valley is much larger than would result from flooding of a river the size of the present day Kanawha River. In fact, much of the alluvial depth can be attributed to glacial periods, when a continental ice sheet near Chillicothe, Ohio dammed an ancient river. This damming created a huge reservoir (called Teays Lake today) that resulted in alluvial material being deposited over thousands of years on the lakebed during flood events. When the ice shelf eventually retreated, and the massive reservoir drained, Kanawha River and its tributaries began to meander through the thick alluvium of the ancient lakebed. (Cardwell, 1975)

FIGURE 3: ECOREGIONS IN THE LOWER KANAWHA RIVER WATERSHED



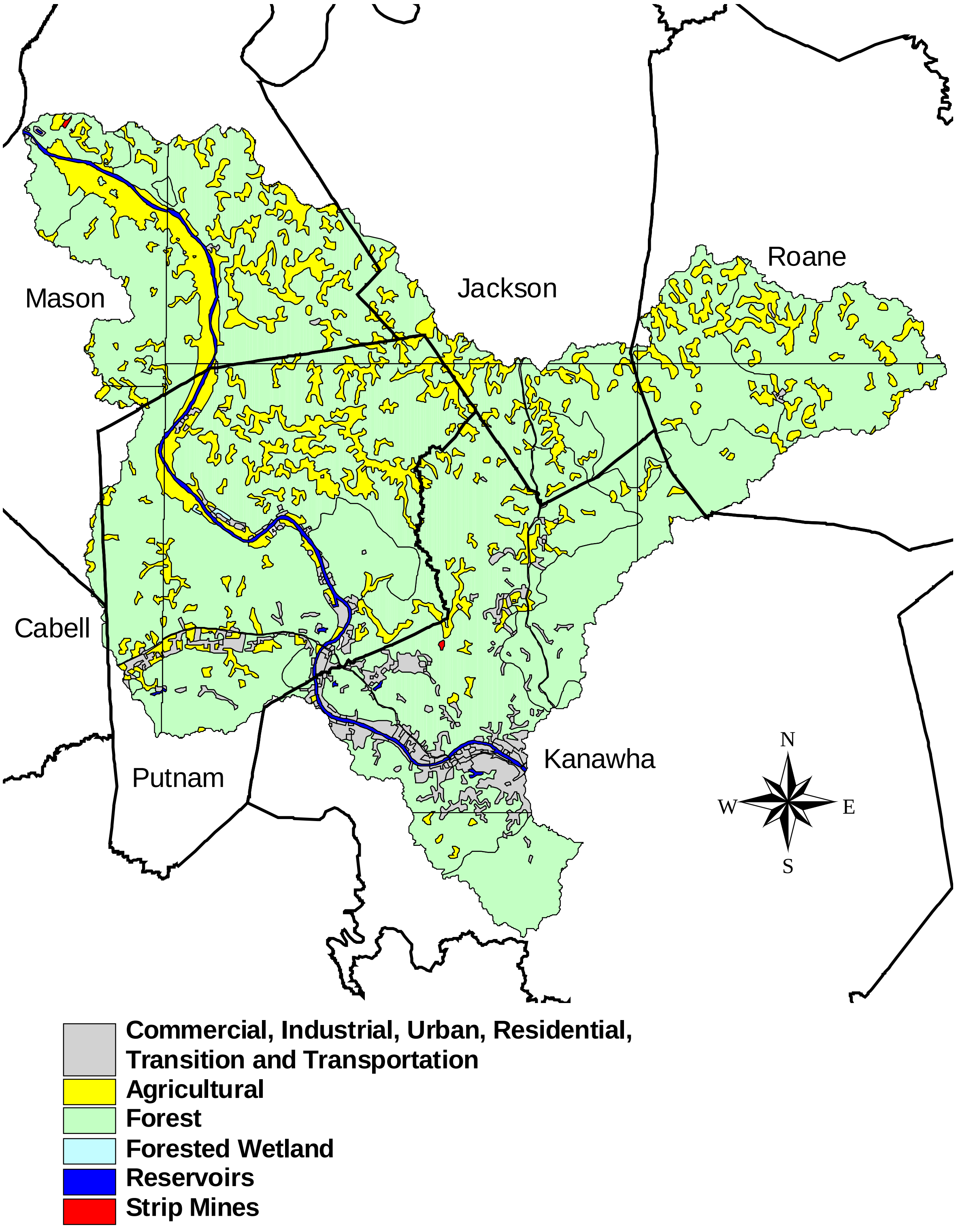
Climate throughout the watershed is considered mild. Generally, summers are warm and winters are moderately cold. Summer temperatures may reach the low nineties on occasion while winter lows average in the middle twenties. Precipitation occurs on an average of 152 days each year. While 1996 set the record as the wettest year for West Virginia in more than a century of keeping records, (Friedlander, Jr., Blaine P.) 1997 was much closer to the average.

The Lower Kanawha Valley never developed the intense salt industry common in the Upper Kanawha Valley. Limited extraction of natural gas, oil and some coal still occurs in the region. Prior to the twentieth century the Lower Kanawha River was primarily an agricultural and timbering region.

The lower Kanawha River was first altered, beginning in 1825, by a series of sluices and wing dams to improve navigation. It was hoped that this effort would provide a channel with a guaranteed three feet of navigable water. By 1900, a system of locks and dams had been created, which provided six feet of water for an average of 136 days each year (Hale). Modern locks and dams have altered the river so that the mainstem channel has nine feet of water available during the entire year. Several tributaries of the Lower Kanawha are navigable for short stretches. Only the Coal River, covered in a separate report, had its channel altered to support navigation. These eight locks and dams suffered from neglect during the War Between the States and ceased operating in 1878 when a spring freshet destroyed the locks (Harris). Remnants of these locks and dams can still be seen along Coal River, especially in the vicinity of Lower Falls.

FIGURE 4: LANDUSE CATEGORIES IN THE LOWER KANAWHA WATERSHED

AN ECOLOGICAL ASSESSMENT OF THE LOWER KANAWHA RIVER WATERSHED



As of January 1998, there were at least 67 NPDES discharge permits in effect within the Lower Kanawha River watershed. Of the known permitted discharges, 23 are sewage treatment plants and 44 are industrial discharges.

The West Virginia Division of Natural Resources (West Virginia DNR) lists the Kanawha River, the Pocatalico River, and Flat Fork Creek, as high quality streams (Anonymous 1986). The DEP has placed these same streams on the 303(d) list of water quality limited streams due to various impacts. This discrepancy may be due to the fragmented nature of the impacts on these tributaries. One segment may suffer from the impact, while another may be either upstream of the impact or far enough downstream to have recovered.

Another factor to consider is the different criteria used by the two different state agencies in listing streams. The Division of Wildlife Resources considered any stream a high quality stream if it contained a native trout population or was stocked with trout. They also included any warm water stream over five miles in length with a desirable fish population that was actively fished by the public. If a portion of a stream deserved to be listed as high quality, then the entire stream was listed.

The Office of Water Resources, on the other hand, bases its decision upon water quality data collected from sections of streams which are suspected of being impaired. If a portion of the stream deserved to be listed as water quality impaired, especially if only limited data was available, usually the entire stream was listed.

WATERSHED ASSESSMENT METHODS

In May 1989, the EPA published a document entitled *Rapid Bioassessment Protocols for Use in Streams and Rivers - Benthic Macroinvertebrates and Fish* (Plafkin et al. 1989). The primary purpose of the document was to provide water quality monitoring programs such as DEP's Watershed Assessment Program with a practical technical reference for conducting cost-effective biological assessments of flowing waters. Originally, the rapid bioassessment protocols (RBP) were considered to be an inexpensive screening tool for determining whether a stream was supporting a designated aquatic life use. However, the current consensus is that the RBPs can also be applied to other program areas, such as:

- Characterizing the existence and severity of use impairment
- Helping identify sources and causes of impairments in watershed studies
- Evaluating the effectiveness of control actions
- Supporting use attainability studies
- Characterizing regional biological components.

The diversity of applications provided by the RBPs was the primary reason the Program adopted it for use in assessing watersheds in West Virginia. Specifically, the Program used a slightly modified version of the rapid bioassessment protocol II (RBP II). RBP II involves the collection of field data on ambient biological, chemical, and physical conditions. The following sections summarize the procedures used in assessing the streams in the Lower Kanawha River watershed. A more detailed description of the Programs' assessment procedures can be found in the Watershed Assessment Program's *Standard Operating Procedures* (Smithson, undated working document). This document is available to the public.

SITE SELECTION

Sites were selected for assessment by one of four ways. Some sites were chosen through a random process developed and promoted by the EPA. Others were selected after consultation with stakeholders who identified streams and stream locations of particular concern due to perceived pollution, inclusion on the current 303(d) list of impaired streams, the presence of rare species, or for similar reasons. A few sampling locations were selected because reconnaissance crews or assessment teams identified them as potential reference sites. Finally, some sites were selected simply because they were located on streams that had not been selected for sampling via the other three methods.

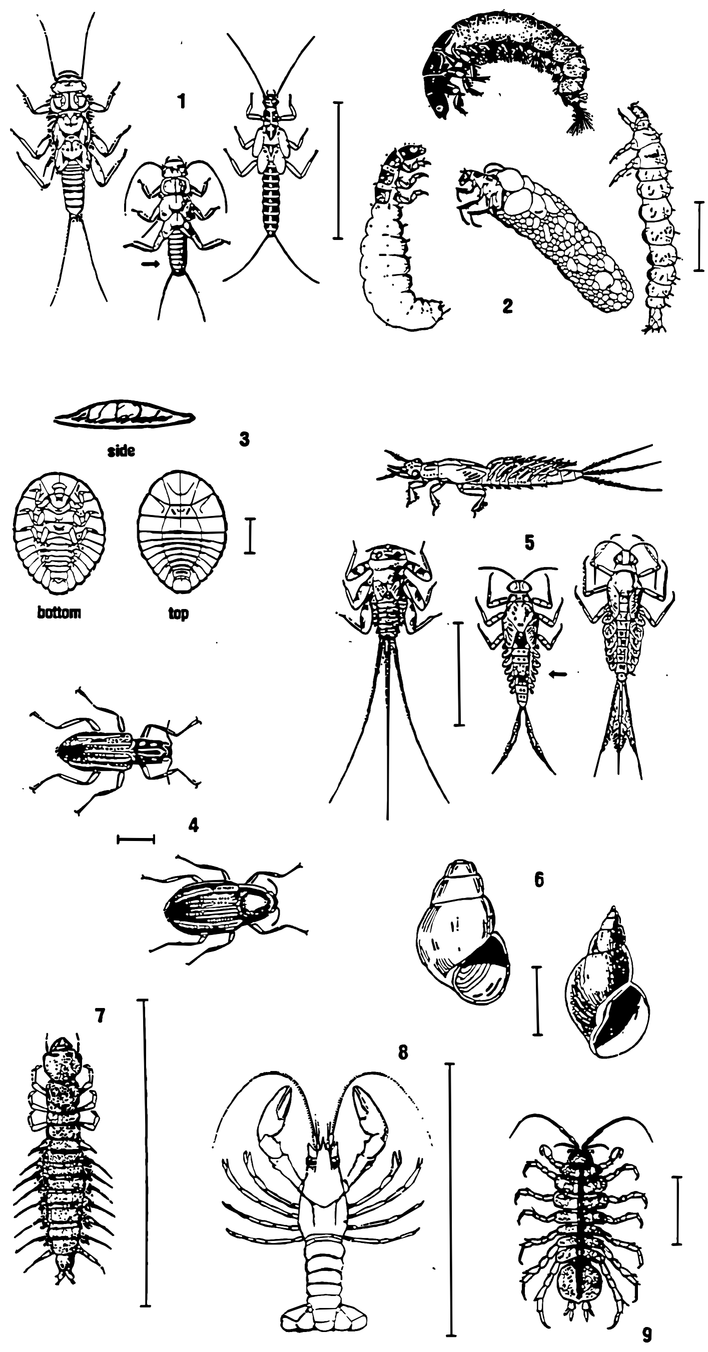
BIOLOGICAL MONITORING -- BENTHIC MACROINVERTEBRATES

Benthic macroinvertebrates are small animals living among the rocks and stones on the bottom of streams, rivers, and lakes. Insects comprise the most diverse class of these animals and include mayflies, stoneflies, caddisflies, beetles, midges, crane flies, dragonflies and others. Benthic macroinvertebrates also include snails, clams, aquatic worms and crayfish. These animals are extremely important in the food chain of aquatic environments. They are important players in the processing and cycling of nutrients, and are major food sources for fish and other aquatic animals. In general, a clean stream has a diverse array of benthic organisms that occupy a variety of ecological niches. Polluted streams generally are low in diversity and often are devoid of sensitive species.

The use of benthic macroinvertebrate data for biological monitoring of streams has persisted over several decades as an integral tool for conducting ecological assessments. There are many federal, state, and private agencies/organizations currently using this group of animals as part of their biological monitoring programs. The advantages are myriad. The most recognized benefits, however, ar e that benthic macroinvertebrate communities can reflect overall ecological integrity (i.e., chemical, physical, and biological integrity). They provide a holistic measure of environmental condition by integrating stresses over time and the public better understands them (as opposed to chemical conditions) as measures of a healthy environment (Plafkin et al. 1989).

BANK COLLAPSING INTO THE KANAWHA RIVER

FIGURE 5: STREAM INSECTS & CRUSTACEANS (SOS CARD)



Bar lines indicate relative size

Stream Insects & Crustaceans

GROUP ONE TAXA

Pollution sensitive organisms found in good quality water.

1 *Stonefly: Order Plecoptera.* 1/2" - 1 1/2", 6 legs with hooked tips, antennae, 2 hair-like tails. Smooth (no gills) on lower half of body. (See arrow.)

2 *Caddisfly: Order Trichoptera.* Up to 1", 6 hooked legs on upper third of body, 2 hooks at back end. May be in a stick, rock or leaf case with its head sticking out. May have fluffy gill tufts on lower half.

3 *Water Penny: Order Coleoptera.* 1/4", flat saucer-shaped body with a raised bump on one side and 6 tiny legs on the other side. Immature beetle. Three views.

4 *Riffle Beetle: Order Coleoptera.* 1/4", oval body covered with tiny hairs, 6 legs, antennae. Walks slowly underwater. Does not swim on surface.

5 *Mayfly: Order Ephemeroptera.* 1/4" - 1", brown, moving, plate-like or feathery gills on sides of lower body (see arrow), 6 large hooked legs, antennae, 2 or 3 long, hair-like tails. Tails may be webbed together.

6 *Gilled Snail: Class Gastropoda.* Shell opening covered by thin plate called operculum. Shell usually opens on right.

7 *Dobsonfly (Hellgrammite): Family Corydalidae.* 3/4" - 4", dark-colored, 6 legs, large pinching jaws, eight pairs feelers on lower half of body with paired cotton-like gill tufts along underside, short antennae, 2 tails and two small hooks hooks at back end.

GROUP TWO TAXA

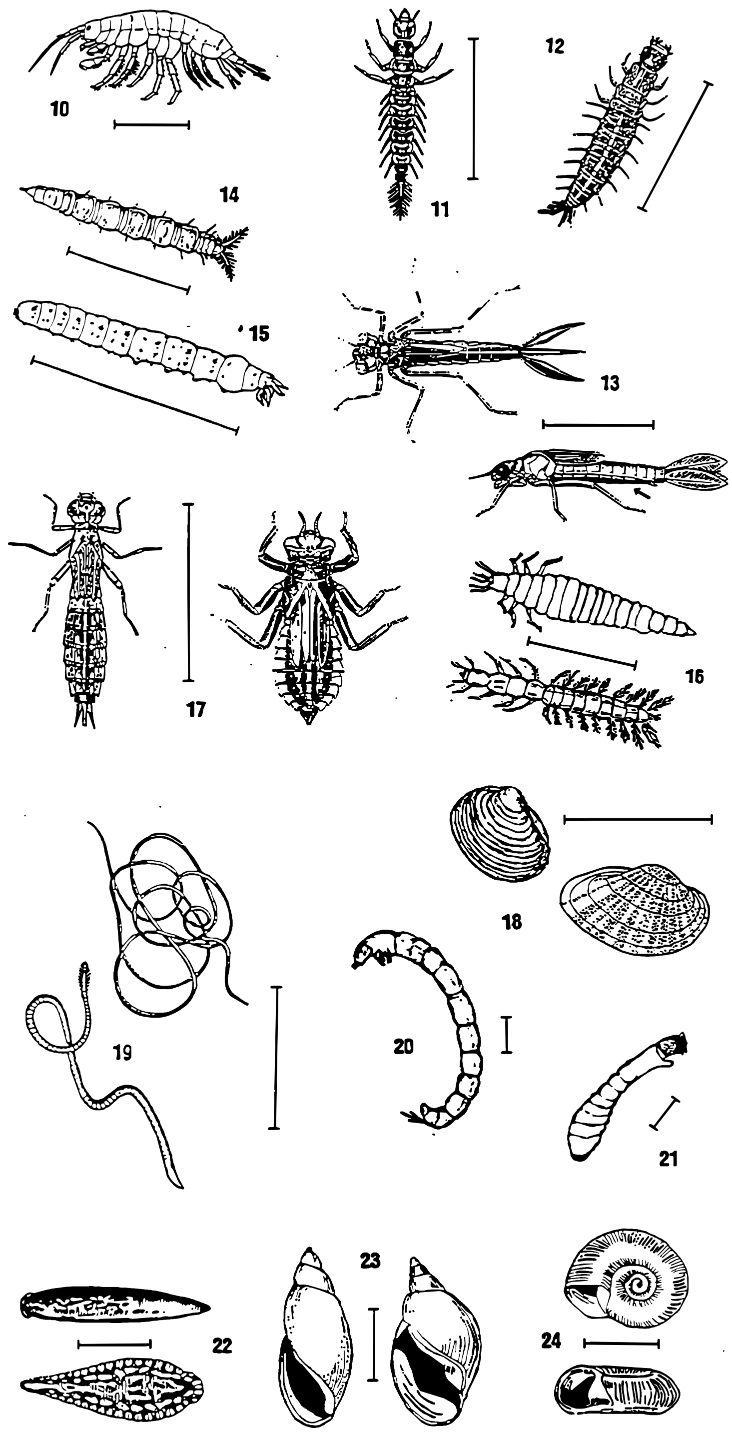
Somewhat pollution tolerant organisms can be in fair quality water.

8 *Crayfish: Order Decapoda.* Up to 6", 2 large claws, 8 legs, resembles small lobster.

9 *Sowbug: Order Isopoda.* 1/4" - 3/4", gray oblong body wider than it is high, more than 6 legs, long antennae.

Save Our Streams

Izaak Walton League of America
1401 Wilson Blvd. Level B
Arlington, VA 22209



Bar lines indicate relative size

GROUP TWO TAXA continued

10 *Scud: Order Amphipoda.* 1/4", white to grey, body higher than it is wide, swims sideways, more than 6 legs, resembles small shrimp.

11 *Alderfly larva: Family Sialidae.* 1" long. Looks like small hellgrammite but has 1 long, thin, branched tail at back end. No gill tufts underneath.

12 *Fishfly larva: Family Corydalidae.* Up to 1 1/2" long. Looks like small hellgrammite but often a lighter reddish-tan color, or with yellowish streaks. No gill tufts underneath.

13 *Damselfly: Suborder Zygoptera.* 1/2" - 1", large eyes, 6 thin hooked legs, 3 broad oar-shaped tails, positioned like a tripod. Smooth (no gills) on sides of lower half of body. (See arrow.)

14 *Watersnipe Fly Larva: Family Athericidae (Atherix).* 1/4" - 1", pale to green, tapered body, many caterpillar-like legs, conical head, feathery "horns" at back end.

15 *Crane Fly: Suborder Nematocera.* 1/3" -2", milky, green, or light brown, plump caterpillar-like segmented body, 4 finger-like lobes at back end.

16 *Beetle Larva: Order Coleoptera.* 1/4" 1", light-colored, 6 legs on upper half of body, feelers, antennae.

17 *Dragon Fly: Suborder Anisoptera.* 1/2" - 2", large eyes, 6 hooked legs. Wide oval to round abdomen.

18 *Clam: Class Bivalvia.*

GROUP THREE TAXA

Pollution tolerant organisms can be in poor quality water.

19 *Aquatic Worm: Class Oligochaeta.* 1/4" - 2", can be very tiny; thin worm- like body.

20 *Midge Fly Larva: Suborder Nematocera.* Up to 1/4", dark head, worm-like segmented body, 2 tiny legs on each side.

21 *Blackfly Larva: Family Simulidae.* Up to 1/4", one end of body wider. Black head, suction pad on end.

22 *Leech: Order Hirudinea.* 1/4" - 2", brown, slimy body, ends with suction pads.

23 *Pouch Snail and Pond Snails: Class Gastropoda.* No operculum. Breathe air. Shell usually opens on left.

24 *Other snails: Class Gastropoda.* No operculum. Breath air. Snail shell coils in one plane.

An example of an organization that utilizes benthic macroinvertebrates for monitoring the health of streams is the West Virginia Save Our Streams program (WVSOS). This progam was developed by the Izaak Walton League of America and emphasizes teaching the public how to recognize and prevent nonpoint sources of pollution. The collection and interpretation of benthic macroinvertebrate data is an integral tool in the WVSOS program. Figure 5 is adopted from the WVSOS program procedures manual and provides an illustration and description of the benthic organisms common in West Virginia streams.

Collecting Benthic Samples

Benthic macroinvertebrates can be collected using several techniques. The program utilized EPA's RBP II (Plafkin et. al., 1989) with some modifications involving the type of sampling device used to make the collections. The two-man kick net procedure of the original RBP was replaced with a kick net modified for use by one person. In streams having adequate riffle/run habitat, the program used a modified kick net (Surber-on-a-stick) to capture organisms dislodged by 'kicking' the stream bottom substrate and rubbing large rocks and sticks. In riffle/run streams that were too small to accommodate the Surber-on-a-stick, the smaller D-frame net was used to collect dislodged organisms. In both cases approximately 2.0 square meters of substrate were sampled.

Riffle/run streams with low flow that did not have enough water to sample with either net were sampled using a procedure called "hand picking". This procedure involved picking and washing stream substrate materials in a bucket of water. Field crews attempted to sample 2 square meters of stream substrate (equivalent to 8 kicks with a Surber-on-a-stick).

The D-frame net was also used to collect macroinvertebrates in slow flowing (glide/pool dominated) streams that did not have riffle/run habitat. Macroinvertebrates in glide/pool streams were sampled using the procedure developed for sluggish streams along the mid-Atlantic coast. This procedure is called the Mid-Atlantic Coastal Streams (MACS) technique and consists of sampling a variety of habitats (aquatic plants, woody debris, undercut stream banks, etc.) through sweeping and jabbing motions of the net (Maxted 1993).

Benthic macroinvertebrate samples were preserved in ethyl alcohol and delivered to the Department of Biological Sciences at Marshall University for processing. Processing involved removing a 100-organism subsample from the composite sample following RBP II protocols. The subsample of organisms was returned to Program biologists who counted and identified them to family or the lowest level of classification possible. The samples were kept for future reference and for identification to lower taxonomic levels, if necessary.

Appropriate biological collection permits were obtained before sampling from the West Virginia Division of Natural Resources (DNR). Fish specimens inadvertently collected during macroinvertebrate sampling were transferred to Dan Cincotta at the DNR Office in Elkins, West Virginia. Salamanders inadvertently collected were donated to the Marshall University Biological Museum.

The Program's primary goal in collecting macroinvertebrate data was to determine the "biological condition" of the selected stream assessment sites in the watershed. Determining the biological condition of each site involved calculating and summarizing five-community metrics using the benthic macroinvertebrate data. Benthic metrics were selected to ensure usefulness in discriminating between reference sites and sites with human-induced stressors. The following benthic community metrics were calculated for each assessment site:

1. *Taxa Richness* - measures the number of distinct taxa (diversity or different kinds) collected in the sample. In general, taxa richness increases with improving water quality.

2. *EPT Index* - measures the number of distinct taxa within the generally pollution sensitive groups Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies). In general, the EPT Index increases with improving water quality.

3. *HBI* (Hilsenhoff's Biotic Index - modified) - summarizes tolerances of the benthic community to organic pollution. Tolerance values range from 0 to 10 and generally decrease with improving water quality.

4. *Percent Contribution of Dominant Taxon* - measures the relative dominance of a particular taxon to the total number of organisms in the sample (community balance). Domination by one or a few taxa may indicate environmental stress.

5. *Number of Intolerant Taxa* – measures the number of distinct taxa that are known to be generally sensitive (tolerance values of 0 to 2) to various pollutant sources. In general the number increases with improving water quality.

In order to determine biological condition, the five calculated metrics from each sample station were compared to metric values derived from a set of reference stations located in the same region, and sampled during the same time frame. Reference stations are characterized by stream segments that are least impaired by human activities. They can be used to define attainable biological and habitat conditions. The term reference condition is used to describe the characteristics of reference stations in this report.

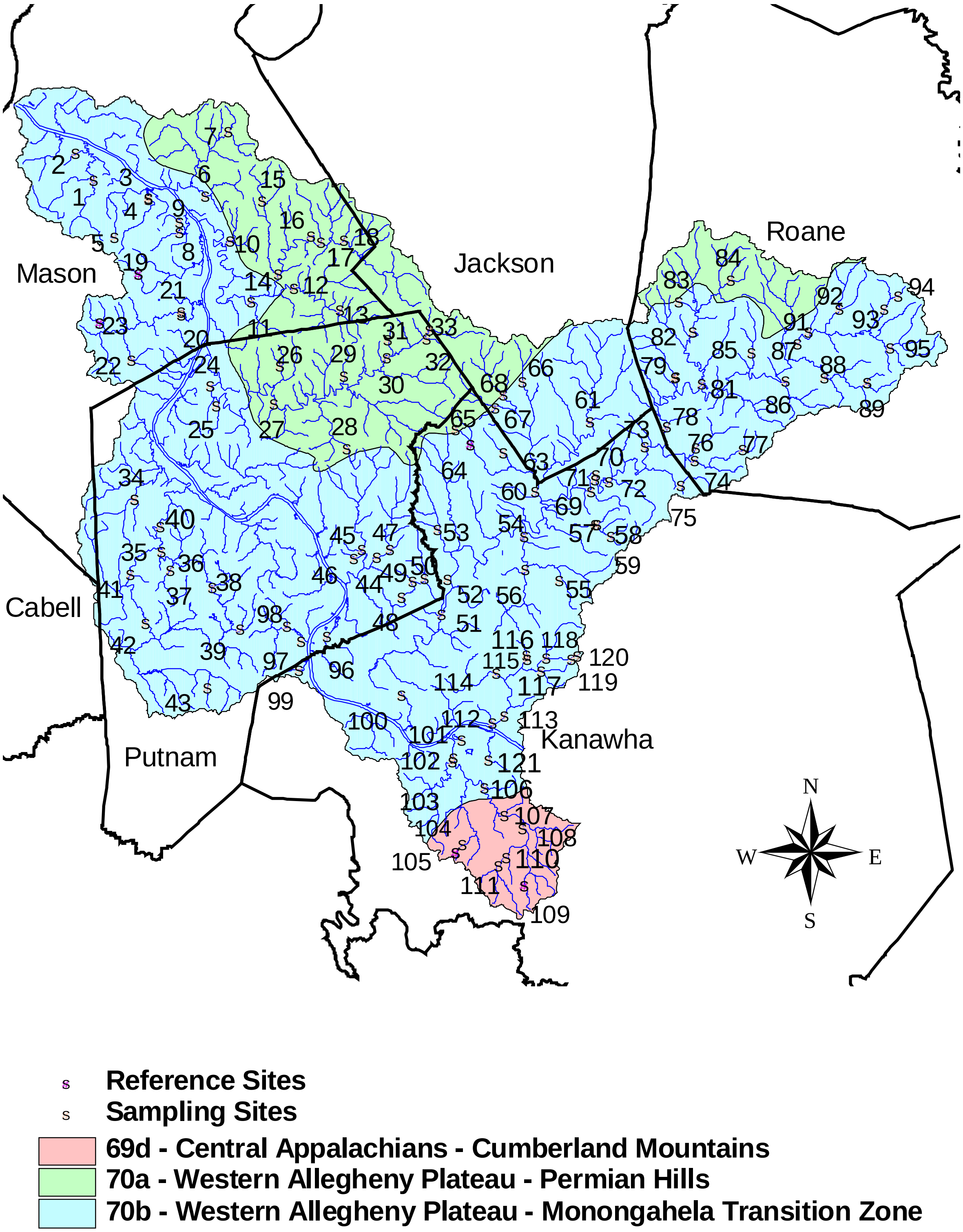
Reference conditions were established by subjecting the habitat and physico-chemical data of each assessment site to a list of minimum degradation criteria or reference site criteria. Assessment sites that met all of the minimum criteria were given reference site status. The degradation criteria were developed based on the assumption that they provide a reasonable approximation of least disturbed conditions, and thus accurately describe reference conditions.

<u>REFERENCE CONDITION</u> – Reference conditions describe the characteristics of stream segments least impaired by human activities and are used to define attainable biological and habitat conditions. Final selection of reference sites depends on a determination of minimal disturbance, which is derived from physico-chemical and habitat data collected during the assessment of the stream sites. A site must meet least disturbed criteria established by the Program before it is given reference site status.

In general, the following parameters are examined: dissolved oxygen, pH, conductivity, fecal coliform bacteria, violations of water quality standards, nonpoint sources (NPS) of pollution, benthic substrate, channel alteration, sediment deposition, streambank vegetation, riparian vegetation, overall habitat condition, human disturbances, point sources of pollution.

The information from the sites that meet the defined criteria is used to establish a reference condition for the watershed (or ecoregion). Benthic macroinvertebrate data from each assessment site can then be compared to the reference condition to produce a biological condition score for

FIGURE 6: SAMPLING SITES


Mason
Jackson
Roane
Cabell
Putnam
Kanawha
N
S
E
W
Reference Sites
Sampling Sites
69d - Central Appalachians - Cumberland Mountains
70a - Western Allegheny Plateau - Permian Hills
70b - Western Allegheny Plateau - Monongahela Transition Zone

To determine reference sites for watershed (or ecoregional) studies, candidate streams are selected from maps and evaluated using existing information on water quality and personal experience. The level of human disturbance is evaluated and a number of relatively undisturbed sites are selected from the candidate sites.

The distribution of benthic metric values of the reference sites was used to determine the scoring criteria for each metric. The lower quartile of metric values (taxa richness, EPT taxa, and number of intolerant taxa) of the reference sites was used to establish the lower threshold for receiving an optimal score for each metric. The upper quartile was used to determine the scoring threshold for HBI and percent dominant taxon which have values that increase with increasing perturbation. The mid-point between this score and zero (or the worst score from all sites for HBI and percent dominant taxon) was the lower threshold for the intermediate score. Each site was scored for each metric following a comparison to the threshold values established by the range of values of the reference sites. The sum of the scores of the 5 metrics provided a single index value for each site. This value was adjusted to a scale of 100 and is referred to as the biological condition score or bioscore.

For the purposes of this report, an assessment site receiving a bioscore of less than 50 was considered biologically impaired and in need of further investigation or corrective action.

In previous watershed reports, the Program classified benthic data based on stream width. Historic information has shown that aquatic communities in small streams are not comparable to those of large streams. The reasons for this fact are myriad, but collectively they can be identified as differences in number and character of ecological niches among various stream sizes. However, recent research has indicated that similar habitats in wadeable streams of orders I to III (Stribling et al. 1993) and in streams draining less than 500 square miles (PA DEP 1997) may be combined for analysis. In other words, a riffle in a small stream is likely to support a benthic community similar to a riffle in a large stream as long as other factors, including water quality, are similar. The individual taxa may differ, but the community metrics will be generally comparable. Also, the number of individuals may be greater per unit area in larger streams, but the 100-organism subsampling procedure utilized in this study equalizes this parameter.

FECAL COLIFORM BACTERIA

Numerous disease-causing organisms may accompany coliform bacteria released to the environment in feces. Thus, the presence of fecal coliform bacteria in a water sample indicates the potential presence of human pathogens. A fecal coliform bacteria sample was collected at each assessment site. U.S. EPA sampling guidelines limit the field holding time for such samples to 6 hours. Due to the distance to laboratories, personnel limitations, and time constraints, 24 hours was the limit used during this sampling effort. All bacteria samples were packed in wet ice until delivered to the laboratory for analysis.

During this study, some laboratories rounded result values before reporting them. Therefore, the reader should keep in mind that many of the values presented are estimates, not actual values obtained from analyses.

PHYSICO-CHEMICAL SAMPLING

Physico-chemical samples were collected at each site to help determine what types of stressors, if any, were impacting the benthic macroinvertebrate community. They also helped provide clues about the sources of stressors.

Several parameters were measured at all sites. Temperature (°C), dissolved oxygen (mg/l), pH, and conductivity (μmhos/cm) were measured in the field with a Hydrolab™ Scout™ and Multiprobe™ assembly. The manufacturer's calibration guidelines were followed with minimal variation except that the instruments were generally not calibrated at the end of each sampling day. Samples were collected at each site for analysis for specific constituents.

In areas where mine drainage was present, assessment teams collected water samples for the analysis of aluminum (Al), iron (Fe), manganese (Mn), hot acidity, alkalinity, and sulfate. Water samples were collected in conjunction with the habitat assessment and benthic macroinvertebrate sampling. A list of the water quality parameters is included in Table 1 on the following page.

Assessment teams were instructed to collect water samples for the analysis of nitrite + nitrate, total phosphorus and ammonia if they suspected the stream had elevated levels of nutrients. Chloride samples were taken from Pocatalico River tributaries when oil or gas activity was obvious.

Because of the value of data from the random sites, additional parameters were measured from these 33 sites. The random parameters include the four on-site parameters, the nutrient parameters, chlorides, sulfates, hot acidity, alkalinity, suspended solids, and several metals: aluminum (total and dissolved), calcium (total and dissolved), manganese, iron, copper, magnesium, and zinc. Table 2 summarizes the analytical methods, minimum detection limits, and holding times for all of the parameters analyzed.

Assessment teams measured flow (cfs) if a stream was listed on the 303(d) list for severe impairment or when field readings indicated that there was mine drainage impacting the stream. A current meter was used across a stream transect and the discharge was calculated with the sum-of-partial-discharges method.

TABLE 1: WATER QUALITY PARAMETERS

All numbered references to analytical methods are from EPA: Methods for Chemical Analysis of Water and Wastes; March 1983 unless otherwise noted.

Parameter	Minimum Detection Limit or Instrument Accuracy	Analytical Method	Maximum Holding Time
Acidity	5 mg/l	305.1	14 days
Alkalinity	5 mg/l	310.1	14 days
Sulfate	5 mg/l	375.4	28 days
Iron	200 g/l	200.7	6 months
Aluminum	100 g/l	200.7	6 months
Manganese	10 g/l	200.7	6 months
Fecal Coliform Bacteria	Not Applicable	9222 D[1]	24 hours[2]
Conductance	1% of range[3]	Hydrolab™	Instant
pH	± 0.2 units[3]	Hydrolab™	Instant
Temperature	± 0.15 C[3]	Hydrolab™	Instant
Dissolved Oxygen	± 0.2 mg/l[3]	Hydrolab™	Instant
Total Phosphorus	0.02 mg/l	4500-PE[1]	28 days
Nitrite+Nitrate-N	0.5 mg/l	353.3	28 days
Ammonia-N	0.5 mg/l	350.2	28 days
Unionized Amm-N	0.5 mg/l	350.2	28 days
Suspended Solids	5 mg/l	160.2	28 days
Chloride	1 mg/l	325.2	28 days

[1] Standard Methods For The Examination Of Water And Wastewater, 18th Edition, 1992.
[2] U. S. EPA guidelines limit the holding time for these samples to 6 hours. Due to laboratory location, personnel limitations and time constraints, 24 hours was the limit utilized during this sampling effort.
[3] Explanations of and variations in these accuracies are noted in Hydrolab Corporation's Reporter™ Water Quality Multiprobe Operating Manual, May 1995, Application Note #109.

The collection, handling, and analysis of water samples generally followed procedures approved by the U.S. EPA. Field blanks for water sample constituents were prepared on a regular basis by each assessment team. The primary purpose of this procedure was to check for contamination of preservatives, containers, and sample water during sampling and transporting. A secondary purpose was to check the precision of analytical procedures.

HABITAT ASSESSMENT

An eight page Stream Assessment Form (Appendix B) was filled out at each site. A 100 meter section of stream and the land in its immediate vicinity were qualitatively evaluated for instream and streamside habitat conditions. The assessment team recorded the location of each site, utilizing GPS when possible, and provided detailed directions so future researchers may return to the same site. A map was sketched to aid in locating each site. The team recorded stream measurements, erosion potential, possible nonpoint source pollution, periphyton and algae abundance, and any anthropogenic activities and disturbances. They also recorded observations about the substrate, water and riparian zone.

An important part of each stream assessment was the completion of a two page rapid habitat assessment (from EPA's EMAP-SW, Klemm and Lazorchak, 1994), which provided a numerical score of the habitat conditions most likely to affect aquatic life. This section provides the Program's biologists valuable information to help explain what benthic macroinvertebrate taxa may be present or are expected to be present at the sample site. It also provided information on any physical impairments to the stream habitat that were encountered during the assessment. The following 12 parameters were evaluated:

- Instream cover (fish)
- Benthic substrate
- Embeddedness
- Velocity/Depth regimes
- Channel alteration
- Sediment deposition
- Riffle frequency

- Channel flow status
- Bank condition
- Bank vegetative protection
- Bank disruptive pressure (grazing), and
- Riparian vegetation zone width.

Each parameter was given a score ranging from 0 to 20. The following descriptive categories were used to rate each parameter:

TABLE 2: SCORING FOR RAPID HABITAT ASSESSMENT PARAMETERS	
<u>Optimal</u> (score 16-20)	Habitat quality meets natural expectations.
<u>Suboptimal</u> (score 11-15)	Habitat quality is less than desirable but satisfies expectations in most areas.
<u>Marginal</u> (score 6-10)	Habitat quality has a moderate level of degradation; severe degradation at frequent intervals of area.
<u>Poor</u> (score 0-5):	Habitat substantially altered; severe degradation.

The 12 individual scores for each parameter were added (maximum possible = 240) and this number provided the final habitat condition score for each assessment site. The habitat condition score and biological condition score for each site was plotted on an X-Y graph (see box on page 43) to simplify interpretation of the results.

FINDINGS

In May and June 1997, staff from the DEP's Watershed Assessment Program (the Program), visited 120 sites throughout the watershed. Thirty-three of these sites were selected at random. A summary of the sampling sites may be found in Table 1. Details of the sampling sites are in Table 3 in Appendix A.

Of the 452 named streams in the Lower Kanawha River watershed, 91 (approximately 20%) were visited during this study. Only 8 unnamed tributaries were visited. Some streams were visited at more than one site, making the total number of sites visited 120. Of these 120 sites, 114 were sampled for benthic macroinvertebrates. Macroinvertebrate samples were from riffle /run areas in 109 of the 114 sites where samples were collected. The remaining 5 samples were from slower streams where riffles were absent. Crews collected benthic macroinvertebrates via the MACS technique at these sites.

SAMPLING SITE SUMMARY	
Named streams	452
Streams on 1996 303(d) list	7
Mainstem sites visited	0
Tributary sites visited	120
Named streams visited	91
Named streams not visited	361
Unnamed streams visited	8
Habitat assessed	116
Water quality sampled	120
Fecal coliform bacteria sampled	120
Benthos sampled	114
Benthos samples identified	114
Streams sampled for mine constituents	11

Of the 7 stream segments listed on the 1998 303(d) list of impaired streams, (Kanawha River, Pocatalico River, Heizer Creek, Manilla Creek, Rich Fork of Twomile Creek, Armour Creek, and Tupper Creek) all but 1 were sampled for water quality, habitat and benthic macroinvertebrates during this study. The Kanawha River mainstem is too large to be sampled for benthic macroinvertebrates using the Program's methods.

Duplication of effort was deliberate at 3 sites. Team personnel switched roles after all assessment procedures had been performed once and then carried them out again. This exercise was designed to help evaluate the degree of consistency in assessment techniques between different personnel. Both are listed in the tables, but only the best was used in generating the metrics and bioscore.

FINDINGS - BENTHIC MACROINVERTEBRATES

The data analysis procedure used in this report integrates several community richness and tolerance measures into a single evaluation of biological condition. Each metric measures a different component of community structure. This integrated approach provides greater assurance that a valid assessment has been achieved because a variety of parameters are evaluated.

Benthic collection data is difficult if not impossible, to interpret without comparing it to a reference site (i.e., one from a similar region and time that has a minimum of human or other impacts) or, preferably, a collection of reference sites. Of the 120 sites visited in the Lower Kanawha watershed, 118 are within the Western Allegheny Plateau ecoregion (the two exceptions are in the headwaters of Davis Creek in the Central Appalachian ecoregion) and were sampled during a relatively short time period.

The use of ecoregions to classify streams is based on the prediction that natural biological differences exist between ecoregions as a result of differences in land use, soil conditions, vegetation type, stream morphology, climate, elevation, and underlying geology. In the past, the Program would have considered analyzing assessment sites separately based on their respective ecoregion (Western Allegheny Plateau and Central Appalachians for this report). However, a recent study of benthic samples from various ecoregions within West Virginia and other mid-Atlantic states suggests that a statewide reference condition can be established from sites throughout various ecoregions (Tetra Tech personal communication 1999). Consequently, the Program did not separate assessment sites for analysis based on ecoregion.

Over 92% (105 of 114) of the stream sites assessed in the Lower Kanawha River Watershed with benthic samples collected had stream widths of ten meters or less. The widest average stream width at the sites with riffle/run samples collected was 13.8 meters. Because almost all of the sites are within the same ecoregion, and because the differences in the time of collection and stream sizes were minor, all of the benthic data from riffle/run sites were considered similar enough to be compared to a single reference set.

From the 109 sites that had riffle /run benthic samples collected, only 5 met the minimum degradation criteria. These five are considered to be minimally impaired by human activity and are the standard (reference set) against which all the other sites are compared. The five sites are: Little Sixteenmile Creek (WVK-13); unnamed tributary of Fivefork Branch (WVK-14-B-1); Railroad Hollow (WVKP-17-C-4); Bays Fork (WVK-39-E-3-{0.6}); and Hoffman Hollow (WVK-39-M-1-A-{1.0}).

The distribution of the benthic community metric scores for these reference sites determines the criteria for scoring all sites. The lower quartile (upper quartile for HBI and percent dominant taxa) of this set determines the lower threshold for the optimal score for each metric. The midpoint between this point and zero (or the worst score from the entire set for HBI and percent dominant taxa) is the lower threshold for the intermediate score. The resulting scoring criteria were established:

METRIC SCORING CRITERIA FOR LOWER KANAWHA RIFFLE /RUN		
	Optimal	Intermediate
Total taxa	15	8
EPT taxa	9	5
HBI	3.94	6.81
Percent dominant taxa	33.9	65.82
Number of intolerant taxa	5	3

The sum of the scores for the five metrics is adjusted to 100 and this is considered the biological score or bioscore. The benthic metric values are found in Table 20 of Appendix A.

The following discussion on the biological health of the streams in the watershed relies heavily on these figures, as well as water quality data and other habitat information. Following a brief explanation of the figures, this section will deal with impaired streams in sequence from the mouth upstream, generally in the same order as in Table 3 in Appendix A.

The habitat score and bioscore for each benthic sample site is graphically presented in Figures 7, 8 and 9. The Program utilized these X-Y graphs as a means of summarizing the relationship between biological condition and habitat condition. The data is separated into three figures, primarily to make it more readable. The first group includes the sites between the mouth of the Kanawha River and Pocatalico River (Figure 7). The second group is the Pocatalico River and its tributaries (Figure 8). The third group consists of the sites between the Pocatalico River and the Elk River (Figure 9). A total of 109 assessment sites with comparable benthic samples (40 from the mouth of the Kanawha River to the Pocatalico River, 45 in the Pocatalico sub-watershed, and 24 between the mouth of the Pocatalico River and the mouth of Elk River) are presented on the three graphs. For the purposes of this report, an assessment site receiving a biological condition score of less than 50 was considered biologically impaired and in need of further investigation or corrective action. This threshold is also used to list streams as biologically impaired in 303(d) reports. Of the 109 sites that had comparable benthic samples from riffle /run habitats, 34 scored lower than 50. For a complete explanation of the X-Y graph see the box right at right.

Figure 7 shows that between the mouth of the Kanawha River and the Pocatalico River only 9 of 40 (approximately 22.5%) comparable benthic samples received a bioscore of less than 50. Figure 8 indicates 11 out of 45 (approximately 25%) sites in the Pocatalico sub-watershed scored below 50. However, Figure 9 indicates a much higher percentage of sites (14 of 24 or approximately 58%) scored below 50 in the heavily developed region between the Pocatalico River and the Elk River.

INTERPRETING X-Y GRAPHS

Habitat quality is an important measurement in biological surveys because aquatic animals often have specific habitat requirements independent of water quality.

A point on an XY graph (Figures 7, 8 and 9) represents two numbers, one for the biological condition score on the Y axis (vertical axis or side axis), and one on the X axis (horizontal axis or bottom axis) for the habitat condition score.

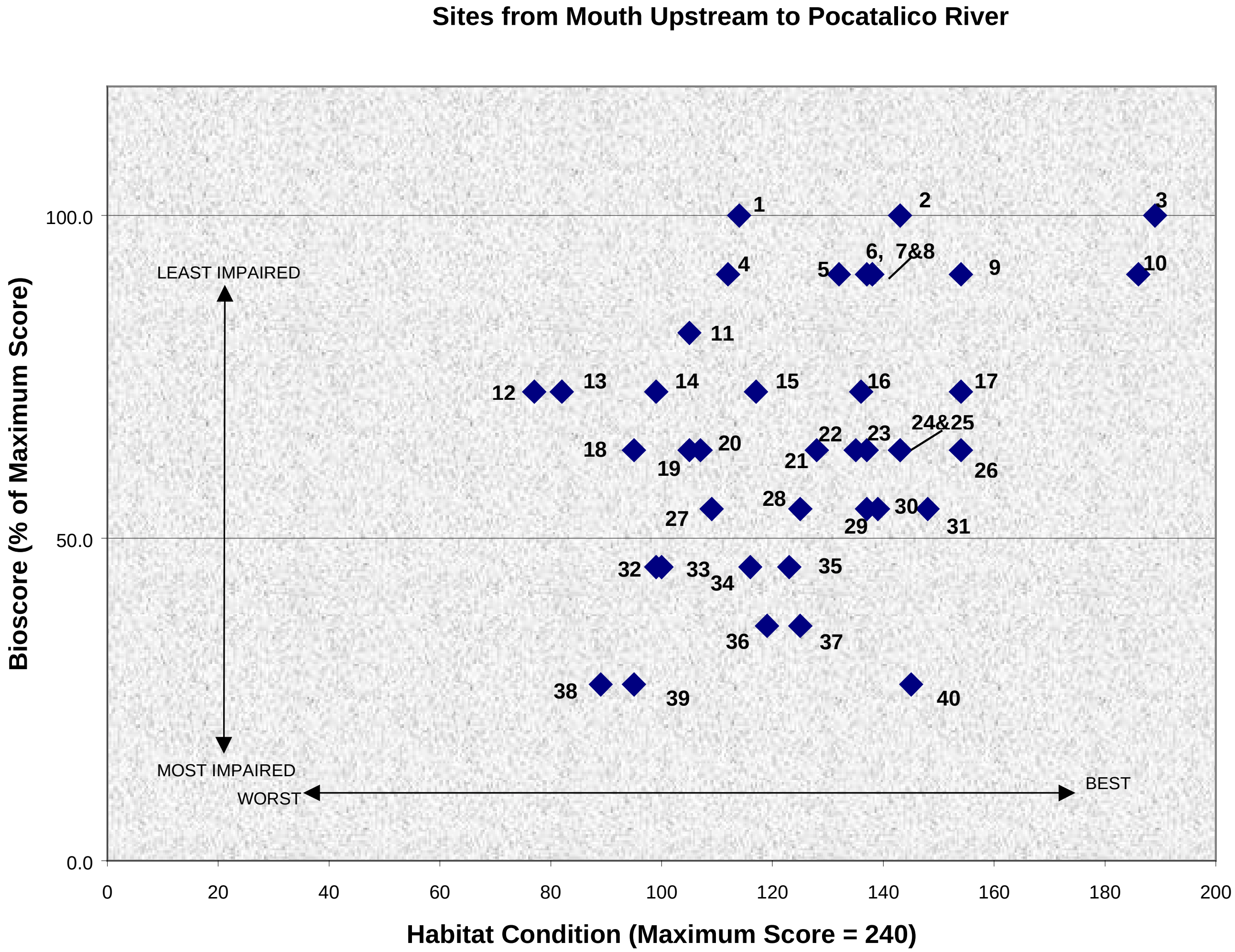
The upper right-hand section of the graph is the ideal situation where optimal habitat quality and biological condition exist. The upper left-hand corner of the graph is where optimal biological condition is generally not possible due to severely degraded habitat.

The lower left-hand portion of the graph is where habitat quality is poor and further degradation may result in relatively little difference in biological condition. The lower right-hand corner of the graph is often considered the most important since this is where degraded biological condition can be attributed to something other than habitat quality (i.e., chemical pollutants). (Adopted from Barbour et al. 1997)

Seventy-three distinct taxa were identified from all samples collected in the Lower Kanawha Watershed. Generally, the watershed as a whole displayed good benthic diversity with several pollution sensitive taxa well represented. The most frequently encountered taxon was the midge family Chironomidae. This family was collected at 110 sites. The mayfly family Baetidae was next with 88 sites. Twenty-five of the taxa were only collected once. Thirteen taxa had only one organism found. A list of the benthic macroinvertebrates collected by frequency is presented in Table 22 of Appendix A.

HIGH WATER MARK LEFT IN YARD ON TRIBUTARY OF KANAWHA TWO MILE

FIGURE 7: BIOLOGICAL AND HABITAT DATA SUMMARY



AN-CODE
1. WVK-12-H
2. WVK-12-J
3. WVK-14-B-1
4. WVK-12-A
5. WVK-16-{12.8}
6. WVK-16-S
7. WVK-10-A
8. WVK-10-F
9. WVK-16-L
10. WVK-13
11. WVK-9-A (DUP2)
12. WVK-12-F
13. WVK-16-G-1-{0.4}
14. WVK-16-{25.0}
15. WVK-12-{12.0}
16. WVK-14-A.5-{1.6}
17. WVK-12-E-2.5-{4.0}
18. WVK-6
19. WVK-14
20. WVK-19-C(DUP2)
21. WVK-12-{20.7}
22. WVK-12-E-{2.4}
23. WVK-16-B
24. WVK-16-{33.0}
25. WVK-22-B
26. WVK-16-Q-{1.0}
27. WVK-11
28. WVK-19-C(DUP1)
29. WVK-9-A(DUP1)
30. WVK-9-C-{5.4}
31. WVK-12-F-{5.0}
32. WVK-22-B-3
33. WVK-22-B-2
34. WVK-22-J-{1.3}
35. WVK-14-{2.2}
36. WVK-22-{10.6}
37. WVK-22-{6.0}
38. WVK-22-{14.4}
39. WVK-22-B-5-B
40. WVK-16-J-3-{1.0}

FIGURE 8: BIOLOGICAL AND HABITAT DATA SUMMARY

Pocatalico River Watershed

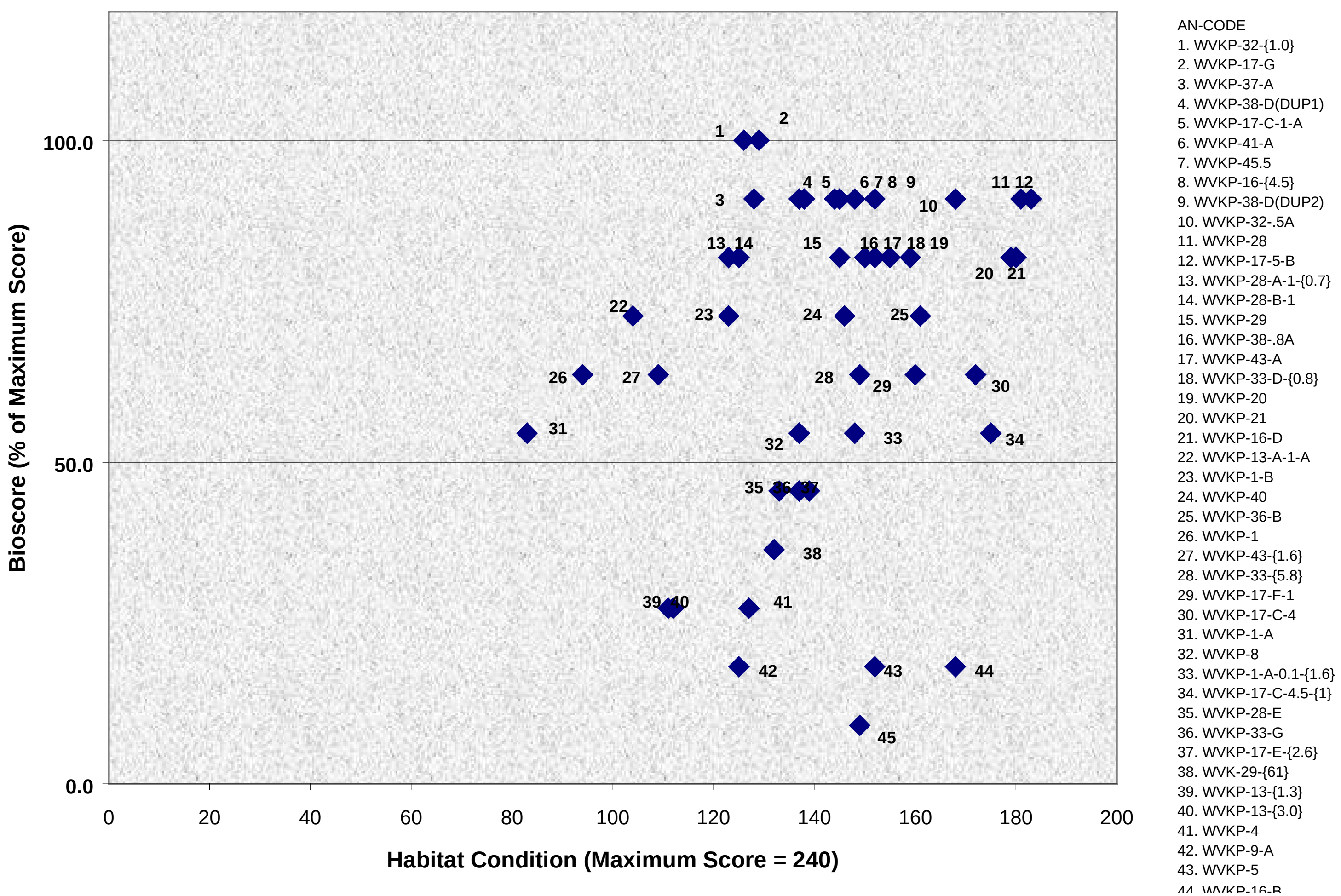


FIGURE 9: BIOLOGICAL AND HABITAT DATA SUMMARY

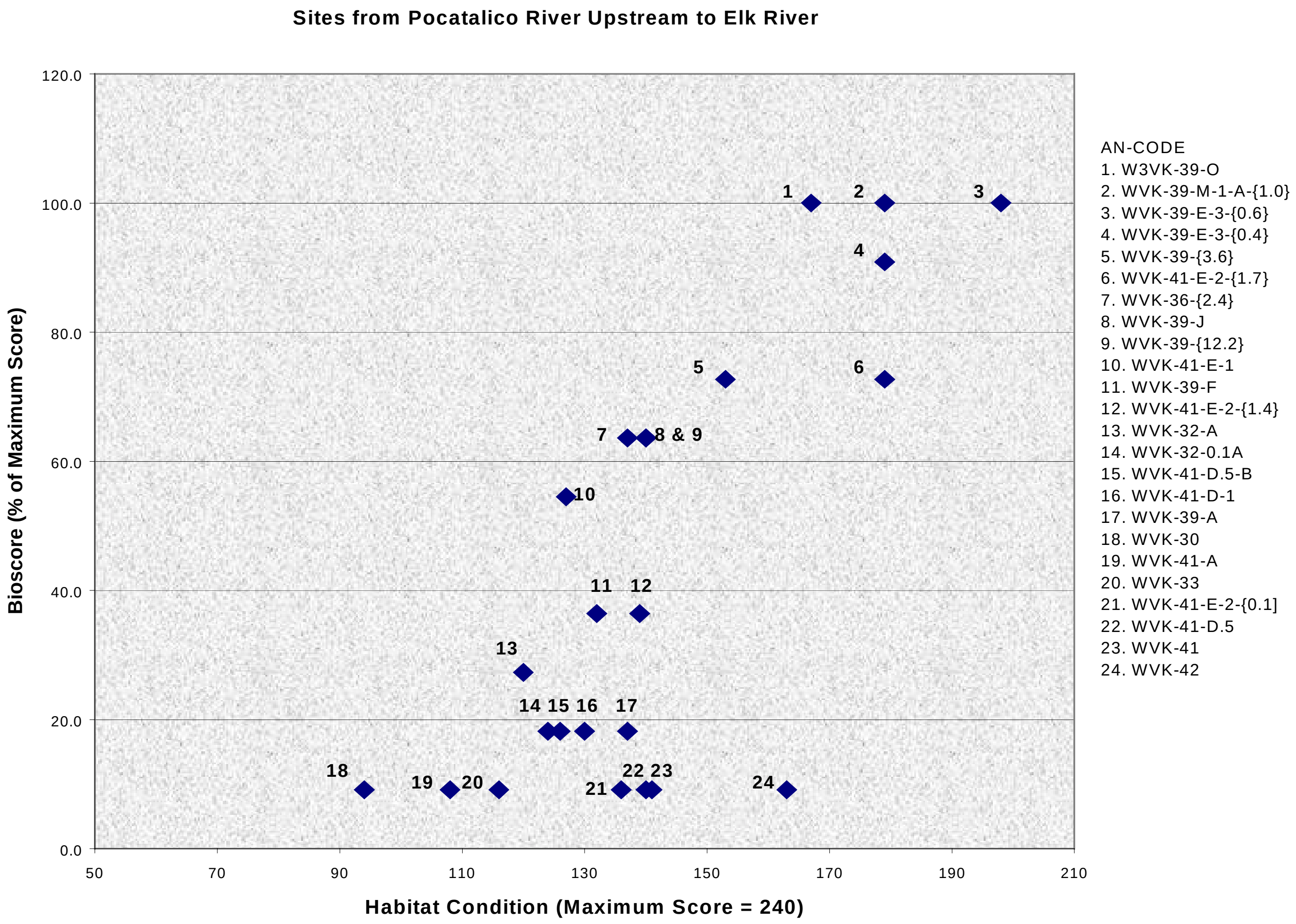
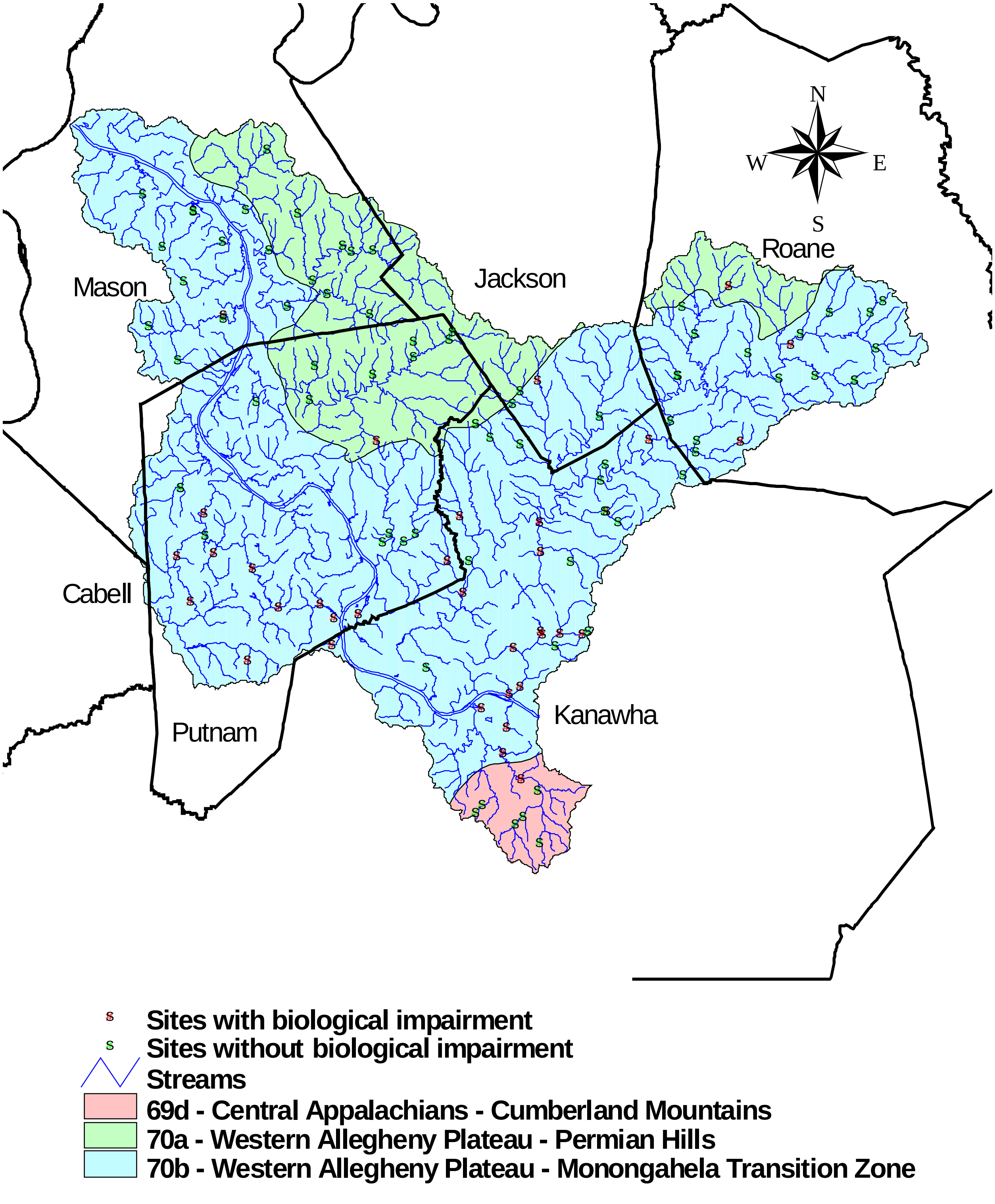


FIGURE 10: BIOSCORES BY SITE


N
W
E
S
Mason
Jackson
Roane
Cabell
Putnam
Kanawha
Sites with biological impairment
Sites without biological impairment
Streams
69d - Central Appalachians - Cumberland Mountains
70a - Western Allegheny Plateau - Permian Hills
70b - Western Allegheny Plateau - Monongahela Transition Zone

STREAMS WITH BIOLOGICAL IMPAIRMENT

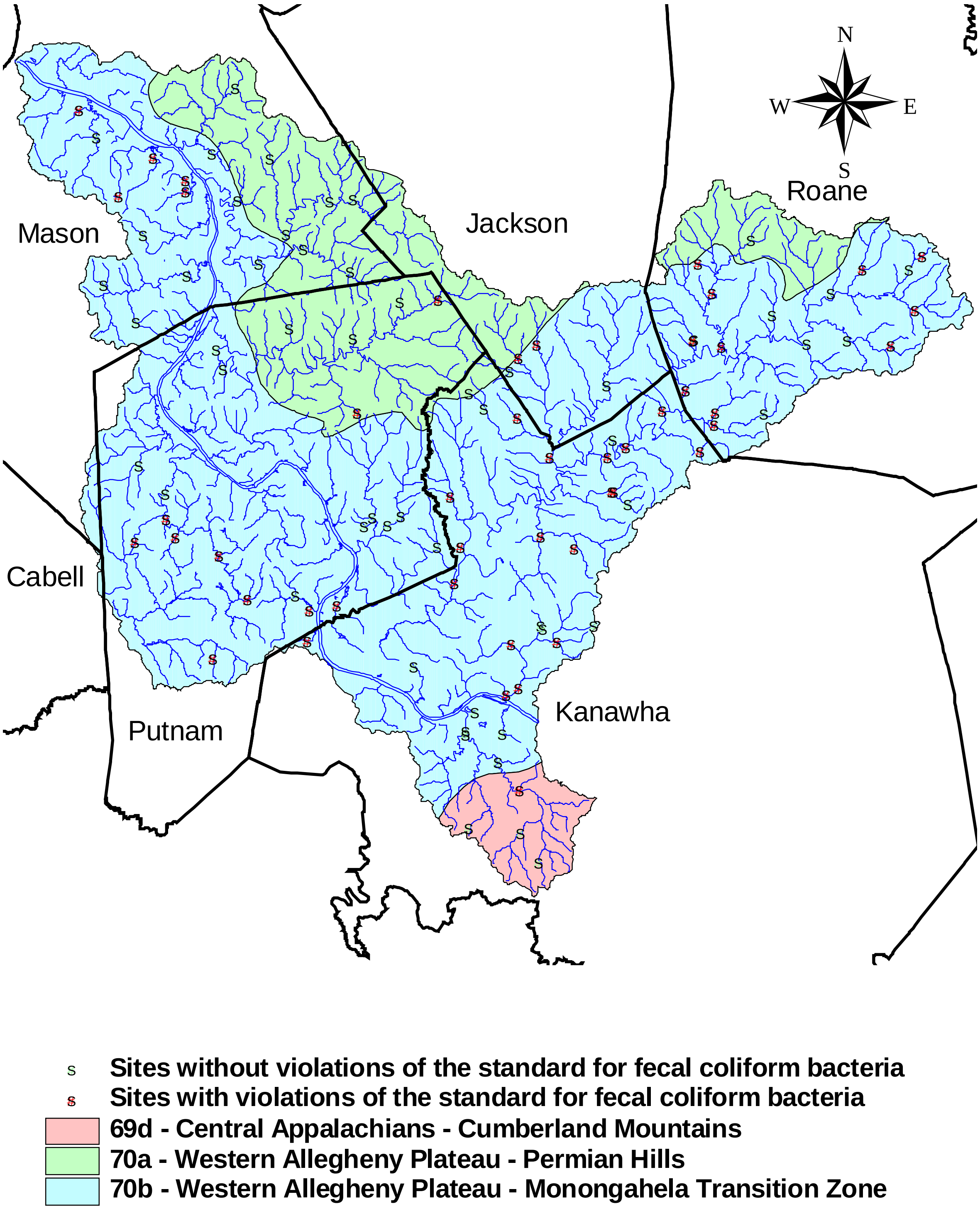
In the following discussion, major streams are denoted in bold italicized text at first mention. Smaller tributaries are identified with italics only.

The benthic sample obtained from *Sixteenmile Creek* (WVK-14-{2.2}) 2.2 miles from its mouth showed some impairment. Cattle had access to the stream at this site (Table 7), thus damaging the stream bank. The embeddedness and sediment deposition scores were in the marginal category (Table 15). Habitat degradation appears to be the main problem here.

The site on *Saltlick Creek* of Eighteenmile Creek (WVK-16-J-3-{1.0}) received a low bio-score (27.3). The substrate at this site was predominantly bedrock, with no cobble and only 8% gravel (Table 13). This lack of productive habitat could explain the appearance of an impaired biological community. This stream should be sampled again in a more productive habitat to determine if there are other problems.

Of eight sites sampled on ***Hurricane Creek (WVKP-22),*** seven were biologically impaired (78% of the impaired sites in Figure 7). This watershed includes the highly developed Teays Valley area. Several major roadways (I-64, Rt. 34, and Rt. 60) also run through the area. In addition, the city of Hurricane's wastewater treatement plant discharges into the stream. The area is relatively flat and pasture and hay fields can be seen throughout the watershed. All seven of the sites tested for nutrients had detectable levels of nitrate + nitrite nitrogen and phosphorus (Table 18).

FIGURE 11: FECAL COLIFORM BACTERIA CONCENTRATIONS BY SITE


N
W
E
S
Mason
Jackson
Roane
Cabell
Putnam
Kanawha
Sites without violations of the standard for fecal coliform bacteria
Sites with violations of the standard for fecal coliform bacteria
69d - Central Appalachians - Cumberland Mountains
70a - Western Allegheny Plateau - Permian Hills
70b - Western Allegheny Plateau - Monongahela Transition Zone

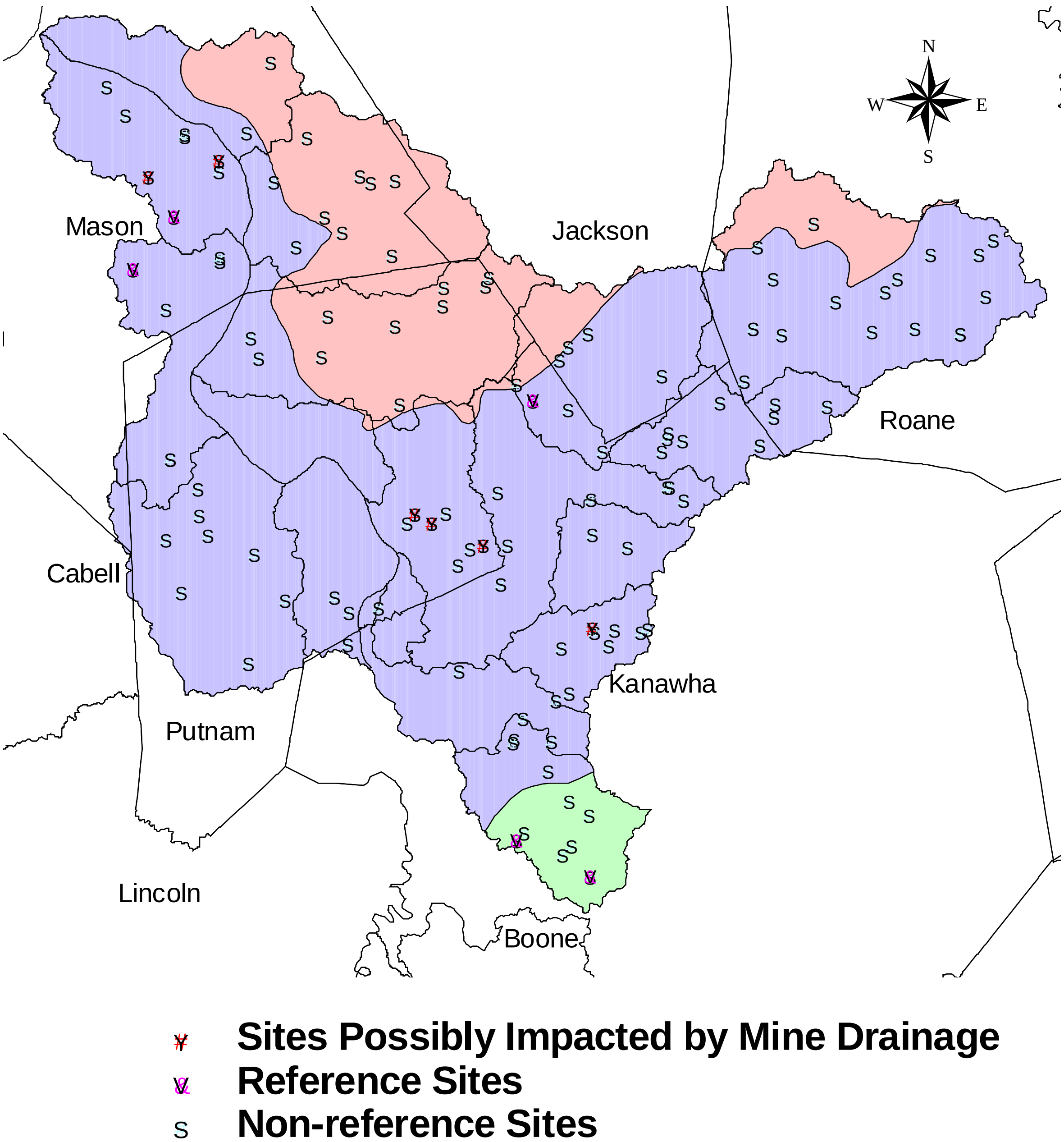
The *Cow Creek* (WVK-22-B-2) site ran through a pasture. Cattle had direct access to the stream bank at several points. Allowing cattle access to stream banks causes bare areas that are highly vulnerable to erosion at higher flows and adds animal waste directly to the water. The benthic sample was almost 65 % Chironomidae (midges) which are highly tolerant of organic enrichment.

The site on *Long Branch* (WVK-22-B-3) had a total habitat score of 99 (Table 15). The stream substrate was highly embedded and suffers from high levels of sediment. In addition, midges (88 %) dominated the benthic collection.

The *unnamed tributary of Crooked Creek* (WVK-22-B-5-B) is severely impaired by sedimentation. It scored very low for embeddedness (1) and sediment deposition (2) (Table 15). It also had a high fecal coliform bacteria level (1,900 colonies /100 ml).

All three *Hurricane Creek* (WVKP-22) mainstem sites were impacted by sedimentation and excess nutrients. The lower two sites had benthic collections dominated by hydropsychid caddisflies and midges, the upper site (just downstream from the sewage treatment plant) was dominated by black fly larvae. Despite the fact that all three sites had samples taken from riffle /run habitats, the stream is dominated by stretches of glide/pool habitat. In fact, the rapid habitat assessment for streams with a prevalence of glide/pool habitats was used. The scores from these habitat assessments may not be comparable to the other sites, but they can be useful independently.

FIGURE 12: SITES POSSIBLY IMPACTED BY ACID MINE DRAINAGE



The *Rider Creek* (WVK-22-J-{1.3}) site is similar to the other Hurricane Creek sites in that sedimentation and agriculture are affecting the stream. Horses, mules, and cattle were allowed free access to the stream around this site, thus damaging the stream bank. The embeddedness and sedimentation values were predictably low.

Figure 8 shows the biological score plotted against the total habitat scores for the sites within the ***Pocatalico River (WVKP)*** watershed. Eleven of the 45 sites sampled have impaired benthic communities.

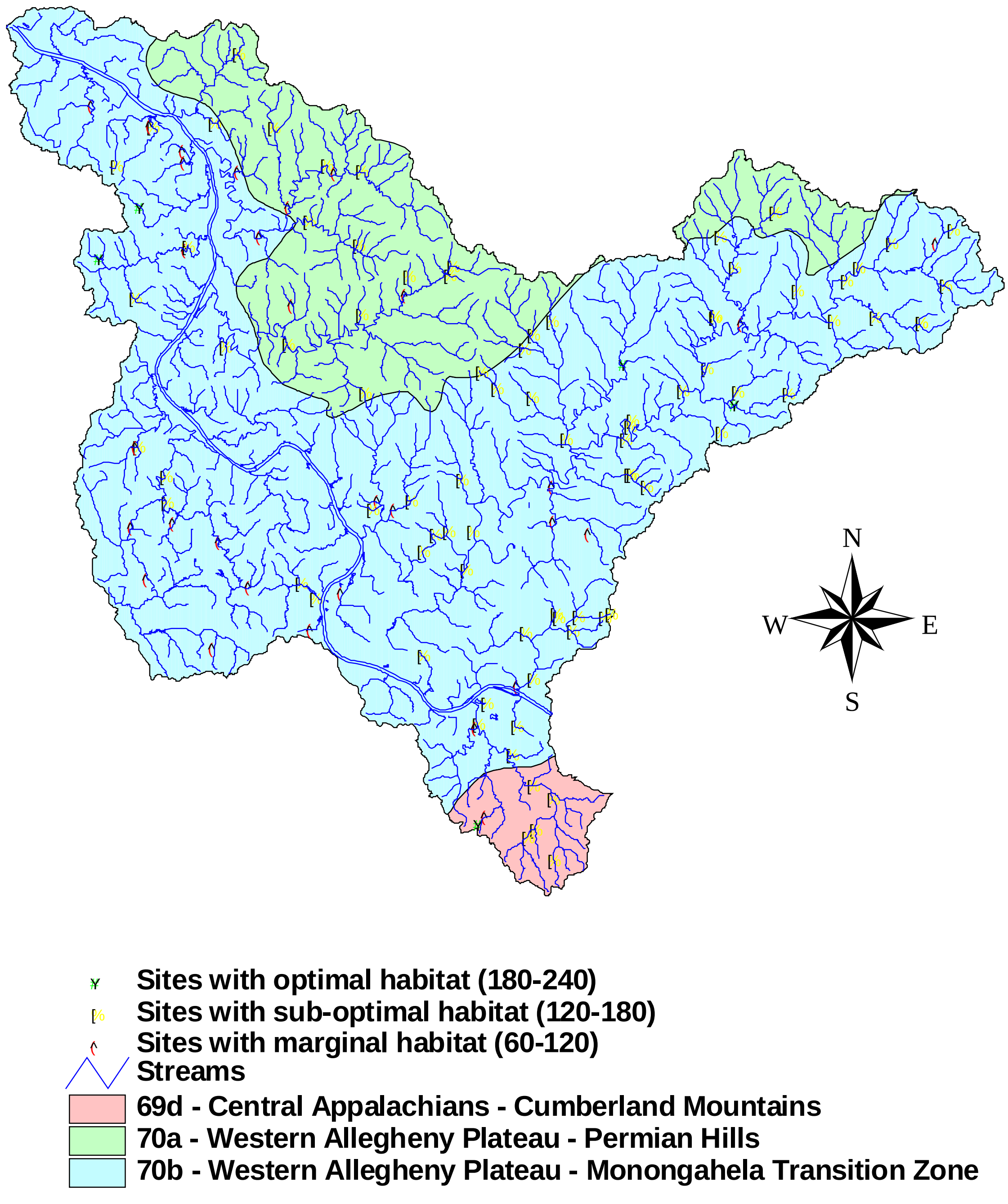
Harmond Creek (WVKP-4) is severely impacted by acid mine drainage. The substrate at the sample site was covered with white aluminum precipitate. The iron, aluminum, and magnesium levels were all high (Table 19). There are several deep mines in the area. The main problem appears to originate from a small creek which enters Harmond Creek about one half mile upstream from the sample site. This unnamed tributary (known locally as Church of Nazarene Creek) had a pH of 3.2 and conductivity of 1550 µmhos/cm. The white precipitate formed where this creek entered the less acidic Harmond Creek.

The site on *Rocky Fork* (WVKP-5) scored very low biologically and above average for habitat. Generally this would indicate a water quality problem. The topographical map shows large areas of strip mining on Lick Branch (WVKP-5-.5A), a tributary of Rocky Fork. There is also mining activity on Limestone Branch (WVKP-5-A-1). The limited water quality data that was collected from the Rocky Fork site reveals little to explain the poor benthic condition. The fecal coliform bacteria level, however was high (Table 17) and there was a heavy coating of periphyton on the rocks. The Union Public Service District operates a sewage treatment plant on Rocky Fork. Although this plant pumps its effluent directly to the Kanawha River it may occasionally have an overflow and bypass the treatment system. This information coupled with the fact that there are many residences in the watershed would suggest the possibility that sewage or gray water is entering the stream.

Spring Branch (WVKP-9-A) of Kellys Creek (WVKP-9) had a bio-score of only 18.1. More than 80% of the organisms collected were midges and worms (oligocheats). These organisms are indicative of organic pollution. Hay fields and pastures are in the area. Nutrient data was not collected, but the fecal levels were elevated. Because there are not many residences upstream of this site, runoff from the hayfields and pasture are the most likely source of pollution.

Both of the *Tupper Creek* sites (WVKP-13-{1.3} and WVKP-13-{3.0}) scored low biologically. Interstate 77 runs parallel to most of the lower portion of Tupper Creek. A large percentage of the stream above these sites was altered at the time of the interstate construction. The majority of the streams in this watershed run along highly residential roads. When rain falls on areas with a high percentage of disturbed land, water tends to run off quickly, resulting in flash flooding. These high flows combined with the lack of boulders and cobble at these two sites (the substrate at both of the sites was dominated by gravel, sand, and silt) makes the substrates very susceptible to scouring and thus very poor habitat for benthic organisms. Also, the relatively high fecal levels (3,200 colonies /100 ml) indicate the possibility of some untreated sewage entering the stream.

FIGURE 13: RAPID HABITAT SCORES



Broadtree Run (WVKP-16-B) is another site with a poor benthic community. Its habitat score is well above average for this watershed, thus indicating a water quality problem. The four parameters measured onsite revealed no problems. The fecal coliform level was high at 6,600 colonies/100 ml., so the probability of one or more of the residences upstream having inadequate sewage treatment is likely.

Often rural houses will have gray water discharges into streams. This water is often only from washing machines, but just as likely, it can be all non-sewage water which could include water from utility sinks where any number of possible pollutants can enter the streams. Unless an investigator happens to take a sample when such a discharge occurs, it is very difficult to identify these sources. It is only by looking at the biological health of these streams that we can narrow our search of these elusive point sources.

The site on *Dudden Fork* (WVKP-17-E-{2.6}) scored just below 50 and is thus considered impaired. The composition of the benthic collection however is not typical of most of the other impaired sites in the watershed. The dominant taxon is a stonefly family, perlidae. The reason for its low score is its relatively low diversity. The stream runs parallel to Interstate 77 for much of its length and is only about 50 meters away at the sample site. The composition of the benthic sample does not indicate organic pollution, and the reason for the low diversity may be due to runoff from the interstate. Because this was a random site, the full set of water quality parameters was tested. These results revealed nothing of consequence. If however, the runoff from the interstate is the problem, it would only be evident at times of rainfall. Thus, further sampling is necessary to accurately describe the impairment to the benthic community at this site.

Camp Creek (WVK-26) has a severely impaired biological community. More than 90 % of the organisms in the sample were midges. This domination of the sample by midges and the fact that only one EPT taxa was collected indicate the probability of nutrient pollution. There is nothing in the field sheets to indicate the source of the problem, other than the presence of a couple of houses upstream. Again, further investigation is warranted.

The Pocatalico River watershed has considerable oil and gas activity The site on *Anderson Lick Run* (WVKP-28-E) appears to be negatively affected by this activity. There was a noticeable odor of natural gas, several pipes ran the length of the stream, an oil storage tank was about 20 meters from the left bank, and a dirt road (presumably used for access to wells) ran parallel to the stream. There is an impoundment about 60 meters upstream from the upper end of our sample reach. The instream habitat appears to be capable of supporting a diverse assemblage of benthic organisms, so the lack of diversity is most likely due to some aspect of the oil and gas activity.

Cabbage Fork (WVKP-33-G) is located in an area of Roane County with a high percentage of pastureland. The effects of this can be seen in the sediment deposition and embeddedness scores, both in the marginal category. A landowner near the site informed the crew that an oil tank had spilled into the stream three or four months before the sample date. The dominant taxon was a mayfly (baetidae) and the site had a bioscore just below 50. It would be interesting to sample this site again when the effects of the oil spill are completely gone.

The *Pocatalico River* was sampled at five sites for water quality. Three sites included benthic samples, but only the uppermost site (WVK-29-{61.0}) had habitat suitable for obtaining a riffle/run sample. There was a riffle at the site, but it was of poor quality from the viewpoint of benthic organisms. The substrate consisted of small cobble and gravel that was very unstable, indicating that it moved a lot at higher flows. The other two sites sampled for benthos were sampled using the MACS technique. This method depends greatly on the quality of habitat available.

The variability of habitat from site to site makes comparison among them difficult. The site nearest the mouth (WVK-29-{04.7}) had only seven taxa in the benthic sample. The water quality at this site seems to be supportive of a diverse biological community. However, the field crew reported that the substrate consisted of sand, silt, and clay, and that the sampleable habitats were limited to a few fallen trees. Being a random site, the most productive habitats are not always sampled and the preselected location may fall in an area where there simply is no good habitat. While this does give a more statistically valid estimation of the number of stream miles with good benthic populations, it does not answer the question of wether this site is impaired by something other than lack of good habitat.

This site is less diverse than the other *Pocatalico River* site (WVK-29-{32.5}) sampled with the MACS technique. Both collections were entirely from woody snags. The site 32.5 miles from the mouth had twice the number of taxa collected, and included individuals from four mayfly families. It would appear, based on this comparison, that the downstream site (WVK-29-{04.7}) does have some impairment, although as stated previously, it is difficult to discount the effects of poor habitat. Several sites with impaired benthic communities are on tributaries upstream from this site, including Harmond Creek and Rocky Fork.

As the Kanawha River winds through the heavily industrialized area around Charleston, it would be logical to assume that there would be some negative effects on the biological communities in the waters draining these areas. Figure 9 shows that nearly 60% of the streams sampled in the area upstream of the Pocatalico River are impaired.

The *Armour Creek* (WVK-30) site had an extremely impaired benthic community. Over 97% of the sample consisted of worms and midges. This site is located behind a large auto dealership in Nitro, just off the I-64 interchange. Armour Creek drains a heavily populated area from Nitro to Cross Lanes. The fecal coliform bacteria level was very high, with over 6,000 colonies/100 ml. In addition to the problems associated with densely populated areas, the habitat was very poor. The epifaunal substrate and embeddedness scored very poorly (Table 15) and 60% of the sampled substrate was clay.

Vintroux Hollow (WVK-32-0.1A) is a small first-order tributary of Scary Creek with residences along its entire length. Several sewer pipes were seen dumping directly into the stream. Predictably the fecal coliform bacteria level was high (greater than 6,000 colonies /100 ml). The substrate was highly embedded and affected by sedimentation. Midges were the dominant taxa here, almost 80%.

Rockstep Run (WVK-32-A) is another tributary of Scary Creek with an impaired benthic community. Almost 96% of the sample were midges (67%), black fly larvae (26%), and worms (approximately 3%). Rockstep Run drains residential areas north of I-64, crosses under the interstate, then runs along Rt. 35 for about a mile before entering Scary Creek. Embeddedness and sediment deposition both scored in the marginal category (Table 15). A typical sample from a riffle/run habitat would include four kicks from a fast riffle and four from a slow one. The site on Rockstep Run lacked any fast riffle areas. This lack of the most productive habitat could partially explain the low bioscore this site received.

Gallatin Branch (WVK-33) is another site with a benthic sampled dominated by midges and worms (greater than 98%). This small stream was significantly altered when a housing development was constructed. The group of townhouses lines about a third of the length of the stream. The fecal coliform bacteria level was high (3,400 colonies / 100 ml) and the substrate was heavily embedded with silt.

The ***Davis Creek*** (WVK-39) watershed was sampled at nine places. It was sampled at three sites along the mainstem creek. The wide range of bioscores is explained by the wide range of environments within this watershed. Ward Hollow (WVK-39-A) drains the heavily industrialized section of South Charleston, whereas Bays Fork (WVK-39-E-3) and Hoffman Hollow (WVK-39-E-M-1-A) are headwater streams within Kanawha State Forest.

Ward Hollow (WVK-39-A) drains part of Union Carbide's Technical Center, the large railyard just north of I-64, and the area around the old Ordnance center, which is now used by many industries for production and warehousing. There were metal hydroxide precipitates present in some areas of the stream, the sediment smelled septic at the lower end of reach, and the substrate was more than 75% embedded by fine sediment.

Rays Branch (WVK-39-F) and *Coal Hollow* (WVK-39-J) are both affected by the growth of the South Hills residential area. Rays Branch drains areas along Clark Road and around John Adams Jr. High School. Runoff from construction sites results in excess sedimentation entering the streams, thus reducing the amount of habitat available for benthic colonization. Predictably, the crew reported heavy amounts of sand deposits. The dominant organisms (midges and worms) are indicative of organic pollution, but the results of tests for fecal coliform bacteria showed fairly low levels and the amount of periphyton was reported to be low.

The area around Coal Hollow also is being developed for residential areas and the stream has many of the problems associated with development (heavy sand deposits, embeddedness, etc.). But the area also includes several older homes. Several of the homes at the lower end of the stream had gray water discharge pipes. Soap suds were present the day of sampling. Along with older homes comes the possibility of failing septic systems. The fecal coliform sample was high at 3,400 colonies / 100 ml.

Two of the Davis Creek mainstem sites scored above 50, and the third (WVK-39-{01.6}) was sampled with the MACS technique. This site lacked good habitat, yet had four mayfly taxa and one stonefly taxon. Considering the habitat, it appears that the water quality here supports a relatively unimpaired benthic population.

Trace Fork enters just upstream from the MACS site on Davis Creek. It too was sampled using the MACS methodology. Its benthic sample had fewer EPT taxa and had a higher percentage of midges than the MACS site on Davis Creek. It is difficult to determine the level of impairment without a reference set. Comparing it to the Davis Creek site suggests there may be a slight impairment. This sample was taken prior to most of the development of the shopping districts known as Dudley Farms Plaza and the Shoppes at Trace Fork. This site should be sampled again to determine the extent of any damage to Trace Fork.

It also should be noted that there was a mine blowout on Davis Creek just downstream from Middle Fork during the summer of 1998. It originally discharged large amounts of acidic water with high levels of aluminum and iron. A major fish kill resulted. Eventually the flow from the mine diminished and the mine was sealed in September. The water was treated by depositing fine limestone sand on the stream banks. The acidic water dissolves the limestone fines and are neutralized by it. As of this writing the substrate is choked with precipitate from the metals that resulted from the treatment. A period of high flow is needed to flush most of this precipitate out and allow the benthic organisms to repopulate.

Twomile Creek (WVK-41) suffers from the effects of several landfills, surface and deep mining, Interstate I-77, and heavily populated residential areas. Of nine sites sampled in this watershed, seven have impaired biological communities.

The site on *Twomile Creek* (WVK-41) had a severely impacted benthic community. This site suffers from the cumulative effects of all of the upstream disturbances. As with most of the other sites in this watershed, the embeddedness and sediment deposition values were low (marginal category). The presence of heavy periphyton and elevated levels of fecal coliform bacteria, along with the high percentage of midges in the benthic sample, indicate the possibility of untreated sewage entering the stream.

Woodward Branch (WVK-41-A) was sampled near its mouth in North Charleston. The site was surrounded by industrial parking lots that drain into the stream. The area upstream is mostly developed, with residences present all the way up to top of the drainage area. Many of these houses are older with the corresponding increase in the chance of poorly treated sewage entering the stream. Not surprisingly, the fecal coliform levels were high. The modified HBI, a metric which increases with increasing organic pollution was the highest calculated (9.69) for the entire watershed (Table 20).

The u*nnamed tributary of the Left Fork of Twomile Creek* (WVK-41-D-1) drains the developed area along Route 21 north of Charleston. It suffers from the effects of being close to a major road where any number of contaminants can make their way into the stream. Car batteries, tires, and other trash were found at the sample site. As at many of the sites in the Twomile watershed, the fecal coliform bacteria level was high.

Rich Fork (WVK-41-D.5) had the lowest pH value of any of the sample sites in the watershed (4.8, Table 17). There are several deep mines upstream and one or more of these discharges acidic water, resulting in high levels of aluminum (3.6 mg/l) at the sample site. The white aluminum precipitate was visible at the site. Only one non-midge organism was found in the sample.

Craigs Branch of Rich Fork (WVK-41-D.5-B) also has mining upstream, but the effects do not seem as severe. There is a waste disposal landfill on the site of the old surface mine. This landfill was closed in 1994. The leachate supposedly drains into the sewer system. The nitrogen level (nitrate + nitrite N = 0.48 mg/l) is higher than would be expected from a non-agricultural area, suggesting that some water draining from the landfill may be entering the stream. As in Rich Fork, midges are the dominant taxa. The water quality is such that it does support a limited fauna of EPT taxa.

Holmes Branch (WVK-41-E-2) was sampled at three places to document the effects of alleged dumping of sewage waste into the stream. The lower two sites were below the spot of alleged dumping, the third, above. The *Holmes Branch* site just below the dumpsite (WVK-41-E-2-{1.4}) showed the most drastic effects of excess nutrients. The fecal coliform bacteria level was 12,000 colonies/100 ml, and large numbers of worms (1269) and midges (255) were found. The nitrate + nitrite nitrogen level was fairly high at 0.40 mg/l. The site nearest the mouth (WVK-41-E-2-{0.1}) was about 1.3 miles downstream of WVK-41-E-2-{1.4} and appears to be somewhat improved in water quality and benthic community composition. However, the dominant taxa are still worms and midges. The site upstream from the dumpsite was much improved. The fecal levels were normal, the nitrogen levels were lower, and worms and midges were replaced by mayflies and stoneflies as the dominant organisms present. Confounding the identification of the source of the problem on Holmes Branch is the presence of a large greenhouse near the site of the alleged dumping. A poorly operated greenhouse could be responsible for the elevated nitrogen levels, though probably not contributing significantly to the fecal levels.

Joplin Branch (WVK-42) drains the heavily populated residential areas of Joplin Park, Weberwood, and the Oakwood section of South Hills. A section of the stream runs along busy Corridor G, Route 119. The habitat appears to be stable and should be capable of supporting a healthy benthic community (see Figure 9). When a site has an impaired benthic sample and a relatively good habitat, it normally means that the water quality is poor. The only parameter hinting at a problem is conductivity. At 553 µmhos/cm, this site has one of the highest conductivities in the watershed. Further water quality investigations at different flows should be conducted.

FINDINGS - HABITAT ASSESSMENT

Habitat data is useful in determining the types and degree of human influences. This information often helps in determining the cause of water quality problems or impairment to a stream's biology. This information can also be useful to program managers when prioritizing areas to target for restoration projects.

The eight-page stream assessment form (Appendix B) deals largely with the habitat in and around the sample reach. Results are in Tables 6 through 16 in Appendix A. Table 6 presents the physical measurements of the stream. The averages for the stream width, riffle depth, run depth, and pool depth were recorded. The majority of the streams sampled were relatively small, with 75 percent being less than or equal to 5.3 meters wide.

The residential activities and disturbances observed near the sample sites are recorded in Table 7. The most common disturbances were the presence of lawns and residences, present at more than 45% of the sites. Other disturbances related to residences were the presence of pipes, and bridges and/or culverts. Several sites had agricultural activities, with pasture, hayfields, and row crops the most common disturbances.

Observations and estimations were made at the sites on the sediment and substrate. Crews checked for the presence of odors and oils in the sediment. They recorded the makeup of the sediment, and they recorded the percent composition of the inorganic substrate at the areas where the benthic sample was collected. Table 13 summarizes the substrate composition. The results for the sediment are found in Table 14.

Crews also recorded observations about the water at the site. Table 16 presents the crew's observations of relative (seasonal) water level, water odor, surface oils, turbidity and color of the water. The vast majority of the sites had normal water odor, and no surface oils. The odors of sewage and petroleum were each detected at two sites.

An important factor in maintaining the quality of habitat of streams is the intactness of the riparian buffer zone. That is, the vegetation in the area closest to the stream. In areas where trees have been removed and their roots no longer present, the stream banks are much more susceptible to erosion. The crews evaluated the canopy, understory and ground cover in the area running the length of the reach and 18 meters out from each stream bank. Results from this evaluation are presented in Tables 10, 11 and 12.

The Rapid Habitat Assessment is perhaps the most valuable of habitat data collected, since it allows comparing sites to each other. The twelve parameters are scored 0 to 20 for a total possible score of 240. It is this total score that is used in the biological and habitat data summary graphs (Figures 7, 8, and 9). The results of the assessment are in Table 15. The lowest scoring parameters were riparian vegetation zone width, sedimentation, and embeddedness. All three of these are related. As the trees and brush are cut back from the stream bank for agriculture, pasture, or lawns, more soil will wash off of the banks and add sediment to the stream, thus further embedding the substrate. This data along with the results from the benthic samples, point to development and the resulting increases in sediment load to the stream as the problem affecting the largest number of streams in this watershed.

FINDINGS - BACTERIAL AND PHYSICO-CHEMICAL SAMPLING

The results of the four field measured parameters and the fecal coliform bacteria levels are in Table 17. The results for all other water quality parameters are in Tables 18 and 19.

Water temperature ranged from 9.4 to 24.7 degrees Celsius, with a mean of 15.6 and a median of 13.4. The pH of the streams in this watershed was generally between 6.0 and 8.2 standard units. One site had a pH of 4.8. This was Rich Fork of Twomile Creek (WVK-41-D.5), which has known acid mine drainage problems.

The mean level of dissolved oxygen (DO) was 8.9 mg/l (median 9.4), and ranged from 3.5 to 11.1. Only two sites had DO levels below 5.0. Little Fivemile Creek (WVK-6-A) had the lowest value of 3.5 mg/l. This site was not sampled for benthos, however the water chemistry, time of day, and presence of high periphyton or other plant life indicate the probability of impairment caused by a poorly managed cattle feed lot. The other site with a low DO level was the unnamed tributary of Pond Branch (WVK-11-0.5-{0.6}). It also drained an area with a high cattle density. This site also was very flat, lacking any turbulent areas where oxygen is mixed into the water, thus partially explaining the low DO.

The conductivity of the water at the sites ranged from 46 to 713 µmhos/cm and had a mean of 241 (median - 213).

The West Virginia water quality standards state that for primary contact recreation (e.g., swimming, boating, fishing), the fecal coliform bacteria content is not to exceed 400 colonies/100 ml in more than 10% of all samples taken during a month. In other words, streams with a count greater than 400 are generally considered to be unsafe. Fecal coliform bacteria concentrations for every site may be found in Table 17 in Appendix A.

> **FECAL COLIFORM BACTERIA**
>
> **Fecal Coliform Bacteria are organisms that naturally live in the intestines of birds and mammals, including man.**
>
> **Released to the environment in feces, disease-causing organisms may accompany fecal coliform bacteria. Thus, the presence of fecal coliform in a water sample indicates the potential presence of human pathogens. A stream could have a high concentration of fecal coliform bacteria due to a variety of sources, including failing septic systems, wildlife that concentrates along a stream, livestock herds with free access to the stream and field applied manure that washes into the stream. Therefore, understanding local land uses is important for inferring the reasons for a high count at any particular site.**

The nutrient data reveals problems in several areas (Table 18). The two streams with the low dissolved oxygen levels (Little Fivemile and an unnamed tributary of Pond Branch) also had high levels of phosphorus. Several sites within the Hurricane Creek watershed had elevated levels of both nitrogen and phosphorus. The site on Craigs Branch (WVK-41-D.5-B) which drains a closed municipal landfill had a nitrogen (nitrite + nitrate) level of 0.48 mg/l. Both Holmes Branch sites below a suspected sewage dumping area had elevated levels of nitrogen (0.40 and 0.29 mg/l) and one had high levels of phosphorus (0.49 mg/l).

Forty-three sites had water samples analyzed for the presence of metals. Twelve of these sites were for acid mine drainage parameters (aluminum, iron and manganese) only. The results are in Table 19. Six of these sites exceeded the criterion for at least one of the AMD parameters. These six sites were: the unnamed tributary of Pond Branch (WVK-11-0.5-{0.6}), Rich Fork of Twomile

Creek (WVK-41-D.5), Lower Ninemile Creek (WVK-9-C-{5.4}), Heizer Creek (WVKP-1), Manilla Creek (WVKP-1-A) and Harmond Creek (WVKP-4). Figure 12 presents the geographic location of these sites.

The unnamed tributary of Pond Branch (WVK-11-0.5-{0.6}) had noticeably high levels of magnesium (10mg/l), aluminum (1.3 mg/l), iron (3.2 mg/l), and manganese (2.5 mg/l). As this site was in the middle of pastureland, the source of these metals is unknown.

The two upstream sites on Hurricane Creek (WVK-22-{10.6}, and WVK-22-{14.4}) had the highest zinc levels in the watershed. These sites are downstream of the Hurricane wastewater treatment plant. Water treatment plants use zinc orthophosphate to coat their lines and prevent lead from being released into the drinking water. The drinking water carries the dissolved zinc to wastewater treatment plants where it is discharged to streams. It is unknown if the high zinc concentrations originate at the wastewater treatment plant.

The Heizer Creek (WVKP-1) sample had the highest level of iron (5.1 mg/l) and its tributary, Manilla Creek WVKP-1-A) had the second highest (4.4 mg/l). Manilla Creek also had high levels of aluminum (1.8 mg/l). Harmond Creek (WVKP-4), which was noted as having a white precipitate on the substrate, had the highest aluminum level measured (4.1 mg/l). The site with the lowest pH and known AMD problems (Rich Fork of Twomile Creek (WVKP-41-D.5)), predictably had levels of aluminum (3.6 mg/l) and manganese (1.2 mg/l) which exceed the state's water quality standards (0.75 mg/l for aluminum and 1.0 mg/l for manganese), and had slightly elevated levels of iron.

IMPLICATIONS

The restoration of highly degraded streams and the preservation of high quality streams present great challenges to the Program and other concerned agencies, as well as the citizens of West Virginia. The mission of the Office of Water Resources, is to address these challenges by enhancing and preserving the physical, chemical and biological integrity of surface and ground waters, considering nature and the health, safety, recreational and economic needs of humanity. The following discussion attempts to address the charges of restoration and preservation of streams assessed by the Program in the Lower Kanawha River watershed. Ideally, a discussion of the status of each stream would be presented. However, due to the extensive scope of the study, implications are given in generalities, with citations of specific examples given for illustration.

Approximately 75% of the named streams in the Lower Kanawha River watershed were not visited and therefore received no assessment. Although assessments at most sites visited were more thorough than past OWR efforts, checking only one fourth of the named streams and only a few of the unnamed streams in a watershed leaves many questions unanswered, especially regarding the smaller headwater streams.

Reducing cattle access to streams would improve water quality in this and other watersheds. When cattle and other domestic livestock are allowed free access to streams, it results in the degradation of the stream banks, increased erosion, increased sediment in the streams, increased nutrients and increased fecal coliform bacteria concentrations. Continuing and enhancing efforts to communicate this information to farmers throughout West Virginia is a major recommendation by the Program.

Nutrients and bacteria from failing septic systems or other improper disposal of sewage or gray water also have a major impact on water. The Program recommends developing a process to communicate information on these impacts and their costs to the taxpayer in West Virginia in an attempt to reduce these impacts.

RECCOMENDATIONS BY THE PROGRAM

- **Enhance the processes to educate farmers on the benefits of reducing cattle access to streams.**
- **Develop a process to eliminate failing septic and sewer systems and straight pipe discharges to streams.**
- **Develop a program to restore instream habitat destroyed by construction of interstates and other highways.**
- **Resample Saltlick Creek (WVK-16-J-3) at a site with more productive habitat to determine if there are additional problems on this stream.**
- **Sample the unnamed tributary of Harmond Creek to determine if it is the source of the AMD impacting Harmond Creek.**
- **Conduct additional sampling on Cabbage Fork to document the recovery from the impact of the oil tank spill there.**
- **Sample above and below the developments on Trace Fork to determine the extent of the impact these developments have on the stream.**
- **Additional sampling at several sites to accurately identify the source and nature of the stressors to those sites.**

The Program recommends re-sampling Saltlick Creek of Eighteenmile Creek at a site with more productive habitat to determine if there are additional problems on this stream.

The Program recommends sampling the unnamed tributary of Harmond Creek known locally as Church of Nazarene Creek to determine if it is the source of the acid mine drainage impacting Harmond Creek. If so the Program recommends initiating restoration activities in this area.

The Program recommends development of a program to restore instream habitat destroyed by construction of interstates and other highways. A major portion of such a program would include placing large boulders and cobble in the stream to provide habitat for benthic macroinvertebrates. Any such program must be developed in coordination with the Division of Highways.

The Program recommends conducting additional sampling at the site on Cabbage Fork (WVKP-33-G) in Roane County to document to stages of recovery from the impact of the oil tank spill that occurred there.

The Program recommends sampling above and below the developments on Trace Fork (WVK-41) (Dudley Farms Plaza and The Shoppes at Trace Fork) to determine the extent of the impact these developments had on the stream.

Additional sampling is recommended at several sites to accurately determine the source and nature of the stressors to those sites. These sites include: Dudden Fork (WVKP-17-E-{2.6}), Camp Creek (WVK-26), Broadtree Run (WVKP-16-B), Anderson Lick Run (WVKKP-28-E), Vintroux Hollow (WVK-32-0.1A), Coal Hollow (WVK-39-J), and Joplin Branch (WVK-42).

NATURAL GAS PIPELINE

ADDITIONAL RESOURCES

The watershed movement in West Virginia includes a wide variety of federal, state and non-governmental organizations that are available to help improve the health of the streams in this watershed. Several agencies have established the West Virginia Watershed Management Framework. A basin coordinator has been employed to coordinate the activities of these agencies. The basin coordinator may be contacted at (304) 558-2108. In addition, the DEP's Stream Partners Program, available at (800) 556-8181, serves as a clearinghouse for these and other resources.

CHEMICAL PLANT AT INSTITUTE

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APPENDIX A: TABLES

TABLE 3: SAMPLING SITES

#	Stream Name	Stream AN-Code	Date	Latitude Deg	Min	Sec	Longitude Deg	Min	Sec	County	Ecoregion
1	FIVEMILE CREEK	WVK-6	5/13/97	38	46	52.39	82	3	48.66	MASO	70b
2	LITTLE FIVEMILE CREEK	WVK-6-A	5/13/97	38	48	4.46	82	4	50.36	MASO	70b
3	UPPER NINEMILE CREEK	WVK-9-A-(DUP1)	5/13/97	38	46	1.99	82	0	37.66	MASO	70b
4	UPPER NINEMILE CREEK	WVK-9-A-(DUP2)	5/13/97	38	46	5.48	82	0	36.76	MASO	70b
5	LOWER NINEMILE CREEK	WVK-9-C-{5.4}	6/9/97	38	44	18.48	82	2	33.22	MASO	70b
6	COOPER CREEK	WVK-10-A	5/14/97	38	46	12.03	81	57	17.56	MASO	70b
7	BARNETT FORK	WVK-10-F	5/14/97	38	49	9.95	81	56	0.73	MASO	70a
8	POND BRANCH	WVK-11	5/13/97	38	44	33.65	81	58	46.14	MASO	70b
9	U.T. OF POND BRANCH	WVK-11-0.5-{0.6}	6/10/97	38	45	1.61	81	58	47.03	MASO	70b
THIRTEENMILE CREEK											
10	THIRTEENMILE CREEK	WVK-12-{12.0}	5/19/97	38	41	24.71	81	54	35.43	MASO	70b
11	ROCKY FORK	WVK-12-A	5/14/97	38	44	9.64	81	55	48.88	MASO	70b
12	MUDLICK FORK	WVK-12-E-{2.4}	6/10/97	38	42	3.36	81	52	4.96	MASO	70a
13	U.T. OF MUDLICK FORK	WVK-12-E-2.5-{0.4}	6/11/97	38	41	4.77	81	49	24.59	MASO	70a
14	POPLAR FORK	WVK-12-F	5/14/97	38	42	41.74	81	53	3.52	MASO	70a
15	POPLAR FORK	WVK-12-F-{5.0}	6/16/97	38	46	0.84	81	54	1.47	MASO	70a
16	THIRTEENMILE CREEK	WVK-12-{20.7}	5/19/97	38	44	26.66	81	51	10.38	MASO	70a
17	BAKER BRANCH	WVK-12-H	5/19/97	38	44	9.86	81	50	34.98	MASO	70a
18	BEE RUN	WVK-12-J	5/19/97	38	44	14.91	81	49	15.55	MASO	70a
19	LITTLE SIXTEENMILE CREEK	WVK-13	5/12/97	38	42	37.05	82	1	8.52	MASO	70b
20	SIXTEENMILE CREEK	WVK-14	5/14/97	38	40	48.69	81	58	38.26	MASO	70b
21	SIXTEENMILE CREEK	WVK-14-{2.2}	6/10/97	38	40	56.88	81	58	38.35	MASO	70b
22	U.T. OF SIXTEENMILE CREEK	WVK-14-A.5-{1.6}	6/9/97	38	38	42.92	82	1	29.90	MASO	70b
23	U.T. OF FIVEFORK BRANCH	WVK-14-B-1	5/12/97	38	40	23.31	82	3	20.85	MASO	70b
EIGHTEENMILE CREEK											
24	EIGHTEENMILE CREEK	WVK-16-{3.5}	5/21/97	38	37	34.59	81	56	55.62	PUTN	70b
25	JAKES BRANCH	WVK-16-B	5/21/97	38	36	43.00	81	56	32.00	PUTN	70b
26	LEFT FORK TURKEY BRANCH	WVK-16-G-1-{0.4}	6/16/97	38	38	31.16	81	52	50.46	PUTN	70a
27	EIGHTEENMILE CREEK	WVK-16-{12.8}	5/21/97	38	36	48.57	81	53	9.92	PUTN	70a
28	SALTLICK CREEK	WVK-16-J-3-{1.0}	6/19/97	38	34	48.98	81	48	56.38	PUTN	70a
29	SULUG CREEK	WVK-16-L	5/20/97	38	38	6.60	81	49	11.64	PUTN	70a
30	EIGHTEENMILE CREEK	WVK-16-{25.0}	5/21/97	38	38	57.63	81	46	39.80	PUTN	70a
31	HARRIS BRANCH	WVK-16-Q-{1.0}	6/11/97	38	39	45.11	81	46	37.01	PUTN	70a
32	COTTRELL RUN	WVK-16-S	5/20/97	38	39	50.09	81	44	24.21	PUTN	70a
33	EIGHTEENMILE CREEK	WVK-16-{33.0}	6/16/97	38	40	13.44	81	44	13.81	JACK	70a
34	L FK FIVE & TWENTY MILE CK	WVK-19-C-(DUP1)	5/20/97	38	32	24.82	82	1	13.27	PUTN	70b
35	L FK FIVE & TWENTY MILE CK	WVK-19-C-(DUP2)	5/20/97	38	32	24.82	82	1	13.27	PUTN	70b
HURRICANE CREEK											
36	POPLAR FORK	WVK-22-B	5/28/97	38	30	2.84	81	59	37.99	PUTN	70b
37	COW CREEK	WVK-22-B-2	5/28/97	38	29	12.86	81	59	7.33	PUTN	70b
38	LONG BRANCH	WVK-22-B-3	5/28/97	38	28	26.93	81	56	38.45	PUTN	70b

TABLE 3: SAMPLING SITES (continued)

#	Stream Name	Stream AN-Code	Date	Latitude Deg	Min	Sec	Longitude Deg	Min	Sec	County	Ecoregion
39	U.T. OF CROOKED CREEK	WVK-22-B-5-B	5/28/97	38	26	32.36	81	54	59.95	PUTN	70b
40	HURRICANE CREEK	WVK-22-{6.0}	6/11/97	38	31	9.98	81	59	42.79	PUTN	70b
41	HURRICANE CREEK	WVK-22-{10.6}	6/24/97	38	29	0.60	82	1	23.70	PUTN	70b
42	HURRICANE CREEK	WVK-22-{14.4}	6/24/97	38	26	47.90	82	0	30.70	PUTN	70b
43	RIDER CREEK	WVK-22-J-{1.3}	6/19/97	38	23	52.99	81	56	54.71	PUTN	70b
POCATALICO RIVER											
44	HEIZER CREEK	WVKP-1	5/14/97	38	29	51.51	81	47	10.24	PUTN	70b
45	MANILLA CREEK	WVKP-1-A	5/14/97	38	30	13.18	81	48	3.07	PUTN	70b
46	U.T. OF MANILLA CREEK	WVKP-1-A-0.1-{1.6}	6/11/97	38	29	49.26	81	48	29.08	PUTN	70b
47	BIGGER BRANCH	WVKP-1-B	5/15/97	38	30	14.70	81	46	24.90	PUTN	70b
48	POCATALICO RIVER	WVK-29-{4.7}	6/17/97	38	28	3.71	81	45	42.18	PUTN	70b
49	POCATALICO RIVER	WVK-29-{08.5}	6/17/97	38	28	47.26	81	45	4.71	PUTN	70b
50	HARMOND CREEK	WVKP-4	5/14/97	38	28	56.25	81	44	23.39	PUTN	70b
51	ROCKY FORK	WVKP-5	5/19/97	38	27	19.38	81	43	23.68	KANA	70b
52	SCHOOLHOUSE BRANCH	WVKP-8	5/19/97	38	28	55.55	81	43	4.56	KANA	70b
53	SPRING BRANCH	WVKP-9-A	5/19/97	38	31	9.21	81	43	39.03	KANA	70b
54	TUPPER CREEK	WVKP-13-{1.3}	5/19/97	38	30	53.23	81	38	38.22	KANA	70b
55	TURKEYPEN BRANCH	WVKP-13-A-1-A	5/20/97	38	28	53.97	81	36	37.75	KANA	70b
56	TUPPER CREEK	WVKP-13-{3.0}	6/24/97	38	29	24.20	81	38	33.10	KANA	70b
57	GRAPEVINE CREEK	WVKP-16-{4.5}	6/10/97	38	31	25.67	81	34	32.65	KANA	70b
58	BROADTREE RUN	WVKP-16-B	5/12/97	38	31	25.58	81	34	25.66	KANA	70b
59	VANCE HOLLOW	WVKP-16-D	5/12/97	38	30	53.41	81	33	39.19	KANA	70b
POCATALICO CREEK											
60	POCATALICO CREEK	WVKP-17-{0.3}	6/10/97	38	32	54.15	81	38	2.43	KANA	70b
61	FIRST CREEK / MIDDLE FORK	WVKP-17-B-5	5/13/97	38	36	6.73	81	34	51.84	JACK	70b
62	SECOND CREEK	WVKP-17-B-6	5/13/97	38	36	57.00	81	34	42.00	JACK	70b
63	DAN SLATER HOLLOW	WVKP-17-C-1-A	5/14/97	38	34	40.98	81	39	53.15	KANA	70b
64	RAILROAD HOLLOW	WVKP-17-C-4	5/14/97	38	35	2.20	81	41	46.93	KANA	70b
65	U.T. OF ALLENS FORK	WVKP-17-C-4.5-{1}	6/10/97	38	35	42.49	81	42	40.17	KANA	70a
66	DUDDEN FORK	WVKP-17-E-{2.6}	6/12/97	38	37	53.24	81	38	49.73	JACK	70b
67	LOOM TREE HOLLOW	WVKP-17-F-1	5/13/97	38	36	43.99	81	40	21.78	JACK	70b
68	FABER HOLLOW	WVKP-17-G	5/13/97	38	37	19.65	81	39	53.28	JACK	70b
69	RACCOON CREEK	WVKP-20	5/12/97	38	32	55.83	81	34	49.35	KANA	70b
70	PERNEL BRANCH	WVKP-21	5/12/97	38	33	42.21	81	34	29.37	KANA	70b
71	POCATALICO RIVER	WVK-29-{32.5}	6/18/97	38	33	29.63	81	34	33.54	KANA	70b
72	POCATALICO RIVER	WVK-29-{35.0}	5/13/97	38	33	23.81	81	33	45.65	KANA	70b
73	CAMP CREEK	WVKP-26	5/12/97	38	34	59.96	81	31	43.59	KANA	70b
74	GREEN CREEK	WVKP-28	5/28/97	38	34	23.49	81	28	48.95	ROAN	70b
75	HUNT FORK	WVKP-28-A-1-{0.7}	6/12/97	38	33	12.96	81	29	36.75	KANA	70b

TABLE 3: SAMPLING SITES (continued)

#	Stream Name	Stream AN-Code	Date	Latitude Deg Min Sec	Longitude Deg Min Sec	County	Ecoregion
76	BEAR BRANCH	WVKP-28-B-1	5/28/97	38 34 56.58	81 28 46.21	ROAN	70b
77	ANDERSON LICK RUN	WVKP-28-E	5/28/97	38 34 53.35	81 26 1.16	ROAN	70b
78	STRAIGHT CREEK	WVKP-29	5/12/97	38 35 55.30	81 30 24.75	ROAN	70b
79	SUGAR CAMP HOLLOW	WVKP-32-.5A	5/28/97	38 38 9.67	81 29 57.58	ROAN	70b
80	WOLF CREEK	WVKP-32-{1.0}	6/12/97	38 38 8.87	81 30 0.22	ROAN	70b
81	FLAT FORK	WVKP-33-{0.1}	5/28/97	38 37 50.99	81 28 25.43	ROAN	70b
82	FLAT FORK	WVKP-33-{5.8}	6/9/97	38 40 13.45	81 28 57.14	ROAN	70b
83	COON RUN	WVKP-33-D-{0.8}	6/9/97	38 41 33.45	81 29 45.13	ROAN	70b
84	CABBAGE FORK	WVKP-33-G	5/22/97	38 42 35.35	81 26 46.44	ROAN	70a
85	BONER HOLLOW	WVKP-36-B	5/22/97	38 39 16.46	81 25 33.23	ROAN	70b
86	SNAKE HOLLOW	WVKP-37-A	5/22/97	38 38 1.51	81 23 36.13	ROAN	70b
87	POCATALICO RIVER	WVK-29-{61.0}	6/10/97	38 39 42.04	81 22 52.48	ROAN	70b
88	GREATHOUSE HOLLOW	WVKP-38-.8A	5/22/97	38 38 9.67	81 21 18.86	ROAN	70b
89	HOLLYWOOD FORK	WVKP-38-D-(DUP1)	5/22/97	38 37 56.21	81 18 50.57	ROAN	70b
90	HOLLYWOOD FORK	WVKP-38-D-(DUP2)	5/22/97	38 37 56.19	81 18 50.56	ROAN	70b
91	ROUND KNOB RUN	WVKP-40	5/21/97	38 40 15.49	81 22 14.71	ROAN	70b
92	SLAB FORK	WVKP-41-A	5/21/97	38 41 17.84	81 20 27.17	ROAN	70b
93	LAUREL FORK	WVKP-43-{1.6}	6/12/97	38 41 18.01	81 17 51.01	ROAN	70b
94	SMITH RUN	WVKP-43-A	5/21/97	38 41 52.82	81 17 4.38	ROAN	70b
95	VINEYARD RUN	WVKP-45.5	5/21/97	38 39 31.13	81 17 29.60	ROAN	70b
96	ARMOUR CREEK	WVK-30	5/15/97	38 26 15.94	81 49 59.13	PUTN	70b
97	VINTROUX HOLLOW	WVK-32-0.1A	5/15/97	38 26 1.89	81 51 31.28	PUTN	70b
98	ROCKSTEP RUN	WVK-32-A	5/15/97	38 26 41.78	81 52 20.30	PUTN	70b
99	GALLATIN BRANCH	WVK-33	5/14/97	38 24 43.16	81 51 36.89	KANA	70b
100	FINNEY BRANCH	WVK-36-{2.4}	6/11/97	38 23 38.18	81 45 39.12	KANA	70b
DAVIS CREEK							
101	WARD HOLLOW	WVK-39-A	5/13/97	38 21 38.00	81 42 12.00	KANA	70b
102	DAVIS CREEK	WVK-39-{01.6}	5/6/97	38 20 46.55	81 42 39.90	KANA	70b
103	TRACE FORK	WVK-39-B-{0.1}	5/6/97	38 20 37.05	81 42 41.86	KANA	70b
104	BAYS FORK	WVK-39-E-3-{0.4}	5/8/97	38 16 50.55	81 42 5.48	KANA	69d
105	BAYS FORK	WVK-39-E-3-{0.6}	5/12/97	38 16 29.60	81 42 29.50	KANA	69d
106	RAYS BRANCH	WVK-39-F	5/12/97	38 19 26.54	81 40 49.42	KANA	70b
107	COAL HOLLOW	WVK-39-J	5/13/97	38 18 10.38	81 39 39.81	KANA	70b
108	DAVIS CREEK	WVK-39-{09.4}	5/13/97	38 17 35.00	81 38 37.00	KANA	69d
109	HOFFMAN HOLLOW	WVK-39-M-1-A-{1.0}	6/12/97	38 14 59.95	81 38 30.48	KANA	69d
110	SHREWSBURY HOLLOW	WVK-39-O	5/13/97	38 16 18.00	81 39 33.00	KANA	69d
111	DAVIS CREEK	WVK-39-{12.2}	6/12/97	38 15 56.10	81 39 59.60	KANA	69d

TABLE 3: SAMPLING SITES (continued)

#	Stream Name	Stream AN-Code	Date	Latitude Deg Min Sec	Longitude Deg Min Sec	County	Ecoregion
TWO MILE CREEK							
112	WOODWARD BRANCH	WVK-41-A	5/16/97	38 22 23.35	81 40 25.97	KANA	70b
113	TWO MILE CREEK	WVK-41	5/13/97	38 22 43.00	81 39 45.00	KANA	70b
114	U.T. OF L FK / TWO MILE	WVK-41-D-1	5/15/97	38 24 39.01	81 40 10.77	KANA	70b
115	RICH FORK/TWO MILE	WVK-41-D.5	5/15/97	38 25 28.29	81 38 29.01	KANA	70b
116	CRAIGS BRANCH	WVK-41-D.5-B	5/15/97	38 25 19.00	81 38 23.94	KANA	70b
117	EDENS FORK	WVK-41-E-1	5/20/97	38 24 45.35	81 37 36.88	KANA	70b
118	HOLMES BRANCH	WVK-41-E-2-{0.1}	5/14/97	38 25 22.63	81 37 18.96	KANA	70b
119	HOLMES BRANCH	WVK-41-E-2-{1.4}	5/16/97	38 25 19.00	81 35 54.00	KANA	70b
120	HOLMES BRANCH	WVK-41-E-2-{1.7}	5/16/97	38 25 28.00	81 35 33.00	KANA	70b
121	JOPLIN BRANCH	WVK-42	5/13/97	38 20 42.00	81 40 37.00	KANA	70b

Corresponds to number in Figure 7, 8 and 9

Counties
MASO = Mason
PUTN = Putnam
JACK = Jackson
KANA = Kanawha
ROAN = Roane

Ecoregion = US EPA's Level III Ecoregions (Omernik, 1997):
69d = Central Appalachians
70a = Western Allegheny Plateau
70b = Monongahela Transition

TABLE 4: STUDY REACH CHARACTERISTICS				
Stream AN-Code	Average Stream Width (M)	Average Riffle Depth (M)	Average Run Depth (M)	Average Pool Depth (M)
WVK-6	6.6	0.13	0.18	0.60
WVK-9-A-(DUP1)	4.5	0.10	0.15	0.39
WVK-9-A-(DUP2)	4.5	0.10	0.15	0.39
WVK-9-C-{5.4}	0.9	NP	NP	0.01
WVK-10-A	5.3	0.09	0.15	0.21
WVK-10-F	2.4	0.13	0.18	0.62
WVK-11	1.9	0.10	NP	0.40
WVK-11-0.5-{0.6}	0.8	NP	NP	0.15
WVK-12-A	2.5	0.13	0.18	0.42
WVK-12-{12.0}	13.8	0.10	0.70	1.00
WVK-12-E-{2.4}	6.4	0.20	0.40	0.75
WVK-12-E-2.5-{0.4}	1.6	0.02	0.08	0.40
WVK-12-F	3.8	0.17	0.50	0.50
WVK-12-F-{5.0}	2.4	0.05	0.08	0.28
WVK-12-{20.7}	9.6	0.14	0.25	0.70
WVK-12-H	3.4	0.05	0.38	1.00
WVK-12-J	1.1	0.07	0.10	0.30
WVK-13	3.3	0.05	NP	0.30
WVK-14	7.2	0.16	0.39	0.50
WVK-14-{2.2}	5.7	0.15	0.17	0.30
WVK-14-A.5-{1.6}	3.4	0.13	0.23	0.42
WVK-14-B-1	2.7	0.08	0.15	0.25
WVK-16-B	1.5	0.04	0.11	0.29
WVK-16-G-1-{0.4}	1.6	0.04	0.10	0.18
WVK-16-{12.8}	13.1	0.18	0.30	2.00
WVK-16-J-3-{1.0}	3.6	0.01	0.12	0.25
WVK-16-L	3.1	0.08	0.15	0.40
WVK-16-{25.0}	4.9	0.10	0.30	0.72
WVK-16-Q-{1.0}	1.5	0.04	0.08	0.30
WVK-16-S	1.6	0.05	0.10	0.31
WVK-16-{33.0}	3.7	0.15	0.20	0.00
WVK-19-C-(DUP1)	1.8	0.07	0.13	0.48
WVK-19-C-(DUP2)	1.8	0.20	0.13	0.48
WVK-22-B	7.0	0.15	0.27	1.00
WVK-22-B-2	2.6	0.07	0.20	0.35
WVK-22-B-3	2.7	0.12	0.25	0.40
WVK-22-B-5-B	1.2	0.08	0.09	0.11
WVK-22-{6.0}	13.0	0.10	0.55	1.00
WVK-22-{10.6}	12.3	0.05	0.15	0.75
WVK-22-{14.4}	10.0	0.05	0.20	0.50
WVK-22-J-{1.3}	2.2	0.02	0.12	0.50

TABLE 4: STUDY REACH CHARACTERISTICS (continued)				
Stream AN-Code	**Average Stream Width (M)**	**Average Riffle Depth (M)**	**Average Run Depth (M)**	**Average Pool Depth (M)**
WVKP-1	5.1	NP	0.20	0.30
WVKP-1-A	7.5	0.10	0.30	too deep to measure
WVKP-1-A-0.1-{1.6}	1.4	0.05	0.20	0.40
WVKP-1-B	1.7	0.05	0.10	0.10
WVK-29-{4.7}	30.0	NP	NP	3.00
WVK-29-{08.5}	25.0	NP	NP	2.50
WVKP-4	3.5	0.10	0.30	0.60
WVKP-5	6.0	0.20	0.40	0.60
WVKP-8	0.6	0.05	0.15	0.20
WVKP-9-A	1.9	0.08	0.20	0.45
WVKP-13-{1.3}	7.6	0.20	0.25	0.50
WVKP-13-A-1-A	1.6	0.05	0.20	0.45
WVKP-13-{3.0}	4.2	0.10	0.20	0.30
WVKP-16-{4.5}	3.8	0.10	0.25	NP
WVKP-16-B	1.7	0.03	0.10	0.30
WVKP-16-D	1.2	0.05	0.10	0.25
WVKP-17-{0.3}	10.0	NP	too deep to measure	too deep to measure
WVKP-17-B-5	1.4	0.15	0.20	0.80
WVKP-17-C-1-A	1.8	0.05	0.15	0.50
WVKP-17-C-4	0.9	0.04	NP	0.25
WVKP-17-C-4.5-{1}	0.8	0.03	NP	0.20
WVKP-17-E-{2.6}	1.8	0.10	0.25	0.45
WVKP-17-F-1	1.5	0.10	0.15	0.40
WVKP-17-G	1.2	0.05	0.10	0.30
WVKP-20	1.7	0.07	0.15	0.35
WVKP-21	1.6	0.05	0.10	0.40
WVK-29-{32.5}	15.0	NP	NP	1.20
WVKP-26	2.2	0.05	0.18	NP
WVKP-28	5.8	0.10	0.30	0.55
WVKP-28-A-1-{0.7}	1.1	0.05	0.15	0.25
WVKP-28-B-1	1.1	0.08	0.20	0.30
WVKP-28-E	1.4	0.08	NP	0.25
WVKP-29	1.7	0.05	0.15	0.40
WVKP-32-.5A	1.5	0.05	0.10	0.25
WVKP-32-{1.0}	4.1	0.07	0.55	0.65
WVKP-33-{0.1}	8.3	NP	0.25	0.70
WVKP-33-{5.8}	9.8	0.10	0.40	0.60
WVKP-33-D-{0.8}	0.9	0.03	NP	0.20
WVKP-33-G	1.9	0.05	0.20	0.40
WVKP-36-B	1.1	0.07	0.10	0.35
WVKP-37-A	1.4	0.05	0.10	0.30
WVK-29-{61.0}	9.0	0.10	0.20	NP

TABLE 4: STUDY REACH CHARACTERISTICS (continued)

Stream AN-Code	Average Stream Width (M)	Average Riffle Depth (M)	Average Run Depth (M)	Average Pool Depth (M)
WVKP-38-.8A	0.9	0.05	0.15	0.25
WVKP-38-D-(DUP1)	1.0	0.07	0.15	0.35
WVKP-38-D-(DUP2)	0.9	0.03	0.10	0.20
WVKP-40	3.0	0.10	0.45	0.90
WVKP-41-A	2.3	0.08	0.25	NP
WVKP-43-{1.6}	1.9	0.08	0.12	0.25
WVKP-43-A	0.4	0.05	0.15	0.45
WVKP-45.5	1.6	0.05	0.15	0.25
WVK-30	5.6	0.15	0.40	0.30
WVK-32-0.1A	1.6	0.02	0.10	0.10
WVK-32-A	3.1	0.03	0.10	0.25
WVK-33	1.2	0.05	0.10	0.15
WVK-36-{2.4}	0.7	0.05	NP	0.25
WVK-39-A	1.6	0.08	0.20	0.20
WVK-39-{01.6}	15.0	NP	0.40	0.00
WVK-39-B-{0.1}	6.7	0.15	0.20	0.35
WVK-39-E-3-{0.4}	5.7	0.15	0.15	0.40
WVK-39-E-3-{0.6}	2.8	0.10	0.20	0.23
WVK-39-F	3.2	0.10	0.20	0.20
WVK-39-J	2.3	0.10	0.20	0.25
WVK-39-{09.4}	7.4	0.15	0.40	0.40
WVK-39-M-1-A-{1.0}	2.1	0.05	0.20	0.15
WVK-39-O	1.9	0.10	0.20	0.30
WVK-39-{12.2}	6.0	0.10	0.30	0.35
WVK-41-A	3.0	NP	0.02	0.40
WVK-41	10.2	0.10	0.25	0.40
WVK-41-D-1	2.1	0.10	0.20	0.35
WVK-41-D.5	1.2	0.08	0.15	0.45
WVK-41-D.5-B	1.0	0.05	0.15	0.30
WVK-41-E-1	1.7	0.05	0.15	0.40
WVK-41-E-2-{0.1}	1.2	0.10	0.20	NP
WVK-41-E-2-{1.4}	0.6	0.50	NP	NP
WVK-41-E-2-{1.7}	1.1	0.03	NP	0.30
WVK-42	2.9	0.10	0.30	0.30

NP = habitat type not present.
M = meter

TABLE 5: EROSION, NONPOINT SOURCE POLLUTION, OTHER OBSERVATIONS					
Stream AN-Code	**Erosion**	**NPS Pollution**	**Periphyton**	**Aesthetic**	**Remoteness**
WVK-6	HEAVY	OBVIOUS	HIGH	14	3
WVK-9-A-(DUP1)	MODERATE	OBVIOUS	HIGH	12	8
WVK-9-A-(DUP2)	MODERATE	OBVIOUS	HIGH	12	8
WVK-9-C-{5.4}	NONE	NONE	LOW	17	13
WVK-10-A	SLIGHT	OBVIOUS	MODERATE	18	4
WVK-10-F	MODERATE	OBVIOUS	LOW	17	10
WVK-11	MODERATE	OBVIOUS	HIGH	1	1
WVK-11-0.5-{0.6}	MODERATE	OBVIOUS	MODERATE	11	3
WVK-12-A	HEAVY	OBVIOUS	MODERATE	13	8
WVK-12-{12.0}	HEAVY	OBVIOUS	HIGH	13	13
WVK-12-E-{2.4}	MODERATE	NONE	MODERATE	13	12
WVK-12-E-2.5-{0.4}	NONE	NONE	LOW	19	13
WVK-12-F	HEAVY	OBVIOUS	HIGH	9	3
WVK-12-F-{5.0}	SLIGHT	POTENTIAL	MODERATE	16	10
WVK-12-{20.7}	HEAVY	OBVIOUS	MODERATE	12	7
WVK-12-H	MODERATE	OBVIOUS	MODERATE	15	7
WVK-12-J	MODERATE	POTENTIAL	LOW	17	10
WVK-13	SLIGHT	NONE	MODERATE	17	11
WVK-14	HEAVY	OBVIOUS	HIGH	15	9
WVK-14-{2.2}	MODERATE	OBVIOUS	LOW	15	8
WVK-14-A.5-{1.6}	MODERATE	POTENTIAL	LOW	18	10
WVK-14-B-1	SLIGHT	NONE	MODERATE	20	15
WVK-16-B	MODERATE	OBVIOUS	MODERATE	17	8
WVK-16-G-1-{0.4}	MODERATE	OBVIOUS	MODERATE	9	6
WVK-16-{12.8}	MODERATE	OBVIOUS	MODERATE	15	10
WVK-16-J-3-{1.0}	SLIGHT	POTENTIAL	MODERATE	9	10
WVK-16-L	SLIGHT	POTENTIAL	MODERATE	11	10
WVK-16-{25.0}	HEAVY	OBVIOUS	HIGH	13	7
WVK-16-Q-{1.0}	SLIGHT	OBVIOUS	MODERATE	19	10
WVK-16-S	MODERATE	OBVIOUS	MODERATE	16	5
WVK-16-{33.0}	SLIGHT	POTENTIAL	HIGH	13	13
WVK-19-C-(DUP1)	MODERATE	POTENTIAL	HIGH	10	8
WVK-19-C-(DUP2)	MODERATE	OBVIOUS	HIGH	8	6
WVK-22-B	MODERATE	POTENTIAL	LOW	11	8
WVK-22-B-2	MODERATE	OBVIOUS	LOW	8	8
WVK-22-B-3	HEAVY	OBVIOUS	LOW	13	6
WVK-22-B-5-B	SLIGHT	OBVIOUS	LOW	7	0
WVK-22-{6.0}	MODERATE	POTENTIAL	HIGH	10	5
WVK-22-{10.6}	SLIGHT	POTENTIAL	LOW	18	11
WVK-22-{14.4}	HEAVY	POTENTIAL	MODERATE	1	1
WVK-22-J-{1.3}	HEAVY	OBVIOUS	MODERATE	19	12

See page 86 for header explanations

TABLE 5: EROSION, NONPOINT SOURCE POLLUTION, OTHER OBSERVATIONS (continued)

Stream AN-Code	Erosion	NPS Pollution	Periphyton	Aesthetic	Remoteness
WVKP-1	HEAVY	OBVIOUS	LOW	4	0
WVKP-1-A	MODERATE	OBVIOUS	LOW	10	2
WVKP-1-A-0.1-{1.6}	MODERATE	POTENTIAL	MODERATE	11	15
WVKP-1-B	MODERATE	OBVIOUS	LOW	1	2
WVK-29-{4.7}	SLIGHT	POTENTIAL	MODERATE	14	15
WVKP-4	SLIGHT	OBVIOUS	LOW	8	3
WVKP-5	HEAVY	OBVIOUS	HIGH	15	9
WVKP-8	SLIGHT	POTENTIAL	MODERATE	15	7
WVKP-9-A	MODERATE	OBVIOUS	HIGH	11	6
WVKP-13-{1.3}	HEAVY	OBVIOUS	MODERATE	13	2
WVKP-13-A-1-A	HEAVY	POTENTIAL	MODERATE	15	8
WVKP-13-{3.0}	SLIGHT	POTENTIAL	LOW	5	8
WVKP-16-{4.5}	MODERATE	POTENTIAL	MODERATE	8	5
WVKP-16-B	SLIGHT	POTENTIAL	HIGH	10	5
WVKP-16-D	SLIGHT	POTENTIAL	MODERATE	15	9
WVKP-17-{0.3}	MODERATE	POTENTIAL	MODERATE	14	3
WVKP-17-B-5	NONE	POTENTIAL	MODERATE	16	10
WVKP-17-C-1-A	SLIGHT	OBVIOUS	MODERATE	7	6
WVKP-17-C-4	NONE	POTENTIAL	LOW	19	8
WVKP-17-C-4.5-{1}	SLIGHT	OBVIOUS	LOW	18	15
WVKP-17-E-{2.6}	SLIGHT	OBVIOUS	MODERATE	14	4
WVKP-17-F-1	SLIGHT	NONE	LOW	16	15
WVKP-17-G	SLIGHT	POTENTIAL	MODERATE	12	6
WVKP-20	MODERATE	OBVIOUS	MODERATE	10	5
WVKP-21	NONE	POTENTIAL	MODERATE	16	8
WVK-29-{32.5}	SLIGHT	POTENTIAL	MODERATE	16	15
WVKP-26	SLIGHT	POTENTIAL	MODERATE	7	3
WVKP-28	SLIGHT	NONE	MODERATE	19	15
WVKP-28-A-1-{0.7}	SLIGHT	POTENTIAL	MODERATE	16	7
WVKP-28-B-1	SLIGHT	POTENTIAL	MODERATE	5	7
WVKP-28-E	MODERATE	OBVIOUS	MODERATE	5	6
WVKP-29	SLIGHT	POTENTIAL	MODERATE	6	6
WVK-29-{61.0}	HEAVY	NONE	MODERATE	15	16
WVKP-32-.5A	MODERATE	OBVIOUS	MODERATE	18	10
WVKP-32-{1.0}	SLIGHT	NONE	LOW	11	11
WVKP-33-{0.1}	MODERATE	POTENTIAL	MODERATE	14	9
WVKP-33-{5.8}	MODERATE	POTENTIAL	HIGH	10	5
WVKP-33-D-{0.8}	MODERATE	OBVIOUS	MODERATE	13	15
WVKP-33-G	MODERATE	POTENTIAL	HIGH	8	7
WVKP-36-B	SLIGHT	POTENTIAL	MODERATE	18	10
WVKP-37-A	SLIGHT	POTENTIAL	HIGH	15	7

See page 86 for header explanations

TABLE 5: EROSION, NONPOINT SOURCE POLLUTION, OTHER OBSERVATIONS (continued)

Stream AN-Code	Erosion	NPS Pollution	Periphyton	Aesthetic	Remoteness
WVKP-38-.8A	NONE	OBVIOUS	MODERATE	13	10
WVKP-38-D-(DUP1)	SLIGHT	POTENTIAL	MODERATE	15	10
WVKP-38-D-(DUP2)	SLIGHT	POTENTIAL	LOW	11	9
WVKP-40	SLIGHT	OBVIOUS	HIGH	16	10
WVKP-41-A	SLIGHT	OBVIOUS	MODERATE	16	8
WVKP-43-{1.6}	SLIGHT	OBVIOUS	MODERATE	10	5
WVKP-43-A	SLIGHT	POTENTIAL	HIGH	16	10
WVKP-45.5	SLIGHT	OBVIOUS	MODERATE	14	5
WVK-30	MODERATE	OBVIOUS	LOW	10	3
WVK-32-0.1A	MODERATE	OBVIOUS	MODERATE	3	2
WVK-32-A	MODERATE	POTENTIAL	LOW	16	1
WVK-33	MODERATE	OBVIOUS	LOW	19	0
WVK-36-{2.4}	MODERATE	POTENTIAL	LOW	15	8
WVK-39-A	MODERATE	OBVIOUS	MODERATE	19	1
WVK-39-{01.6}	MODERATE	OBVIOUS	MODERATE	2	4
WVK-39-B-{0.1}	MODERATE	NONE	MODERATE	7	15
WVK-39-E-3-{0.4}	MODERATE	NONE	MODERATE	18	15
WVK-39-E-3-{0.6}	SLIGHT	NONE	MODERATE	20	18
WVK-39-F	HEAVY	POTENTIAL	LOW	11	1
WVK-39-J	SLIGHT	OBVIOUS	LOW	7	0
WVK-39-{09.4}	MODERATE	OBVIOUS	LOW	10	1
WVK-39-M-1-A-{1.0}	SLIGHT	POTENTIAL	LOW	20	12
WVK-39-O	SLIGHT	OBVIOUS	LOW	16	1
WVK-39-{12.2}	MODERATE	OBVIOUS	LOW	14	3
WVK-41-A	MODERATE	OBVIOUS	MODERATE	1	1
WVK-41	MODERATE	OBVIOUS	HIGH	2	1
WVK-41-D-1	SLIGHT	OBVIOUS	MODERATE	7	3
WVK-41-D.5	SLIGHT	OBVIOUS	LOW	12	2
WVK-41-D.5-B	SLIGHT	POTENTIAL	HIGH	11	5
WVK-41-E-1	SLIGHT	POTENTIAL	MODERATE	10	6
WVK-41-E-2-{0.1}	MODERATE	POTENTIAL	LOW	15	2
WVK-41-E-2-{1.4}	MODERATE	POTENTIAL	LOW	12	5
WVK-41-E-2-{1.7}	SLIGHT	POTENTIAL	MODERATE	8	5
WVK-42	SLIGHT	OBVIOUS	MODERATE	14	6

Erosion - erosion in the immediate area of the sample area
NPS Pollution - Non-Point Source Pollution running off the landscape in the vicinity of sample site
Periphyton - relative abundance of periphyton
Aesthetic - on a scale of 0-20, 20 being most aesthetically pleasing, largely related to presence of litter
Remoteness - on a scale of 0-20, 20 being the most remote

TABLE 6: STREAM REACH ACTIVITIES & DISTURBANCES - RESIDENTIAL AND RECREATIONAL

Stream AN-Code	RE	LN	DK RE	CN	PD 1	BC 1	PK	PL	DK RC	SW	FH	PD 2	TR	ATV	BC 2	Road		
																Type	Width	Surface
WVK-6																		
WVK-9-A-(DUP1)	✔	✔			✔	✔										A	A	C
WVK-9-A-(DUP2)	✔	✔			✔	✔										A	A	C
WVK-9-C-{5.4}																		
WVK-10-A	✔	✔				✔							✔			A	B	F
WVK-10-F																		
WVK-11																		
WVK-11-0.5-{0.6}	✔	✔				✔										A	A	C
WVK-12-{12.0}																		
WVK-12-A																		
WVK-12-E-{2.4}											✔		✔	✔		B	A	A
WVK-12-E-2.5-{0.4}													✔					
WVK-12-F		✔																
WVK-12-F-{5.0}	✔	✔														A	A	A
WVK-12-{20.7}					✔			✔		✔	✔	✔						
WVK-12-H																		
WVK-12-J														✔				
WVK-13														✔				
WVK-14																		
WVK-14-{2.2}																		
WVK-14-A.5-{1.6}																		
WVK-14-B-1													✔					
WVK-16-B																		
WVK-16-G-1-{0.4}		✔																
WVK-16-{12.8}																		
WVK-16-J-3-{1.0}		✔														A	A	A
WVK-16-L	✔	✔				✔												
WVK-16-{25.0}																		
WVK-16-Q-{1.0}													✔	✔				
WVK-16-S																		
WVK-16-{33.0}		✔				✔	✔									A	A	A
WVK-19-C-(DUP1)	✔	✔														A	A	C
WVK-19-C-(DUP2)	✔	✔														A	A	C
WVK-22-B	✔	✔		✔	✔	✔					✔		✔					
WVK-22-B-2																		
WVK-22-B-3							✔								✔	B	A	C
WVK-22-B-5-B	✔	✔												✔				
WVK-22-{6.0}	✔	✔				✔										A	B	C
WVK-22-{10.6}																		

See page 90 for header explanations

TABLE 6: STREAM REACH ACTIVITIES & DISTURBANCES RESIDENTIAL AND RECREATIONAL (continued)

Stream AN-Code	RE	LN	DK RE	CN	PD 1	BC 1	PK	PL	DK RC	SW	FH	PD 2	TR	ATV	BC 2	Road		
																Type	Width	Surface
WVK-22-{14.4}	✔																	
WVK-22-J-{1.3}																		
WVKP-1	✔	✔																
WVKP-1-A		✔												✔				
WVKP-1-A-0.1-{1.6}		✔											✔			A	A	A
WVKP-1-B														✔		B	A	A
WVK-29-{4.7}																		
WVK-29-{08.5}	✔	✔																
WVKP-4	✔	✔																
WVKP-5	✔	✔											✔			B	A	A
WVKP-8	✔	✔														A	A	C
WVKP-9-A	✔	✔				✔										A	A	C
WVKP-13-{1.3}													✔			B	A	C
WVKP-13-A-1-A	✔	✔			✔											A	A	E
WVKP-13-{3.0}																		
WVKP-16-{4.5}	✔	✔			✔											A	A	E
WVKP-16-B	✔	✔			✔													
WVKP-16-D						✔										A	A	C
WVKP-17-{0.3}						✔					✔		✔			A	A	A
WVKP-17-B-5																B	A	C
WVKP-17-C-1-A	✔	✔			✔											A	A	D
WVKP-17-C-4	✔	✔			✔											A	A	B
WVKP-17-C-4.5-{1}																		
WVKP-17-E-{2.6}	✔	✔			✔											A	A	C
WVKP-17-F-1		✔																
WVKP-17-G	✔	✔			✔	✔										A	A	C
WVKP-20	✔	✔			✔	✔										A	A	A
WVKP-21					✔													
WVK-29-{32.5}																		
WVKP-26																A	A	C
WVKP-28	✔	✔														A	A	C
WVKP-28-A-1-{0.7}	✔	✔			✔													
WVKP-28-B-1	✔	✔			✔											A	A	C
WVKP-28-E																		
WVKP-29																A	A	C
WVKP-32-.5A	✔	✔														A	A	A
WVKP-32-{1.0}	✔															A	A	C
WVKP-33-{0.1}							✔											
WVKP-33-{5.8}																		

See page 90 for header explanations

TABLE 6: STREAM REACH ACTIVITIES & DISTURBANCES RESIDENTIAL AND RECREATIONAL (continued)

Stream AN-Code	RE	LN	DK RE	CN	PD 1	BC 1	PK	PL	DK RC	SW	FH	PD 2	TR	ATV	BC 2	Road		
																Type	Width	Surface
WVKP-33-D-{0.8}																		
WVKP-33-G	✔	✔			✔	✔												
WVKP-36-B																A	A	A
WVKP-37-A	✔	✔			✔	✔							✔					
WVK-29-{61.0}																		
WVKP-38-.8A																		
WVKP-38-D-(DUP1)	✔	✔			✔											A	A	C
WVKP-38-D-(DUP2)	✔	✔			✔											A	A	C
WVKP-40	✔	✔														A	A	C
WVKP-41-A	✔	✔			✔											A	A	C
WVKP-43-{1.6}																		
WVKP-43-A	✔	✔			✔	✔										A	A	C
WVKP-45.5																		
WVK-30																		
WVK-32-0.1A	✔				✔								✔			A	A	A
WVK-32-A																		
WVK-33	✔	✔			✔											A	B	E
WVK-36-{2.4}																		
WVK-39-A																		
WVK-39-{01.6}																		
WVK-39-B-{0.1}													✔					
WVK-39-E-3-{0.4}														✔				
WVK-39-E-3-{0.6}														✔				
WVK-39-F																		
WVK-39-J	✔	✔			✔	✔										A	A	C
WVK-39-{09.4}	✔	✔				✔					✔		✔	✔		A	A	C
WVK-39-M-1-A-{1.0}																		
WVK-39-O							✔	✔					✔					
WVK-39-{12.2}							✔					✔	✔			B	B	E
WVK-41-A																		
WVK-41	✔	✔					✔						✔					
WVK-41-D-1	✔	✔				✔												
WVK-41-D.5	✔	✔			✔	✔										A	A	C
WVK-41-D.5-B	✔	✔			✔	✔												
WVK-41-E-1	✔	✔				✔										A	A	C
WVK-41-E-2-{0.1}	✔	✔			✔	✔										A	A	C
WVK-41-E-2-{1.4}	✔															A	A	C
WVK-41-E-2-{1.7}																		
WVK-42	✔	✔			✔	✔							✔					

See page 90 for header explanations

TABLE 6: STREAM REACH ACTIVITIES & DISTURBANCES RESIDENTIAL AND RECREATIONAL (continued)

✔ = present in the area of sample reach

RE = residence
DKRE = residential boat dock
CN = residential construction
PD1 = pipe or drain from a residence
BC1 = bridge or culvert serving residence
PK = park or camping area
PL = parking lot for recreational use
BC2 = bridge or culvert serving recreation

DKRC = public boat dock
SW = area used for swimming
FH = area used for fishing
PD2 = pipe/drain from recreational activity
TR = foot trail
ATV = trail used primarily for ATVs, horses, or bicycles

Road data:

Type: A-primarily residential
B-primarily recreational

Width: A= single lane
B= double lane
C= multi-lane

Surface: A= dirt
B= rutted dirt
C= applied limestone
D= applied (non limestone)
E= asphalt
F= concrete

TABLE 7: STREAM REACH ACTIVITIES & DISTURBANCES - AGRICULTURAL

Stream AN-Code	Row Crop	Pasture	Hay	Orchard	Poultry	Cattle Access	Irrigation	Pipe Drain	Bridge Culvert	Roads	
										Width	Surface
WVK-6		✔				✔					
WVK-9-A-(DUP1)	✔							✔			
WVK-9-A-(DUP2)	✔							✔			
WVK-9-C-{5.4}			✔								
WVK-10-A											
WVK-10-F	✔	✔				✔				A	A
WVK-11											
WVK-11-0.5-{0.6}	✔	✔	✔			✔			✔	A	C
WVK-12-{12.0}	✔	✔	✔								
WVK-12-A			✔								
WVK-12-E-{2.4}											
WVK-12-E-2.5-{0.4}											
WVK-12-F											
WVK-12-F-{5.0}			✔							A	A
WVK-12-{20.7}	✔		✔								
WVK-12-H			✔								
WVK-12-J											
WVK-13										A	A
WVK-14	✔							✔		A	C
WVK-14-{2.2}		✔				✔					
WVK-14-A.5-{1.6}		✔	✔								
WVK-14-B-1											
WVK-16-B			✔								
WVK-16-G-1-{0.4}		✔		✔	✔	✔					
WVK-16-{12.8}			✔							A	A
WVK-16-J-3-{1.0}											
WVK-16-L			✔								
WVK-16-{25.0}			✔								
WVK-16-Q-{1.0}		✔							✔		
WVK-16-S		✔				✔		✔			
WVK-16-{33.0}											
WVK-19-C-(DUP1)											
WVK-19-C-(DUP2)											
WVK-22-B										A	A
WVK-22-B-2		✔				✔					
WVK-22-B-3											
WVK-22-B-5-B											
WVK-22-{6.0}											
WVK-22-{10.6}			✔							A	A
WVK-22-{14.4}											

See page 94 for header explanations

TABLE 7: STREAM REACH ACTIVITIES & DISTURBANCES - AGRICULTURAL (continued)

Stream AN-Code	Row Crop	Pasture	Hay	Orchard	Poultry	Cattle Access	Irrigation	Pipe Drain	Bridge Culvert	Roads	
										Width	Surface
WVK-22-J-{1.3}		✓	✓								
WVKP-1											
WVKP-1-A									✓	A	B
WVKP-1-A-0.1-{1.6}	✓										
WVKP-1-B											
WVK-29-{4.7}			✓								
WVK-29-{08.5}	✓										
WVKP-4											
WVKP-5											
WVKP-8		✓									
WVKP-9-A		✓	✓								
WVKP-13-{1.3}											
WVKP-13-A-1-A											
WVKP-13-{3.0}											
WVKP-16-{4.5}											
WVKP-16-B			✓								
WVKP-16-D			✓								
WVKP-17-{0.3}											
WVKP-17-B-5											
WVKP-17-C-1-A		✓									
WVKP-17-C-4											
WVKP-17-C-4.5-{1}		✓				✓					
WVKP-17-E-{2.6}											
WVKP-17-F-1		✓									
WVKP-17-G											
WVKP-20	✓	✓									
WVKP-21		✓	✓							A	A
WVK-29-{32.5}			✓								
WVKP-26											
WVKP-28											
WVKP-28-A-1-{0.7}											
WVKP-28-B-1											
WVKP-28-E											
WVKP-29											
WVKP-32-.5A											
WVKP-32-{1.0}											
WVKP-33-{0.1}											
WVKP-33-{5.8}		✓									
WVKP-33-D-{0.8}		✓				✓					

See page 94 for header explanations

TABLE 7: STREAM REACH ACTIVITIES & DISTURBANCES - AGRICULTURAL (continued)

Stream AN-Code	Row Crop	Pasture	Hay	Orchard	Poultry	Cattle Access	Irrigation	Pipe Drain	Bridge Culvert	Roads	
										Width	Surface
WVKP-33-G		✓									
WVKP-36-B		✓									
WVKP-37-A			✓								
WVK-29-{61.0}		✓									
WVKP-38-.8A											
WVKP-38-D-(DUP1)	✓							✓			
WVKP-38-D-(DUP2)	✓										
WVKP-40		✓				✓					
WVKP-41-A		✓	✓		✓						
WVKP-43-{1.6}									✓		
WVKP-43-A			✓								
WVKP-45.5											
WVK-30											
WVK-32-0.1A											
WVK-32-A											
WVK-33											
WVK-36-{2.4}											
WVK-39-A											
WVK-39-{01.6}											
WVK-39-B-{0.1}											
WVK-39-E-3-{0.4}											
WVK-39-E-3-{0.6}											
WVK-39-F		✓									
WVK-39-J											
WVK-39-{09.4}											
WVK-39-M-1-A-{1.0}											
WVK-39-O											
WVK-39-{12.2}											
WVK-41-A											
WVK-41											
WVK-41-D-1	✓										
WVK-41-D.5											
WVK-41-D.5-B											
WVK-41-E-1											
WVK-41-E-2-{0.1}											
WVK-41-E-2-{1.4}											
WVK-41-E-2-{1.7}											
WVK-42											

See page 94 for header explanations

TABLE 7: STREAM REACH ACTIVITIES & DISTURBANCES - AGRICULTURAL (continued)

✔ = present in the area of sample reach

Road data: Road Information indicates road was in the vicinity of the sample reach and its primary purpose was agricultural.

Width:
A= single lane
B= double lane
C= multi-lane

Surface:
A= dirt
B= rutted dirt
C= applied limestone
D= applied (non limestone)
E= asphalt
F= concrete

TABLE 8: STREAM REACH ACTIVITIES & DISTURBANCES - INDUSTRIAL

Stream AN-Code	IP	SM	DM	CP	QU	OG	LN	LG	SW	LF	WW	PW	PD	PL	BC	RR	Road	
																	Width	Surface
WVK-6																		
WVK-9-A-(DUP1)									✔				✔					
WVK-9-A-(DUP2)									✔				✔					
WVK-9-C-{5.4}																		
WVK-10-A																		
WVK-10-F																		
WVK-11																		
WVK-11-0.5-{0.6}																		
WVK-12-{12.0}																		
WVK-12-A																		
WVK-12-E-{2.4}																		
WVK-12-E-2.5-{0.4}																		
WVK-12-F																		
WVK-12-F-{5.0}																		
WVK-12-{20.7}																		
WVK-12-H																		
WVK-12-J							✔											
WVK-13																		
WVK-14																		
WVK-14-{2.2}																		
WVK-14-A.5-{1.6}																		
WVK-14-B-1																		
WVK-16-B																		
WVK-16-G-1-{0.4}																		
WVK-16-{12.8}																		
WVK-16-J-3-{1.0}							✔		✔									
WVK-16-L							✔											
WVK-16-{25.0}																		
WVK-16-Q-{1.0}																		
WVK-16-S						✔	✔											
WVK-16-{33.0}																		
WVK-19-C-(DUP1)							✔											
WVK-19-C-(DUP2)							✔											
WVK-22-B																		
WVK-22-B-2							✔											
WVK-22-B-3																		
WVK-22-B-5-B																		
WVK-22-{6.0}																		
WVK-22-{10.6}																		

See page 98 for header explanations

TABLE 8: STREAM REACH ACTIVITIES & DISTURBANCES - INDUSTRIAL (continued)

Stream AN-Code	IP	SM	DM	CP	QU	OG	LN	LG	SW	LF	WW	PW	PD	PL	BC	RR	Road	
																	Width	Surface
WVK-22-{14.4}											✓						A	C
WVK-22-J-{1.3}																		
WVKP-1																		
WVKP-1-A																	A	B
WVKP-1-A-0.1-{1.6}																		
WVKP-1-B							✓										A	A
WVK-29-{4.7}							✓											
WVK-29-{08.5}																		
WVKP-4																		
WVKP-5							✓											
WVKP-8							✓											
WVKP-9-A							✓											
WVKP-13-{1.3}															✓		B	E
WVKP-13-A-1-A																		
WVKP-13-{3.0}																		
WVKP-16-{4.5}							✓											
WVKP-16-B																		
WVKP-16-D							✓											
WVKP-17-{0.3}																		
WVKP-17-B-5																		
WVKP-17-C-1-A							✓											
WVKP-17-C-4																		
WVKP-17-C-4.5-{1}																		
WVKP-17-E-{2.6}							✓											
WVKP-17-F-1																		
WVKP-17-G																		
WVKP-20																		
WVKP-21																		
WVK-29-{32.5}							✓											
WVKP-26																		
WVKP-28																		
WVKP-28-A-1-{0.7}							✓											
WVKP-28-B-1																		
WVKP-28-E						✓	✓						✓		✓		A	A
WVKP-29							✓											
WVKP-32-.5A																		
WVKP-32-{1.0}																		
WVKP-33-{0.1}																		
WVKP-33-{5.8}																		

See page 98 for header explanations

TABLE 8: STREAM REACH ACTIVITIES & DISTURBANCES - INDUSTRIAL (continued)

Stream AN-Code	IP	SM	DM	CP	QU	OG	LN	LG	SW	LF	WW	PW	PD	PL	BC	RR	Road	
																	Width	Surface
WVKP-33-D-{0.8}																		
WVKP-33-G							✔											
WVKP-36-B							✔											
WVKP-37-A													✔				A	A
WVK-29-{61.0}																		
WVKP-38-.8A													✔					
WVKP-38-D-(DUP1)							✔											
WVKP-38-D-(DUP2)							✔											
WVKP-40						✔	✔											
WVKP-41-A																		
WVKP-43-{1.6}							✔											
WVKP-43-A						✔	✔											
WVKP-45.5							✔											
WVK-30							✔						✔	✔				
WVK-32-0.1A																		
WVK-32-A															✔	✔		
WVK-33							✔											
WVK-36-{2.4}							✔										A	A
WVK-39-A													✔		✔		A	E
WVK-39-{01.6}							✔											
WVK-39-B-{0.1}							✔											
WVK-39-E-3-{0.4}																		
WVK-39-E-3-{0.6}																		
WVK-39-F																		
WVK-39-J							✔											
WVK-39-{09.4}																		
WVK-39-M-1-A-{1.0}						✔	✔											
WVK-39-O																		
WVK-39-{12.2}							✔										B	E
WVK-41-A													✔	✔	✔			
WVK-41																		
WVK-41-D-1							✔											
WVK-41-D.5							✔											
WVK-41-D.5-B																	B	E
WVK-41-E-1							✔							✔				
WVK-41-E-2-{0.1}														✔	✔		B	C
WVK-41-E-2-{1.4}																		
WVK-41-E-2-{1.7}																		
WVK-42																		

See page 98 for header explanations

TABLE 8: STREAM REACH ACTIVITIES & DISTURBANCES - INDUSTRIAL (continued)

✔ = present in the area of sample reach

IP = industrial plant
SM = surface mine
DM = deep mine .
CP = coal prep
QU = quarry
OG = oil or gas well
LN = power line
LG = logging
SM = sawmill
LF = sanitary landfill
WW = wastewater treatment plant
PW = public water treatment facility
PD = pipes or drains to or from an industrial facility
PL = parking lot for an industrial facility
BC = bridge or culvert serving an industrial facility
RR = railroad serving an industrial facility

Road data: Road Information indicates road was in the vicinity of the sample reach and its primary purpose was Industrial.

Width: A= single lane
B= double lane
C= multi-lane

Surface: A= dirt
B= rutted dirt
C= applied limestone
D= applied (non limestone)
E= asphalt
F= concrete

TABLE 9: STREAM REACH ACTIVITIES & DISTURBANCES - STREAM MANAGEMENT

Stream AN-Code	Liming	Riprap / Stabilization	Dredging	Channelization	Fill	Dams / Impoundments
WVK-6						
WVK-9-A-(DUP1)						
WVK-9-A-(DUP2)						
WVK-9-C-{5.4}						
WVK-10-A						
WVK-10-F						
WVK-11						
WVK-11-0.5-{0.6}						
WVK-12-A						
WVK-12-{12.0}						
WVK-12-E-{2.4}						
WVK-12-E-2.5-{0.4}						
WVK-12-F						
WVK-12-F-{5.0}						
WVK-12-{20.7}						
WVK-12-H						
WVK-12-J						
WVK-13						
WVK-14						
WVK-14-{2.2}						
WVK-14-A.5-{1.6}						
WVK-14-B-1						
WVK-16-B						
WVK-16-G-1-{0.4}			✓	✓		
WVK-16-{12.8}						
WVK-16-J-3-{1.0}						
WVK-16-L		✓				
WVK-16-{25.0}						
WVK-16-Q-{1.0}						
WVK-16-S						
WVK-16-{33.0}						
WVK-19-C-(DUP1)						
WVK-19-C-(DUP2)						
WVK-22-B						
WVK-22-B-2						
WVK-22-B-3						
WVK-22-B-5-B						
WVK-22-{6.0}						
WVK-22-{10.6}						
WVK-22-{14.4}						

TABLE 9: STREAM REACH ACTIVITIES & DISTURBANCES – STREAM MANAGEMENT (continued)

Stream AN-Code	Liming	Riprap / Stabilization	Dredging	Channelization	Fill	Dams / Impoundments
WVK-22-J-{1.3}						
WVKP-1		✔			✔	
WVKP-1-A		✔				
WVKP-1-A-0.1-{1.6}						
WVKP-1-B		✔			✔	
WVK-29-{4.7}						
WVK-29-{08.5}						
WVKP-4						
WVKP-5						
WVKP-8						
WVKP-9-A		✔				
WVKP-13-{1.3}						
WVKP-13-A-1-A						
WVKP-13-{3.0}						
WVKP-16-{4.5}		✔		✔		
WVKP-16-B		✔				
WVKP-16-D				✔		
WVKP-17-{0.3}		✔		✔		
WVKP-17-B-5						
WVKP-17-C-1-A						
WVKP-17-C-4						
WVKP-17-C-4.5-{1}						
WVKP-17-E-{2.6}						
WVKP-17-F-1						
WVKP-17-G						
WVKP-20						
WVKP-21						
WVK-29-{32.5}						
WVKP-26						
WVKP-28						
WVKP-28-A-1-{0.7}						
WVKP-28-B-1						
WVKP-28-E						
WVKP-29						
WVKP-32-.5A						
WVKP-32-{1.0}						
WVKP-33-{0.1}						
WVKP-33-{5.8}						
WVKP-33-D-{0.8}						

TABLE 9: STREAM REACH ACTIVITIES & DISTURBANCES – STREAM MANAGEMENT (continued)

Stream AN-Code	Liming	Riprap / Stabilization	Dredging	Channelization	Fill	Dams / Impoundments
WVKP-33-G						
WVKP-36-B						
WVKP-37-A						
WVK-29-{61.0}						
WVKP-38-.8A						
WVKP-38-D-(DUP1)		✔				
WVKP-38-D-(DUP2)		✔				
WVKP-40						
WVKP-41-A						
WVKP-43-{1.6}						
WVKP-43-A						
WVKP-45.5						
WVK-30				✔	✔	
WVK-32-0.1A						
WVK-32-A				✔		
WVK-33		✔		✔	✔	
WVK-36-{2.4}						
WVK-39-A						
WVK-39-{01.6}		✔			✔	
WVK-39-B-{0.1}						
WVK-39-E-3-{0.4}						
WVK-39-E-3-{0.6}						
WVK-39-F						
WVK-39-J		✔				
WVK-39-{09.4}				✔		
WVK-39-M-1-A-{1.0}						
WVK-39-O				✔		
WVK-39-{12.2}						
WVK-41-A				✔	✔	
WVK-41				✔		
WVK-41-D-1						
WVK-41-D.5		✔				
WVK-41-D.5-B						
WVK-41-E-1						
WVK-41-E-2-{0.1}						
WVK-41-E-2-{1.4}						
WVK-41-E-2-{1.7}						
WVK-42		✔		✔	✔	

✔ = indicates presence in vicinity of sample site.

TABLE 10: RIPARIAN HABITAT ASSESSMENT - GROUND COVER
(<0.5 M HIGH)

Stream AN-Code	Left Descending Bank				Right Descending Bank				Stream Shade
	Shrubs Seedlings	Non-Woody Herbs, Grasses, Ferns, Etc	Leaf Litter	Bare Soil	Shrubs Seedlings	Non-Woody Herbs, Grasses, Ferns, Etc	Leaf Litter	Bare Soil	
WVK-6	1	2	1	3	1	3	1	3	1
WVK-9-A-(DUP1)	1	3	1	2	1	3	1	2	3
WVK-9-A-(DUP2)	1	2	1	2	1	2	1	2	2
WVK-9-C-{5.4}	1	4	3	1	1	4	3	1	4
WVK-10-A	1	4	3	1	1	4	2	1	2
WVK-10-F	1	3	1	1	1	2	2	2	3
WVK-11	1	4	1	2	1	4	1	2	3
WVK-11-0.5-{0.6}	1	4	0	0	0	4	0	0	1
WVK-12-A	1	4	2	1	0	4	0	2	1
WVK-12-{12.0}	1	4	1	2	1	4	1	2	3
WVK-12-E-{2.4}	2	4	1	2	2	3	2	1	2
WVK-12-E-2.5-{0.4}	2	3	4	1	2	2	3	1	4
WVK-12-F	0	1	1	4	0	1	1	3	2
WVK-12-F-{5.0}	1	2	0	1	1	2	0	1	3
WVK-12-{20.7}	1	3	1	2	2	1	2	2	1
WVK-12-H	1	3	1	2	1	2	2	1	1
WVK-12-J	1	2	1	3	1	3	3	2	3
WVK-13	1	4	2	1	1	4	3	1	3
WVK-14	1	3	1	2	1	2	2	2	2
WVK-14-{2.2}	1	3	1	3	1	4	1	1	3
WVK-14-A.5-{1.6}	1	4	1	1	1	4	0	1	3
WVK-14-B-1	2	2	4	1	1	4	4	1	4
WVK-16-B	1	4	1	2	1	4	2	2	3
WVK-16-G-1-{0.4}	1	3	0	1	3	3	0	2	1
WVK-16-{12.8}	1	4	1	2	1	4	1	2	2
WVK-16-J-3-{1.0}	3	4	1	2	0	4	0	0	1
WVK-16-L	1	3	3	1	1	3	1	1	3
WVK-16-{25.0}	1	4	2	1	0	4	0	4	2
WVK-16-Q-{1.0}	2	3	4	1	2	4	3	1	3
WVK-16-S	0	4	0	2	0	4	0	2	1
WVK-16-{33.0}	1	3	3	1	2	4	0	1	3
WVK-19-C-(DUP1)	1	3	2	2	1	3	1	2	1
WVK-19-C-(DUP2)	1	3	1	3	1	2	1	2	1
WVK-22-B	1	2	1	2	1	2	1	2	3
WVK-22-B-2	0	3	0	2	0	3	0	2	1
WVK-22-B-3	1	3	2	1	1	4	0	1	4
WVK-22-B-5-B	2	4	2	1	1	4	1	1	4

TABLE 10: RIPARIAN HABITAT ASSESSMENT - GROUND COVER (<0.5 m high) (continued)

Stream AN-Code	Left Descending Bank				Right Descending Bank				Stream Shade
	Shrubs Seedlings	Non-Woody Herbs, Grasses, Ferns, Etc	Leaf Litter	Bare Soil	Shrubs Seedlings	Non-Woody Herbs, Grasses, Ferns, Etc	Leaf Litter	Bare Soil	
WVK-22-{6.0}	2	2	1	2	2	3	1	2	2
WVK-22-{10.6}	2	1	0	2	2	3	0	0	4
WVK-22-{14.4}	1	2	0	2	1	3	0	3	3
WVK-22-J-{1.3}	2	1	1	0	0	4	0	0	2
WVKP-1	1	4	0	1	1	4	0	1	1
WVKP-1-A	2	3	2	1	1	2	0	1	1
WVKP-1-A-0.1-{1.6}	1	3	1	2	2	3	1	2	3
WVKP-1-B	1	4	2	1	1	2	1	2	2
WVK-29-{4.7}	2	3	1	1	1	3	2	2	1
WVK-29-{08.5}	1	4	1	1	2	4	1	1	1
WVKP-4	2	3	1	1	2	4	0	1	4
WVKP-5	2	3	2	1	2	2	2	1	3
WVKP-8	3	1	1	1	2	4	0	1	2
WVKP-9-A	2	4	1	1	1	3	0	2	2
WVKP-13-{1.3}	1	3	1	3	2	3	1	3	3
WVKP-13-A-1-A	2	2	0	2	1	4	0	2	2
WVKP-13-{3.0}	0	4	1	0	0	4	1	1	3
WVKP-16-{4.5}	1	4	1	1	1	2	1	3	3
WVKP-16-B	1	2	0	1	2	4	1	1	2
WVKP-16-D	2	3	2	0	1	4	1	0	1
WVKP-17-{0.3}	1	3	1	2	1	2	2	3	3
WVKP-17-B-5	2	4	1	1	1	4	1	1	3
WVKP-17-C-1-A	3	3	1	1	1	4	0	0	2
WVKP-17-C-4	1	4	1	1	2	4	1	1	4
WVKP-17-C-4.5-{1}	2	2	2	1	2	3	2	1	4
WVKP-17-E-{2.6}	1	4	1	1	1	4	1	1	2
WVKP-17-F-1	2	3	1	1	2	3	2	1	4
WVKP-17-G	2	3	2	1	1	4	1	1	3
WVKP-20	1	4	1	2	1	3	1	2	2
WVKP-21	2	4	1	1	2	4	1	0	2
WVK-29-{32.5}	1	3	2	1	1	4	1	1	1
WVKP-26	1	4	1	1	1	4	1	1	2
WVKP-28	2	4	1	1	2	4	2	1	3
WVKP-28-A-1-{0.7}	0	3	0	2	1	2	3	1	4
WVKP-28-B-1	1	4	1	1	2	4	1	1	2
WVKP-28-E	2	4	1	1	2	2	3	1	4
WVKP-29	1	3	2	2	1	3	1	1	2

TABLE 10: RIPARIAN HABITAT ASSESSMENT - GROUND COVER (<0.5 m high) (continued)

Stream AN-Code	Left Descending Bank				Right Descending Bank				Stream Shade
	Shrubs Seedlings	Non-Woody Herbs, Grasses, Ferns, Etc	Leaf Litter	Bare Soil	Shrubs Seedlings	Non-Woody Herbs, Grasses, Ferns, Etc	Leaf Litter	Bare Soil	
WVKP-32-.5A	1	3	2	1	1	4	0	1	4
WVKP-32-{1.0}	1	4	2	2	2	2	3	2	3
WVKP-33-{0.1}	2	2	2	2	2	3	1	1	3
WVKP-33-{5.8}	2	4	0	1	2	3	1	2	3
WVKP-33-D-{0.8}	1	4	1	1	2	3	2	1	2
WVKP-33-G	3	3	1	1	2	4	0	1	2
WVKP-36-B	2	3	1	2	2	4	1	0	2
WVKP-37-A	2	3	1	1	1	3	2	1	4
WVK-29-{61.0}	1	4	1	1	1	4	1	1	3
WVKP-38-.8A	2	4	1	1	2	3	2	1	4
WVKP-38-D-(DUP1)	1	4	0	1	1	4	1	0	1
WVKP-38-D-(DUP2)	1	4	0	1	2	4	1	1	1
WVKP-40	1	4	1	1	2	4	1	1	1
WVKP-41-A	2	4	0	1	2	4	1	1	2
WVKP-43-{1.6}	2	4	0	1	2	4	0	1	1
WVKP-43-A	0	4	0	1	0	4	0	0	2
WVKP-45.5	2	3	1	1	1	3	1	2	2
WVK-30	1	2	0	1	1	3	0	0	0
WVK-32-0.1A	1	3	2	1	1	3	2	1	4
WVK-32-A	1	4	1	1	1	4	1	1	3
WVK-33	0	4	0	0	0	4	0	0	1
WVK-36-{2.4}	3	2	1	1	3	2	2	1	4
WVK-39-A	1	4	2	1	0	3	1	2	2
WVK-39-{01.6}	2	2	2	2	2	2	2	3	3
WVK-39-B-{0.1}	1	4	1	2	1	4	1	1	2
WVK-39-E-3-{0.4}	3	3	4	2	3	3	4	2	4
WVK-39-E-3-{0.6}	1	2	4	1	2	3	4	0	4
WVK-39-F	0	3	1	1	0	4	0	1	1
WVK-39-J	1	4	1	0	1	4	1	2	2
WVK-39-{09.4}	1	4	1	1	3	3	3	1	4
WVK-39-M-1-A-{1.0}	2	3	4	0	2	4	4	1	4
WVK-39-O	0	4	0	1	1	1	4	0	1
WVK-39-{12.2}	1	4	1	1	1	4	1	1	2
WVK-41-A	1	2	1	2	1	2	1	1	4
WVK-41	1	4	1	1	1	3	1	1	3
WVK-41-D-1	2	4	1	1	2	3	1	1	4
WVK-41-D.5	1	2	1	3	2	2	2	2	3

TABLE 10: RIPARIAN HABITAT ASSESSMENT - GROUND COVER (<0.5 m high) (continued)

Stream AN-Code	Left Descending Bank				Right Descending Bank				Stream Shade
	Shrubs Seedlings	Non-Woody Herbs, Grasses, Ferns, Etc	Leaf Litter	Bare Soil	Shrubs Seedlings	Non-Woody Herbs, Grasses, Ferns, Etc	Leaf Litter	Bare Soil	
WVK-41-D.5-B	2	4	1	0	1	4	1	1	2
WVK-41-E-1	1	4	1	1	2	3	1	1	2
WVK-41-E-2-{0.1}	0	4	0	0	0	4	0	0	1
WVK-41-E-2-{1.4}	2	4	1	0	3	4	1	0	3
WVK-41-E-2-{1.7}	1	2	1	1	1	4	2	1	2
WVK-42	1	4	1	1	2	1	3	0	4

Values: 0 = absent
1 = sparse (0-10% of ground cover)
2 = moderate (10-40%)
3 = heavy (40-75%)
4 = very heavy (>75%)

Stream shade: 1 = fully exposed (0-25% shade)
2 = partially exposed (25-50 %)
3 = partially shaded (50-75%)
4 = fully shaded (75-100%)

TABLE 11: RIPARIAN HABITAT ASSESSMENT – UNDERSTORY (0.5 to 5.0 m high)						
Stream AN-Code	Left Descending Bank			Right Descending Bank		
	Dominant Vegetation Type	Shrubs / Saplings	Non-Woody Herbs	Dominant Vegetation Type	Shrubs / Saplings	Non-Woody Herbs
WVK-6	D	1	1	D	1	1
WVK-9-A-(DUP1)	D	1	2	D	2	2
WVK-9-A-(DUP2)	D	1	0	D	1	0
WVK-9-C-{5.4}	M	1	4	D	3	4
WVK-10-A	D	2	1	D	1	0
WVK-10-F	D	1	1	D	2	1
WVK-11	D	2	2	D	3	2
WVK-11-0.5-{0.6}	N	0	0	N	0	0
WVK-12-A	D	1	0	D	1	1
WVK-12-{12.0}	D	1	2	D	1	3
WVK-12-E-{2.4}	D	2	4	D	2	2
WVK-12-E-2.5-{0.4}	D	2	1	D	2	4
WVK-12-F	D	1	1	D	1	1
WVK-12-F-{5.0}	D	1	4	D	1	4
WVK-12-{20.7}	D	1	2	D	2	2
WVK-12-H	D	0	1	D	2	1
WVK-12-J	D	2	1	D	2	1
WVK-13	D	2	1	D	2	1
WVK-14	D	2	3	D	2	1
WVK-14-{2.2}	D	1	1	D	1	1
WVK-14-A.5-{1.6}	D	1	1	D	1	1
WVK-14-B-1	D	3	2	D	3	3
WVK-16-B	D	1	1	D	2	1
WVK-16-G-1-{0.4}	D	0	1	D	1	3
WVK-16-{12.8}	D	1	1	D	1	1
WVK-16-J-3-{1.0}	D	2	3	N	0	0
WVK-16-L	D	1	3	D	2	2
WVK-16-{25.0}	D	1	1	D	1	1
WVK-16-Q-{1.0}	D	2	2	D	2	2
WVK-16-S	D	0	1	D	0	1
WVK-16-{33.0}	M	4	1	D	2	1
WVK-19-C-(DUP1)	D	2	2	D	1	1
WVK-19-C-(DUP2)	D	1	1	D	1	1
WVK-22-B	D	1	2	D	1	3
WVK-22-B-2	D	1	1	D	1	1
WVK-22-B-3	D	1	2	D	1	1
WVK-22-B-5-B	D	1	2	D	1	1
WVK-22-{6.0}	D	3	1	D	3	1
WVK-22-{10.6}	D	2	3	D	3	1

TABLE 11: RIPARIAN HABITAT ASSESSMENT - UNDERSTORY (0.5 to 5.0 m high) (continued)

Stream AN-Code	Left Descending Bank			Right Descending Bank		
	Dominant Vegetation Type	Shrubs / Saplings	Non-Woody Herbs	Dominant Vegetation Type	Shrubs / Saplings	Non-Woody Herbs
WVK-22-{14.4}	D	3	2	D	2	1
WVK-22-J-{1.3}	D	2	2	N	0	0
WVKP-1	D	1	1	D	1	1
WVKP-1-A	D	2	2	D	1	2
WVKP-1-A-0.1-{1.6}	M	2	1	D	3	1
WVKP-1-B	D	2	2	D	1	2
WVK-29-{4.7}	D	3	1	D	4	1
WVK-29-{08.5}	D	3	1	D	2	2
WVKP-4	D	3	0	D	3	1
WVKP-5	D	3	1	D	3	1
WVKP-8	D	3	1	D	1	0
WVKP-9-A	D	2	1	D	1	0
WVKP-13-{1.3}	D	3	2	D	3	0
WVKP-13-A-1-A	D	2	1	D	2	0
WVKP-13-{3.0}	D	1	2	D	1	2
WVKP-16-{4.5}	D	3	1	D	2	1
WVKP-16-B	D	1	0	D	2	0
WVKP-16-D	D	1	0	D	1	0
WVKP-17-{0.3}	D	3	1	D	4	0
WVKP-17-B-5	D	2	1	D	3	0
WVKP-17-C-1-A	D	2	0	C	1	1
WVKP-17-C-4	D	3	0	D	4	0
WVKP-17-C-4.5-{1}	D	2	0	D	2	0
WVKP-17-E-{2.6}	D	2	1	D	2	2
WVKP-17-F-1	D	3	0	D	4	0
WVKP-17-G	D	4	0	D	1	1
WVKP-20	D	2	0	D	2	0
WVKP-21	D	2	0	D	2	0
WVK-29-{32.5}	D	3	1	D	3	2
WVKP-26	D	2	2	D	1	0
WVKP-28	D	3	1	D	2	2
WVKP-28-A-1-{0.7}	D	1	0	D	4	0
WVKP-28-B-1	D	1	1	D	2	1
WVKP-28-E	D	2	1	D	3	0
WVKP-29	D	2	0	D	2	1
WVKP-32-.5A	D	3	1	D	2	2
WVKP-32-{1.0}	D	2	2	D	1	3

TABLE 11: RIPARIAN HABITAT ASSESSMENT - UNDERSTORY (0.5 to 5.0 m high) (continued)

Stream AN-Code	Left Descending Bank			Right Descending Bank		
	Dominant Vegetation Type	Shrubs / Saplings	Non-Woody Herbs	Dominant Vegetation Type	Shrubs / Saplings	Non-Woody Herbs
WVKP-33-{0.1}	D	3	0	D	2	1
WVKP-33-{5.8}	D	3	1	D	2	1
WVKP-33-D-{0.8}	M	1	1	D	2	1
WVKP-33-G	D	2	1	D	2	1
WVKP-36-B	D	2	1	D	2	1
WVKP-37-A	D	3	1	M	3	0
WVK-29-{61.0}	D	3	1	D	3	1
WVKP-38-.8A	D	3	1	D	3	0
WVKP-38-D-(DUP1)	M	1	0	D	1	0
WVKP-38-D-(DUP2)	M	1	0	D	2	2
WVKP-40	D	1	0	D	2	0
WVKP-41-A	D	1	1	D	1	1
WVKP-43-{1.6}	D	1	2	D	1	2
WVKP-43-A	D	1	0	N	0	0
WVKP-45.5	D	2	1	D	1	1
WVK-30	D	1	1	D	1	1
WVK-32-0.1A	D	1	1	D	2	1
WVK-32-A	D	2	2	D	2	2
WVK-33	N	0	0	N	0	0
WVK-36-{2.4}	D	2	1	D	3	1
WVK-39-A	D	3	1	D	1	1
WVK-39-{01.6}	D	3	0	D	3	1
WVK-39-B-{0.1}	D	2	1	D	1	1
WVK-39-E-3-{0.4}	D	3	2	D	3	2
WVK-39-E-3-{0.6}	D	3	2	D	3	1
WVK-39-F	D	1	0	D	1	0
WVK-39-J	D	1	2	D	1	1
WVK-39-{09.4}	D	1	1	D	2	2
WVK-39-M-1-A-{1.0}	D	3	3	D	3	3
WVK-39-O	N	0	0	D	1	1
WVK-39-{12.2}	D	2	2	D	2	3
WVK-41-A	D	2	2	D	2	2
WVK-41	D	2	3	D	2	2
WVK-41-D-1	D	1	0	D	2	0
WVK-41-D.5	D	1	1	D	3	0
WVK-41-D.5-B	D	2	1	D	1	0
WVK-41-E-1	M	2	0	D	3	1

TABLE 11: RIPARIAN HABITAT ASSESSMENT - UNDERSTORY (0.5 to 5.0 m high) (continued)

Stream AN-Code	Left Descending Bank			Right Descending Bank		
	Dominant Vegetation Type	Shrubs / Saplings	Non-Woody Herbs	Dominant Vegetation Type	Shrubs / Saplings	Non-Woody Herbs
WVK-41-E-2-{0.1}	N	0	0	N	0	0
WVK-41-E-2-{1.4}	D	3	1	D	3	1
WVK-41-E-2-{1.7}	D	1	2	D	2	1
WVK-42	D	1	1	M	3	0

Dominant Vegetation Type:
D = deciduous
C = coniferous
M = mixed (at least 10 % of each type)
N = none

Tree Values
0 = absent
1 = sparse (0-10% of canopy)
2 = moderate (10-40%)
3 = heavy (40-75%)
4 = very heavy (>75%)

TABLE 12: RIPARIAN HABITAT ASSESSMENT - CANOPY (>5.0 M HIGH)

Stream AN-Code	Left Descending Bank			Right Descending Bank		
	Dominant Vegetation Type	Big Trees	Small Trees	Dominant Vegetation Type	Big Trees	Small Trees
WVK-6	D	2	1	D	1	1
WVK-9-A-(DUP1)	D	3	2	D	2	2
WVK-9-A-(DUP2)	D	1	1	D	1	1
WVK-9-C-{5.4}	M	1	1	D	2	2
WVK-10-A	D	3	2	D	1	1
WVK-10-F	D	2	2	D	2	2
WVK-11	D	1	2	D	1	2
WVK-11-0.5-{0.6}	N	0	0	N	0	0
WVK-12-{12.0}	D	1	1	D	1	1
WVK-12-A	D	1	2	N	0	0
WVK-12-E-{2.4}	D	3	2	D	4	2
WVK-12-E-2.5-{0.4}	D	3	3	D	2	2
WVK-12-F	D	1	1	D	1	1
WVK-12-F-{5.0}	D	0	1	D	0	1
WVK-12-{20.7}	D	2	2	D	2	2
WVK-12-H	N	0	0	D	2	2
WVK-12-J	D	1	1	D	2	2
WVK-13	D	2	2	D	3	2
WVK-14	D	1	1	D	2	2
WVK-14-{2.2}	D	1	1	D	1	1
WVK-14-A.5-{1.6}	D	2	1	D	1	1
WVK-14-B-1	D	2	3	D	3	3
WVK-16-B	D	1	1	D	1	1
WVK-16-G-1-{0.4}	D	1	1	D	0	1
WVK-16-{12.8}	D	1	1	D	2	1
WVK-16-J-3-{1.0}	D	0	2	N	0	0
WVK-16-L	D	1	2	D	2	2
WVK-16-{25.0}	D	2	2	D	1	1
WVK-16-Q-{1.0}	D	2	2	D	2	2
WVK-16-S	D	0	1	D	0	1
WVK-16-{33.0}	M	2	3	D	0	2
WVK-19-C-(DUP1)	D	2	2	D	1	1
WVK-19-C-(DUP2)	D	1	1	D	1	1
WVK-22-B	D	2	2	D	1	1
WVK-22-B-2	D	0	2	N	0	0
WVK-22-B-3	D	3	2	D	1	1
WVK-22-B-5-B	D	4	3	D	2	1

TABLE 12: RIPARIAN HABITAT ASSESSMENT - CANOPY (>5.0 M HIGH) (continued)

Stream AN-Code	Left Descending Bank			Right Descending Bank		
	Dominant Vegetation Type	Big Trees	Small Trees	Dominant Vegetation Type	Big Trees	Small Trees
WVK-22-{6.0}	D	2	3	D	2	2
WVK-22-{10.6}	D	1	2	D	1	3
WVK-22-{14.4}	D	1	3	D	1	1
WVK-22-J-{1.3}	D	1	3	N	0	0
WVKP-1	D	0	1	D	1	1
WVKP-1-A	D	1	2	D	1	1
WVKP-1-A-0.1-{1.6}	M	0	3	D	1	2
WVKP-1-B	D	1	2	D	1	1
WVK-29-{4.7}	D	2	3	D	3	3
WVK-29-{08.5}	D	1	3	D	2	2
WVKP-4	D	2	3	D	3	2
WVKP-5	D	2	3	D	2	3
WVKP-8	D	0	3	D	0	1
WVKP-9-A	D	1	1	D	0	1
WVKP-13-{1.3}	D	2	4	D	2	3
WVKP-13-A-1-A	D	0	2	D	0	1
WVKP-13-{3.0}	D	2	2	D	2	2
WVKP-16-{4.5}	D	1	3	D	2	1
WVKP-16-B	N	0	0	D	1	1
WVKP-16-D	D	1	2	D	0	1
WVKP-17-{0.3}	D	2	3	D	1	4
WVKP-17-B-5	D	1	1	D	1	3
WVKP-17-C-1-A	D	1	2	C	0	1
WVKP-17-C-4	D	2	2	D	2	3
WVKP-17-C-4.5-{1}	D	3	2	D	2	2
WVKP-17-E-{2.6}	D	0	2	D	1	2
WVKP-17-F-1	D	2	3	D	2	4
WVKP-17-G	D	1	4	D	1	1
WVKP-20	D	1	2	D	2	3
WVKP-21	D	2	1	D	0	2
WVK-29-{32.5}	D	3	2	D	2	2
WVKP-26	D	2	2	N	0	0
WVKP-28	D	2	3	D	2	2
WVKP-28-A-1-{0.7}	D	0	1	D	2	3
WVKP-28-B-1	D	1	1	D	1	2
WVKP-28-E	M	2	2	D	3	3
WVKP-29	D	2	2	D	1	2

TABLE 12: RIPARIAN HABITAT ASSESSMENT - CANOPY (>5.0 M HIGH) (continued)

Stream AN-Code	Left Descending Bank			Right Descending Bank		
	Dominant Vegetation Type	Big Trees	Small Trees	Dominant Vegetation Type	Big Trees	Small Trees
WVKP-32-.5A	D	1	3	D	1	3
WVKP-32-{1.0}	D	2	2	D	3	3
WVKP-33-{0.1}	D	2	3	D	2	3
WVKP-33-{5.8}	D	3	2	D	2	1
WVKP-33-D-{0.8}	M	1	1	D	2	2
WVKP-33-G	D	1	2	D	1	1
WVKP-36-B	D	1	2	D	0	2
WVKP-37-A	D	0	2	M	3	3
WVK-29-{61.0}	D	2	3	D	2	3
WVKP-38-.8A	D	1	3	D	2	3
WVKP-38-D-(DUP1)	D	1	1	D	1	2
WVKP-38-D-(DUP2)	D	1	1	D	1	1
WVKP-40	D	1	1	D	0	1
WVKP-41-A	D	2	1	D	2	1
WVKP-43-{1.6}	D	0	1	D	0	1
WVKP-43-A	D	1	1	N	0	0
WVKP-45.5	D	0	2	D	0	1
WVK-30	D	1	1	D	1	1
WVK-32-0.1A	D	1	2	D	1	2
WVK-32-A	D	1	2	D	2	3
WVK-33	N	0	0	D	1	0
WVK-36-{2.4}	D	1	2	D	1	3
WVK-39-A	D	0	2	D	0	1
WVK-39-{01.6}	D	1	4	D	2	2
WVK-39-B-{0.1}	D	2	1	D	2	1
WVK-39-E-3-{0.4}	D	2	4	D	2	4
WVK-39-E-3-{0.6}	D	2	4	D	2	4
WVK-39-F	M	1	2	N	0	0
WVK-39-J	D	1	1	D	1	1
WVK-39-{09.4}	D	1	1	D	3	2
WVK-39-M-1-A-{1.0}	D	2	4	D	2	4
WVK-39-O	D	0	1	D	2	2
WVK-39-{12.2}	D	1	1	D	1	2
WVK-41-A	D	1	2	D	1	2
WVK-41	D	2	3	D	2	3
WVK-41-D-1	D	0	2	D	1	2
WVK-41-D.5	N	0	0	D	2	3

TABLE 12: RIPARIAN HABITAT ASSESSMENT - CANOPY (>5.0 M HIGH) (continued)

Stream AN-Code	Left Descending Bank			Right Descending Bank		
	Dominant Vegetation Type	Big Trees	Small Trees	Dominant Vegetation Type	Big Trees	Small Trees
WVK-41-D.5-B	D	0	2	D	0	1
WVK-41-E-1	M	1	2	D	1	2
WVK-41-E-2-{0.1}	D	0	1	N	0	0
WVK-41-E-2-{1.4}	D	0	2	D	1	2
WVK-41-E-2-{1.7}	D	1	2	D	1	3
WVK-42	D	0	1	M	1	4

Dominant Vegetation Type: D = deciduous
C = coniferous
M = mixed (at least 10 % of each type)
N = none

Big Trees > 0.3 m diameter at breast height

Small Trees < 0.3 m diameter at breast height

Tree Values 0 = absent
1 = sparse (0-10% of canopy)
2 = moderate (10-40%)
3 = heavy (40-75%)
4 = very heavy (>75%)

TABLE 13: SUBSTRATE COMPOSITIONS
(IN AREA OF BENTHIC MACROINVERTEBRATE SAMPLING)

Stream AN-Code	% Bedrock	% Boulder	% Cobble	% Gravel	% Sand	% Silt	% Clay
WVK-6	0	0	0	30	60	10	0
WVK-9-A-(DUP1)	0	0	20	50	10	20	0
WVK-9-A-(DUP2)	0	0	20	40	10	30	0
WVK-9-C-{5.4}	0	5	10	55	25	5	0
WVK-10-A	0	0	20	50	20	10	0
WVK-10-F	0	0	20	50	20	10	0
WVK-11	0	0	15	30	20	35	0
WVK-11-0.5-{0.6}	0	0	0	0	20	70	10
WVK-12-A	0	0	0	45	45	10	0
WVK-12-{12.0}	0	0	30	40	30	0	0
WVK-12-E-{2.4}	0	0	10	25	50	15	0
WVK-12-E-2.5-{0.4}	0	10	40	30	10	10	0
WVK-12-F	0	20	40	20	10	10	0
WVK-12-F-{5.0}	0	0	40	30	20	10	0
WVK-12-{20.7}	0	5	25	30	30	10	0
WVK-12-H	0	0	15	50	25	10	0
WVK-12-J	0	10	30	40	15	5	0
WVK-13	0	0	25	50	10	15	15
WVK-14	0	0	20	30	30	20	0
WVK-14-{2.2}	0	0	10	55	30	5	0
WVK-14-A.5-{1.6}	0	5	10	55	25	5	0
WVK-14-B-1	0	0	35	40	10	15	0
WVK-16-B	0	0	30	30	20	20	0
WVK-16-G-1-{0.4}	0	10	20	40	25	5	0
WVK-16-{12.8}	0	0	35	35	20	10	0
WVK-16-J-3-{1.0}	85	5	0	8	2	0	0
WVK-16-L	0	0	30	40	20	10	0
WVK-16-{25.0}	0	0	15	50	5	30	0
WVK-16-Q-{1.0}	0	10	40	30	10	10	0
WVK-16-S	0	0	40	30	20	10	0
WVK-16-{33.0}	5	0	40	40	5	10	0
WVK-19-C-(DUP1)	0	0	15	40	10	35	0
WVK-19-C-(DUP2)	0	0	5	30	35	25	0
WVK-22-B	0	0	40	30	25	5	0
WVK-22-B-2	0	0	20	40	30	10	0
WVK-22-B-3	0	0	0	40	40	15	5
WVK-22-B-5-B	0	0	15	10	70	5	0
WVK-22-{6.0}	0	10	45	35	5	5	0
WVK-22-{10.6}	0	0	1	55	30	14	0

TABLE 13: SUBSTRATE COMPOSITIONS (continued)
(IN AREA OF BENTHIC MACROINVERTEBRATE SAMPLING)

Stream AN-Code	% Bedrock	% Boulder	% Cobble	% Gravel	% Sand	% Silt	% Clay
WVK-22-{14.4}	0	0	5	35	45	10	0
WVK-22-J-{1.3}	0	0	20	30	20	30	0
WVKP-1	0	0	1	44	45	10	0
WVKP-1-A	0	0	35	35	30	0	0
WVKP-1-A-0.1-{1.6}	0	0	45	45	8	2	0
WVKP-1-B	0	0	40	35	15	0	10
WVK-29-{4.7}	0	0	0	0	10	80	10
WVK-29-{08.5}	0	0	0	0	10	80	10
WVKP-4	10	0	40	40	7	3	0
WVKP-5	10	15	30	30	10	5	0
WVKP-8	0	0	20	60	5	15	0
WVKP-9-A	0	0	40	40	5	15	0
WVKP-13-{1.3}	0	0	5	60	20	15	0
WVKP-13-A-1-A	0	0	40	45	5	10	0
WVKP-13-{3.0}	0	0	1	45	30	24	0
WVKP-16-{4.5}	0	0	50	40	9	1	0
WVKP-16-B	0	5	65	10	15	5	0
WVKP-16-D	0	0	80	10	5	5	0
WVKP-17-{0.3}	0	20	20	0	40	20	0
WVKP-17-B-5	0	0	30	50	20	0	0
WVKP-17-C-1-A	0	0	50	40	3	7	0
WVKP-17-C-4	0	0	50	40	1	9	0
WVKP-17-C-4.5-{1}	10	0	40	45	5	0	0
WVKP-17-E-{2.6}	0	0	30	55	10	5	0
WVKP-17-F-1	0	0	20	70	5	5	0
WVKP-17-G	0	0	50	40	3	7	0
WVKP-20	0	0	20	60	20	0	0
WVKP-21	0	10	20	40	25	5	0
WVK-29-{32.5}	0	0	0	0	80	10	10
WVKP-26	0	0	40	30	25	5	0
WVKP-28	0	0	40	25	25	10	0
WVKP-28-A-1-{0.7}	0	0	40	45	10	3	2
WVKP-28-B-1	0	0	20	45	20	15	0
WVKP-28-E	5	5	25	35	20	10	0
WVKP-29	0	0	25	50	20	5	0
WVKP-32-.5A	0	0	20	40	25	15	0
WVKP-32-{1.0}	0	0	30	40	20	10	0
WVKP-33-{0.1}	0	0	0	0	60	40	0
WVKP-33-{5.8}	0	0	40	45	10	5	0
WVKP-33-D-{0.8}	0	0	30	60	2	8	0

TABLE 13: SUBSTRATE COMPOSITIONS (continued)
(IN AREA OF BENTHIC MACROINVERTEBRATE SAMPLING)

Stream AN-Code	% Bedrock	% Boulder	% Cobble	% Gravel	% Sand	% Silt	% Clay
WVKP-33-G	0	0	40	40	5	15	0
WVKP-36-B	20	10	30	30	5	5	0
WVKP-37-A	0	5	30	50	5	10	0
WVK-29-{61.0}	0	0	40	40	18	2	0
WVKP-38-.8A	0	10	30	45	10	5	0
WVKP-38-D-(DUP1)	0	0	40	45	10	5	0
WVKP-38-D-(DUP2)	0	0	40	50	5	5	0
WVKP-40	0	0	40	40	10	10	0
WVKP-41-A	0	0	40	40	10	10	0
WVKP-43-{1.6}	0	2	3	50	40	5	0
WVKP-43-A	0	0	30	60	8	2	0
WVKP-45.5	0	0	40	50	5	5	0
WVK-30	0	0	20	10	5	5	60
WVK-32-0.1A	0	0	20	40	15	5	20
WVK-32-A	0	0	1	54	38	5	2
WVK-33	0	0	10	40	0	50	0
WVK-36-{2.4}	0	0	20	60	5	15	0
WVK-39-A	0	0	40	30	25	5	0
WVK-39-{01.6}	0	3	2	1	89	5	0
WVK-39-B-{0.1}	0	0	5	5	85	5	0
WVK-39-E-3-{0.4}	0	0	20	25	45	10	0
WVK-39-E-3-{0.6}	3	0	40	30	22	5	0
WVK-39-F	0	0	25	40	35	0	0
WVK-39-J	0	0	35	30	34	1	0
WVK-39-{09.4}	0	0	30	40	30	0	0
WVK-39-M-1-A-{1.0}	0	0	35	25	25	15	0
WVK-39-O	0	0	35	40	25	0	0
WVK-39-{12.2}	0	0	15	50	35	0	0
WVK-41-A	0	0	1	40	4	55	0
WVK-41	0	0	35	30	30	5	0
WVK-41-D-1	0	0	50	35	5	10	0
WVK-41-D.5	0	0	40	40	10	10	0
WVK-41-D.5-B	0	0	45	40	5	10	0
WVK-41-E-1	0	0	30	50	5	15	0
WVK-41-E-2-{0.1}	0	10	10	30	40	10	0
WVK-41-E-2-{1.4}	0	0	20	30	30	20	0
WVK-41-E-2-{1.7}	0	10	20	35	25	10	0
WVK-42	0	15	40	30	15	0	0

TABLE 14: SEDIMENT CHARACTERISTICS			
Stream AN-Code	**Sediment Odor**	**Sediment Oils**	**Sediment Deposits**
WVK-6	NORMAL	ABSENT	SAND, SILT
WVK-9-A-(DUP1)	NORMAL	ABSENT	SAND, SILT
WVK-9-A-(DUP2)	NORMAL	ABSENT	SAND, SILT
WVK-9-C-{5.4}	NORMAL	ABSENT	SAND, SILT
WVK-10-A	NORMAL	ABSENT	SAND, SILT
WVK-10-F	NORMAL	ABSENT	SAND, SILT
WVK-11	NORMAL	ABSENT	PAPER FIBER, SAND, SILT
WVK-11-0.5-{0.6}	ANAEROBIC	SLIGHT	SLUDGE, SAND, SILT
WVK-12-A	NORMAL	ABSENT	SAND, SILT
WVK-12-{12.0}	NORMAL	ABSENT	SAND, SILT
WVK-12-E-{2.4}	NORMAL	ABSENT	SAND, SILT
WVK-12-E-2.5-{0.4}	NORMAL	ABSENT	SAND, SILT
WVK-12-F	NORMAL	ABSENT	SAND, SILT
WVK-12-F-{5.0}	NORMAL	ABSENT	SAND, SILT
WVK-12-{20.7}	NORMAL	ABSENT	SAND, SILT
WVK-12-H	NORMAL	ABSENT	SAND, SILT
WVK-12-J	NORMAL	ABSENT	SAND, SILT
WVK-13	NORMAL	ABSENT	SAND, SILT
WVK-14	NORMAL	ABSENT	SAND, SILT
WVK-14-{2.2}	NONE	ABSENT	SAND, SILT
WVK-14-A.5-{1.6}	NONE	ABSENT	SAND
WVK-14-B-1	NORMAL	ABSENT	SAND, SILT
WVK-16-B	NORMAL	SLIGHT	SAND, SILT
WVK-16-G-1-{0.4}	NORMAL	ABSENT	SAND, SILT
WVK-16-{12.8}	NORMAL	ABSENT	SAND, SILT
WVK-16-J-3-{1.0}	NONE	ABSENT	
WVK-16-L	NORMAL	ABSENT	SAND, SILT
WVK-16-{25.0}	NORMAL	ABSENT	SAND, SILT
WVK-16-Q-{1.0}	NORMAL	ABSENT	SAND, SILT
WVK-16-S	NORMAL	ABSENT	SAND, SILT
WVK-16-{33.0}	NORMAL	ABSENT	SAND, SILT
WVK-19-C-(DUP1)	NORMAL	ABSENT	SAND, SILT
WVK-19-C-(DUP2)	NORMAL	ABSENT	SAND, SILT
WVK-22-B	NORMAL	ABSENT	SAND, SILT
WVK-22-B-2	NORMAL	ABSENT	SAND
WVK-22-B-3	NONE	ABSENT	SAND, SILT
WVK-22-B-5-B	ANAEROBIC	ABSENT	SAND, SILT, CONCRETE, ASPHALT
WVK-22-{6.0}	NORMAL	SLIGHT	SAND, SILT
WVK-22-{10.6}	NORMAL	ABSENT	SAND, SILT
WVK-22-{14.4}	NORMAL	ABSENT	SAND, SILT
WVK-22-J-{1.3}	ANAEROBIC	ABSENT	SILT

TABLE 14: SEDIMENT CHARACTERISTICS (continued)			
Stream AN-Code	**Sediment Odor**	**Sediment Oils**	**Sediment Deposits**
WVKP-1	IRON	ABSENT	SAND, SILT,METAL HYDROXIDES
WVKP-1-A	IRON	ABSENT	SAND, SILT,METAL HYDROXIDES
WVKP-1-A-0.1-{1.6}	NORMAL	ABSENT	SAND
WVKP-1-B	NORMAL	ABSENT	SAND, SILT, & CLAY
WVK-29-{4.7}	NORMAL	ABSENT	SAND, SILT
WVK-29-{08.5}	NORMAL	ABSENT	SAND, SILT
WVKP-4	NORMAL	ABSENT	SAND, METAL HYDROXIDES
WVKP-5	NORMAL	ABSENT	SAND, SILT
WVKP-8	NORMAL	ABSENT	SAND, SILT
WVKP-9-A	SEWAGE	ABSENT	SILT
WVKP-13-{1.3}	NORMAL	ABSENT	SAND, SILT
WVKP-13-A-1-A	NORMAL	ABSENT	SILT
WVKP-13-{3.0}	NORMAL	ABSENT	SAND, SILT
WVKP-16-{4.5}	NORMAL	ABSENT	SAND
WVKP-16-B	NORMAL	ABSENT	SAND, SILT, & TRASH
WVKP-16-D	NORMAL	ABSENT	SAND, SILT
WVKP-17-{0.3}	NORMAL	ABSENT	SAND, SILT
WVKP-17-B-5	NORMAL	ABSENT	SAND
WVKP-17-C-1-A	SEWAGE	ABSENT	SILT
WVKP-17-C-4	NORMAL	ABSENT	SILT
WVKP-17-C-4.5-{1}	NORMAL	ABSENT	SILT
WVKP-17-E-{2.6}	NORMAL	ABSENT	SAND, SILT
WVKP-17-F-1	NORMAL	ABSENT	
WVKP-17-G	NORMAL	ABSENT	SOME JUNK METAL PIECES
WVKP-20	SEWAGE	ABSENT	SAND, SILT
WVKP-21	NORMAL	ABSENT	SAND, SILT
WVK-29-{32.5}	NORMAL	ABSENT	SAND, SILT
WVKP-26	NORMAL	ABSENT	SAND, SILT
WVKP-28	NORMAL	ABSENT	SAND
WVKP-28-A-1-{0.7}	NORMAL	ABSENT	SAND, SILT
WVKP-28-B-1	NORMAL	ABSENT	SAND, SILT
WVKP-28-E	NORMAL	ABSENT	SILT
WVKP-29	NORMAL	ABSENT	SAND, SILT
WVKP-32-.5A	NORMAL	ABSENT	SAND, SILT
WVKP-32-{1.0}	NORMAL	ABSENT	SAND, SILT
WVKP-33-{0.1}	NORMAL	ABSENT	SAND, SILT
WVKP-33-{5.8}	NORMAL	ABSENT	SAND, RELIC SHELLS, SILT
WVKP-33-D-{0.8}	NORMAL	ABSENT	SILT
WVKP-33-G	NORMAL	ABSENT	SAND, SILT
WVKP-36-B	NORMAL	ABSENT	SAND, SILT
WVKP-37-A	NORMAL	ABSENT	SAND, SILT

TABLE 14: SEDIMENT CHARACTERISTICS (continued)			
Stream AN-Code	**Sediment Odor**	**Sediment Oils**	**Sediment Deposits**
WVK-29-{61.0}	NORMAL	ABSENT	SAND, SILT
WVKP-38-.8A	NORMAL	ABSENT	SAND, SILT
WVKP-38-D-(DUP1)	NORMAL	ABSENT	SAND, SILT
WVKP-38-D-(DUP2)	NORMAL	ABSENT	PAPER FIBER, SAND, SILT
WVKP-40	NORMAL	ABSENT	SAND, SILT
WVKP-41-A	NORMAL	ABSENT	SAND, SILT
WVKP-43-{1.6}	NORMAL	ABSENT	SAND, SILT
WVKP-43-A	NORMAL	ABSENT	SAND
WVKP-45.5	MANURE	ABSENT	SILT
WVK-30	NORMAL	ABSENT	SILT, METAL HYDROXIDES
WVK-32-0.1A	NORMAL	ABSENT	SAND, SILT
WVK-32-A	NORMAL	ABSENT	SAND, SILT
WVK-33	NORMAL	ABSENT	SAND, SILT
WVK-36-{2.4}	NORMAL	ABSENT	SILT
WVK-39-A	NORMAL	ABSENT	SAND, SILT, METAL HYDROXIDES
WVK-39-{01.6}	NORMAL	ABSENT	SAND, SILT, LOTS OF TRASH
WVK-39-B-{0.1}	NORMAL	ABSENT	SAND, TRASH , TIRES
WVK-39-E-3-{0.4}	NORMAL	ABSENT	SAND, SILT
WVK-39-E-3-{0.6}	NORMAL	ABSENT	SAND, SILT
WVK-39-F	NORMAL	ABSENT	SAND
WVK-39-J	NORMAL	ABSENT	SAND, SILT
WVK-39-{09.4}	CHEMICAL	ABSENT	SAND, SILT
WVK-39-M-1-A-{1.0}	NONE	ABSENT	SAND, SILT
WVK-39-O	NORMAL	ABSENT	SAND
WVK-39-{12.2}	NORMAL	ABSENT	SAND
WVK-41-A	CHEMICAL	ABSENT	SAND, SILT, METAL HYDROXIDES, BRICKS, BLOCKS
WVK-41	NORMAL	ABSENT	SAND, SILT
WVK-41-D-1	ANAEROBIC	ABSENT	SILT
WVK-41-D.5	NORMAL	ABSENT	SAND, SILT, METAL HYDROXIDES
WVK-41-D.5-B	NORMAL	ABSENT	SAND, SILT
WVK-41-E-1	NORMAL	ABSENT	SILT
WVK-41-E-2-{0.1}	NONE	ABSENT	SAND, SILT
WVK-41-E-2-{1.4}	NORMAL	ABSENT	SAND, SILT
WVK-41-E-2-{1.7}	NORMAL	ABSENT	SAND, SILT
WVK-42	NORMAL	ABSENT	SAND, SILT, METAL HYDROXIDES

TABLE 15: RAPID HABITAT ASSESSMENT SCORES													
Stream AN-Code	cover	substrate	embed	velocity	alter	sediment	riffles	flow	bank	bank veg	graze	rip veg	total
WVK-6	7	7	7	13	11	6	16	9	5	4	7	3	95
WVK-9-A-(DUP1)	12	11	12	10	13	10	14	12	10	13	12	8	137
WVK-9-A-(DUP2)	7	8	7	8	13	6	12	11	6	10	11	6	105
WVK-9-C-{5.4}	6	8	11	6	18	15	7	8	13	16	16	15	139
WVK-10-A	11	9	9	9	14	11	11	13	17	17	7	10	138
WVK-10-F	11	12	13	15	15	11	17	10	10	9	8	7	138
WVK-11	6	6	5	11	14	6	12	13	7	5	13	11	109
WVK-11-0.5-{0.6}	6	3	6	3	8	6	6	5	11	18	4	3	79
WVK-12-A	14	7	7	14	11	8	12	13	8	8	8	2	112
WVK-12-{12.0}	17	11	12	16	13	7	6	12	8	5	7	3	117
WVK-12-E-{2.4}	12	8	7	12	17	8	7	14	8	7	18	17	135
WVK-12-E-2.5-{0.4}	7	17	14	10	17	10	17	14	18	14	12	4	154
WVK-12-F	9	5	2	16	8	4	3	11	6	4	6	3	77
WVK-12-F-{5.0}	15	13	13	11	14	11	16	14	15	15	8	3	148
WVK-12-{20.7}	16	10	10	16	12	9	6	14	12	10	11	2	128
WVK-12-H	16	5	10	14	12	9	8	15	10	10	5	0	114
WVK-12-J	16	12	12	15	13	10	16	14	10	10	10	5	143
WVK-13	15	14	18	10	18	14	19	15	14	18	18	13	186
WVK-14	14	5	9	13	12	5	9	13	5	5	10	5	105
WVK-14-{2.2}	6	11	9	16	16	8	15	12	5	9	7	9	123
WVK-14-A.5-{1.6}	16	10	16	10	14	12	14	10	10	10	9	5	136
WVK-14-B-1	18	18	19	16	18	13	18	11	10	10	19	19	189
WVK-16-B	15	17	13	13	12	6	16	12	11	9	8	5	137
WVK-16-G-1-{0.4}	6	6	13	8	4	5	12	7	8	4	4	5	82
WVK-16-{12.8}	15	15	10	14	10	8	7	13	14	10	7	9	132
WVK-16-J-3-{1.0}	8	12	17	14	16	19	8	9	14	18	10	0	145
WVK-16-L	16	17	12	14	13	10	16	16	12	14	10	4	154
WVK-16-{25.0}	8	12	12	17	6	7	14	11	2	3	6	1	99
WVK-16-Q-{1.0}	10	18	12	13	13	11	17	17	14	15	9	5	154
WVK-16-S	11	16	14	10	13	15	18	16	11	12	0	1	137
WVK-16-{33.0}	10	12	12	10	19	10	11	10	13	14	13	9	143
WVK-19-C-(DUP1)	11	10	10	13	13	7	16	13	8	9	10	5	125
WVK-19-C-(DUP2)	8	6	8	12	10	5	16	8	8	8	11	7	107
WVK-22-B	13	18	11	16	12	10	15	17	11	8	7	5	143
WVK-22-B-2	11	10	8	10	14	7	11	16	5	5	2	1	100
WVK-22-B-3	7	11	7	13	13	4	13	8	5	7	7	4	99
WVK-22-B-5-B	3	4	1	3	11	2	3	11	18	18	15	6	95
WVK-22-{6.0}	9	8	9	12	18	8	6	15	6	8	16	10	125
WVK-22-{10.6}	7	5	7	8	20	7	8	17	12	12	14	2	119
WVK-22-{14.4}	9	4	6	7	11	6	6	11	8	9	9	3	89
WVK-22-J-{1.3}	10	12	6	14	19	6	12	16	1	1	7	12	116
WVKP-1	3	7	4	15	9	4	7	13	10	10	7	5	94

TABLE 15: RAPID HABITAT ASSESSMENT SCORES (continued)													
Stream AN-Code	**cover**	**substrate**	**embed**	**velocity**	**alter**	**sediment**	**riffles**	**flow**	**bank**	**bank veg**	**graze**	**rip veg**	**total**
WVKP-1-A	4	6	3	11	15	3	1	14	8	6	8	4	83
WVKP-1-A-0.1-{1.6}	16	10	14	14	16	15	16	9	9	7	14	8	148
WVKP-1-B	10	16	12	10	12	6	18	13	8	3	9	6	123
WVK-29-{4.7}	8	12	8	14	18	6	6	16	12	13	15	15	143
WVK-29-{08.5}	14	14	7	13	18	6	6	16	14	11	13	7	139
WVKP-4	10	11	7	13	17	12	12	9	5	7	17	7	127
WVKP-5	13	14	10	16	18	10	13	10	8	14	14	12	152
WVKP-8	9	12	10	10	18	9	11	15	16	17	5	5	137
WVKP-9-A	11	10	10	13	13	9	11	10	10	12	10	6	125
WVKP-13-{1.3}	7	9	10	13	10	4	11	11	3	4	16	13	111
WVKP-13-A-1-A	11	11	10	13	15	9	11	9	3	2	7	3	104
WVKP-13-{3.0}	5	2	7	4	20	7	8	9	6	7	20	17	112
WVKP-16-{4.5}	15	12	14	14	12	11	17	13	11	10	16	3	148
WVKP-16-B	15	16	10	12	15	10	17	15	16	18	16	8	168
WVKP-16-D	16	19	16	11	15	15	19	15	16	17	16	5	180
WVKP-17-{0.3}	11	6	8	13	13	7	4	16	7	4	18	13	120
WVKP-17-B-5	14	15	14	14	19	10	16	13	15	15	19	19	183
WVKP-17-C-1-A	12	15	11	13	16	11	16	10	10	10	10	4	138
WVKP-17-C-4	15	18	17	14	19	14	18	8	10	11	18	10	172
WVKP-17-C-4.5-{1}	16	14	15	10	18	16	17	8	15	15	15	16	175
WVKP-17-E-{2.6}	12	13	12	14	18	8	11	10	12	11	12	6	139
WVKP-17-F-1	12	17	16	13	19	16	18	10	10	11	10	8	160
WVKP-17-G	11	13	11	11	17	11	11	10	11	11	7	5	129
WVKP-20	13	16	13	13	18	10	18	15	11	13	13	6	159
WVKP-21	15	15	16	12	19	12	17	15	16	18	16	8	179
WVK-29-{32.5}	9	11	7	12	18	6	6	16	15	10	17	18	145
WVKP-26	11	12	12	11	15	9	16	14	11	14	16	8	149
WVKP-28	16	15	16	15	19	14	14	15	13	15	14	15	181
WVKP-28-A-1-{0.7}	11	11	10	10	13	10	13	8	10	12	10	5	123
WVKP-28-B-1	12	12	9	10	11	13	16	8	10	10	10	4	125
WVKP-28-E	14	13	11	10	16	11	16	8	6	7	15	6	133
WVKP-29	7	12	10	11	18	9	12	11	11	10	18	16	145
WVKP-32-.5A	13	14	15	10	18	14	16	9	15	11	18	15	168
WVKP-32-{1.0}	11	10	10	16	12	6	8	11	10	9	12	11	126
WVKP-33-{0.1}	6	4	7	7	17	3	6	11	9	5	14	13	102
WVKP-33-{5.8}	16	12	14	15	13	11	12	15	9	9	16	7	149
WVKP-33-D-{0.8}	13	13	16	10	18	14	12	8	7	9	17	18	155
WVKP-33-G	9	11	9	14	16	8	10	12	11	11	16	10	137
WVKP-36-B	11	10	15	10	18	12	10	15	14	16	18	12	161
WVKP-37-A	9	10	11	14	13	11	12	11	11	9	9	8	128
WVK-29-{61.0}	9	9	11	10	17	5	16	9	6	6	16	18	132

TABLE 15: RAPID HABITAT ASSESSMENT SCORES (continued)

Stream AN-Code	cover	substrate	embed	velocity	alter	sediment	riffles	flow	bank	bank veg	graze	rip veg	total
WVKP-38-.8A	11	10	11	9	18	10	12	9	11	13	18	18	150
WVKP-38-D-(DUP1)	10	14	13	12	13	11	12	15	14	14	5	4	137
WVKP-38-D-(DUP2)	12	11	16	12	17	14	14	13	15	17	7	4	152
WVKP-40	8	10	7	13	18	10	11	14	11	12	16	16	146
WVKP-41-A	10	14	15	10	17	12	12	16	14	13	7	4	144
WVKP-43-{1.6}	5	6	4	11	13	5	11	6	14	13	12	9	109
WVKP-43-A	10	12	11	10	16	11	9	15	14	19	15	10	152
WVKP-45.5	11	12	14	10	16	12	13	10	11	11	16	9	145
WVK-30	1	1	3	14	11	11	1	20	10	10	8	4	94
WVK-32-0.1A	6	16	4	8	17	6	19	6	11	13	10	8	124
WVK-32-A	5	11	7	10	15	8	17	8	9	7	15	8	120
WVK-33	5	16	5	8	7	10	19	16	12	13	1	4	116
WVK-36-{2.4}	11	10	11	10	18	8	12	7	7	8	18	17	137
WVK-39-A	9	15	5	10	11	11	18	15	11	14	12	6	137
WVK-39-{01.6}	3	10	8	8	13	7	5	18	12	9	16	11	120
WVK-39-B-{0.1}	9	9	9	4	19	6	11	15	8	10	18	18	136
WVK-39-E-3-{0.4}	13	18	9	16	19	8	19	17	11	16	19	14	179
WVK-39-E-3-{0.6}	17	15	14	10	20	15	17	17	17	19	20	17	198
WVK-39-F	12	13	11	9	16	11	16	14	7	15	6	2	132
WVK-39-J	15	15	11	9	5	11	18	18	16	16	5	1	140
WVK-39-{09.4}	11	14	13	16	15	13	16	18	14	11	9	3	153
WVK-39-M-1-A-{1.0}	14	17	11	10	20	11	18	11	15	18	19	15	179
WVK-39-O	16	18	15	14	15	15	19	17	15	16	5	2	167
WVK-39-{12.2}	8	17	13	14	18	7	18	15	7	8	8	7	140
WVK-41-A	3	7	5	14	11	3	17	6	10	11	13	8	108
WVK-41	7	12	8	14	15	9	16	11	14	10	13	12	141
WVK-41-D-1	12	12	11	13	9	10	11	13	14	13	7	5	130
WVK-41-D.5	11	11	10	12	11	11	15	15	14	15	12	3	140
WVK-41-D.5-B	16	11	10	11	13	10	10	9	13	12	7	4	126
WVK-41-E-1	11	12	9	13	16	10	11	9	11	10	10	5	127
WVK-41-E-2-{0.1}	8	10	10	14	12	15	17	19	10	14	1	6	136
WVK-41-E-2-{1.4}	6	13	5	10	14	5	16	10	12	14	16	18	139
WVK-41-E-2-{1.7}	17	18	15	15	13	13	16	16	15	13	13	15	179
WVK-42	17	15	8	14	14	14	19	10	19	19	9	5	163

Key: Categories scored 0-20, higher scores = better habitat, total score possible = 240

cover = instream cover
embed = embeddedness
alter = channel alteration
riffles = frequency of,
bankveg = vegetative protection
graze = grazing or other disruptive pressure
total = total habitat assessment score

substrate = epifaunal substrate
velocity = # of velocity/depth regimes present
sediment = sediment deposition
flow = channel flow status
bank = erosional condition of banks
ripveg = riparian vegetation zone width

TABLE 16: OBSERVED WATER CHARACTERISTICS AT SAMPLE SITES					
Stream AN-Code	**Water Level**	**Water Odor**	**Surface Oils**	**Turbidity**	**Water Color**
WVK-6	NORMAL	NORMAL	NONE	CLEAR	
WVK-9-A-(DUP1)	NORMAL	NORMAL	NONE	CLEAR	
WVK-9-A-(DUP2)	NORMAL	NORMAL	NONE	CLEAR	
WVK-9-C-{5.4}	ABOVE NORMAL	NORMAL	SHEEN	SLIGHT	
WVK-10-A	NORMAL	NORMAL	NONE	CLEAR	
WVK-10-F	NORMAL	NORMAL	NONE	CLEAR	
WVK-11	NORMAL	NORMAL	NONE	CLEAR	
WVK-11-0.5-{0.6}	NORMAL	ANAEROBIC	NONE	SLIGHT	
WVK-12-A	NORMAL	NORMAL	NONE	CLEAR	
WVK-12-{12.0}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-12-E-{2.4}	NORMAL	NORMAL	NONE	MODERATE	
WVK-12-E-2.5-{0.4}	NORMAL	NORMAL	NONE	CLEAR	
WVK-12-F	NORMAL	NORMAL	NONE	CLEAR	
WVK-12-F-{5.0}	NORMAL	NORMAL	NONE	CLEAR	
WVK-12-{20.7}	NORMAL	NORMAL	NONE	MODERATE	
WVK-12-H	NORMAL	NORMAL	NONE	CLEAR	
WVK-12-J	NORMAL	NORMAL	NONE	CLEAR	
WVK-13	NORMAL	NORMAL	NONE	CLEAR	
WVK-14	NORMAL	NORMAL	NONE	SLIGHT	
WVK-14-{2.2}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-14-A.5-{1.6}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-14-B-1	NORMAL	NORMAL	NONE	CLEAR	
WVK-16-{3.5}	NORMAL	NORMAL	NONE	MODERATE	
WVK-16-B	NORMAL	NORMAL	NONE	CLEAR	
WVK-16-G-1-{0.4}	NORMAL	NORMAL	NONE	CLEAR	
WVK-16-{12.8}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-16-J-3-{1.0}	NORMAL	NONE	NONE	CLEAR	
WVK-16-L	NORMAL	NORMAL	NONE	MODERATE	
WVK-16-{25.0}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-16-Q-{1.0}	NORMAL	NORMAL	NONE	CLEAR	
WVK-16-S	NORMAL	NORMAL	NONE	MODERATE	
WVK-16-{33.0}	NORMAL	NORMAL	NONE	CLEAR	
WVK-19-C-(DUP1)	NORMAL	NORMAL	NONE	CLEAR	
WVK-19-C-(DUP2)	NORMAL	NORMAL	NONE	SLIGHT	
WVK-22-B	NORMAL	NORMAL	NONE	MODERATE	
WVK-22-B-2	NORMAL	NORMAL	NONE	CLEAR	
WVK-22-B-3	ABOVE NORMAL	NORMAL	NONE	SLIGHT	
WVK-22-B-5-B	NORMAL	ANAEROBIC	NONE	SLIGHT	
WVK-22-{6.0}	NORMAL	NORMAL	NONE	SLIGHT	

TABLE 16: OBSERVED WATER CHARACTERISTICS AT SAMPLE SITES (continued)					
Stream AN-Code	**Water Level**	**Water Odor**	**Surface Oils**	**Turbidity**	**Water Color**
WVK-22-{10.6}	NORMAL	NORMAL	NONE	MODERATE	
WVK-22-{14.4}	NORMAL	SEWAGE	NONE	MODERATE	
WVK-22-J-{1.3}	NORMAL	NONE	NONE	MODERATE	
WVKP-1	NORMAL	IRON	NONE	SLIGHT	RED - IRON
WVKP-1-A	NORMAL	IRON	NONE	SLIGHT	TAN, ORANGE
WVKP-1-A-0.1-{1.6}	NORMAL	NORMAL	NONE	CLEAR	
WVKP-1-B	NORMAL	NONE	NONE	CLEAR	
WVK-29-{4.7}	NORMAL	NORMAL	NONE	TURBID	BROWN
WVK-29-{08.5}	NORMAL	NORMAL	NONE	TURBID	
WVKP-4	NORMAL	NORMAL	NONE	MODERATE	WHITISH
WVKP-5	NORMAL	NORMAL	NONE	CLEAR	
WVKP-8	NORMAL	NORMAL	NONE	CLEAR	
WVKP-9-A	NORMAL	NORMAL	SLICK	CLEAR	
WVKP-13-{1.3}	NORMAL	NORMAL	NONE	CLEAR	
WVKP-13-A-1-A	NORMAL	NORMAL	NONE	SLIGHT	
WVKP-13-{3.0}	NORMAL	NORMAL	NONE	CLEAR	
WVKP-16-{4.5}	NORMAL	NORMAL	NONE	SLIGHT	
WVKP-16-B	NORMAL	NORMAL	NONE	CLEAR	
WVKP-16-D	NORMAL	NORMAL	NONE	SLIGHT	
WVKP-17-{0.3}	NORMAL	NORMAL	NONE	MODERATE	
WVKP-17-B-5	NORMAL	NORMAL	NONE	CLEAR	
WVKP-17-C-1-A	NORMAL	SEWAGE	NONE	TURBID	MILKY WHITE
WVKP-17-C-4	NORMAL	NORMAL	NONE	CLEAR	
WVKP-17-C-4.5-{1}	NORMAL	NORMAL	NONE	CLEAR	
WVKP-17-E-{2.6}	NORMAL	NORMAL	NONE	CLEAR	
WVKP-17-F-1	NORMAL	NORMAL	NONE	CLEAR	
WVKP-17-G	NORMAL	NORMAL	NONE	CLEAR	
WVKP-20	NORMAL	NORMAL	NONE	SLIGHT	
WVKP-21	NORMAL	NORMAL	NONE	CLEAR	
WVK-29-{32.5}	NORMAL	NORMAL	NONE	TURBID	BROWNISH
WVKP-26	ABOVE NORMAL	NORMAL	NONE	SLIGHT	
WVKP-28	NORMAL	NORMAL	NONE	CLEAR	
WVKP-28-A-1-{0.7}	NORMAL	NORMAL	NONE	CLEAR	
WVKP-28-B-1	NORMAL	NORMAL	NONE	CLEAR	
WVKP-28-E	NORMAL	NORMAL	NONE	CLEAR	
WVKP-29	NORMAL	NORMAL	NONE	SLIGHT	
WVKP-32-.5A	NORMAL	NORMAL	NONE	CLEAR	
WVKP-32-{1.0}	NORMAL	NORMAL	NONE	CLEAR	
WVKP-33-{0.1}	NORMAL	NORMAL	NONE	TURBID	BROWN

TABLE 16: OBSERVED WATER CHARACTERISTICS AT SAMPLE SITES (continued)					
Stream AN-Code	**Water Level**	**Water Odor**	**Surface Oils**	**Turbidity**	**Water Color**
WVKP-33-{5.8}	NORMAL	NORMAL	NONE	MODERATE	
WVKP-33-D-{0.8}	NORMAL	NORMAL	NONE	CLEAR	
WVKP-33-G	NORMAL	NORMAL	NONE	CLEAR	
WVKP-36-B	NORMAL	NORMAL	NONE	CLEAR	
WVKP-37-A	NORMAL	NORMAL	NONE	CLEAR	
WVK-29-{61.0}	NORMAL	NORMAL	NONE	SLIGHT	
WVKP-38-.8A	NORMAL	PETROLEUM	FLECKS	CLEAR	
WVKP-38-D-(DUP1)	NORMAL	NORMAL	NONE	CLEAR	
WVKP-38-D-(DUP2)	NORMAL	NORMAL	NONE	CLEAR	
WVKP-40	NORMAL	NORMAL	NONE	CLEAR	
WVKP-41-A	NORMAL	NORMAL	NONE	CLEAR	
WVKP-43-{1.6}	ABOVE NORMAL	NORMAL	NONE	SLIGHT	
WVKP-43-A	NORMAL	NORMAL	NONE	CLEAR	
WVKP-45.5	NORMAL	NORMAL	NONE	CLEAR	
WVK-30	NORMAL	NORMAL	NONE	MODERATE	
WVK-32-0.1A	NORMAL	NORMAL	NONE	CLEAR	
WVK-32-A	NORMAL	NORMAL	NONE	CLEAR	
WVK-33	NORMAL	NORMAL	NONE	CLEAR	
WVK-36-{2.4}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-39-A	NORMAL	NORMAL	NONE	CLEAR	
WVK-39-{01.6}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-39-B-{0.1}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-39-E-3-{0.4}	NORMAL	NORMAL	NONE	CLEAR	
WVK-39-E-3-{0.6}	NORMAL	NONE	NONE	CLEAR	
WVK-39-F	NORMAL	NORMAL	NONE	CLEAR	
WVK-39-J	NORMAL	NORMAL	NONE	CLEAR	
WVK-39-{09.4}	NORMAL	NORMAL	NONE	CLEAR	
WVK-39-M-1-A-{1.0}	NORMAL	NONE	NONE	CLEAR	
WVK-39-O	NORMAL	NORMAL	NONE	SLIGHT	
WVK-39-{12.2}	NORMAL	NORMAL	NONE	CLEAR	
WVK-41-A	NORMAL	PETROLEUM	NONE	CLEAR	
WVK-41	NORMAL	NORMAL	NONE	CLEAR	
WVK-41-D-1	NORMAL	NORMAL	NONE	SLIGHT	
WVK-41-D.5	NORMAL	NORMAL	NONE	SLIGHT	
WVK-41-D.5-B	NORMAL	NORMAL	NONE	MODERATE	
WVK-41-E-1	NORMAL	NORMAL	NONE	CLEAR	
WVK-41-E-2-{0.1}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-41-E-2-{1.4}	NORMAL	NORMAL	NONE	SLIGHT	
WVK-41-E-2-{1.7}	NORMAL	NORMAL	NONE	CLEAR	
WVK-42	NORMAL	BLUE-GREEN	NONE	CLEAR	

TABLE 17: SUMMARY OF WATER QUALITY PARAMETERS AT ALL SITES

Stream AN-Code	Temperature (°C)	pH	Oxygen (mg/l)	Conductivity (µmhos / cm)	Fecal Coliform (Colonies / 100 ml)
WVK-6	16.0	8.3	9.4	267	>55
WVK-6-A	20.6	7.5	3.5	518	>7000
WVK-9-A-(DUP1)	11.4	7.9	8.5	236	3600
WVK-9-A-(DUP2)	11.4	7.9	8.4	236	1600
WVK-9-C-{5.4}	15.2	7.9	7.5	166	580
WVK-10-A	11.5	8.0	8.9	288	<10
WVK-10-F	9.9	7.8	9.2	242	>30
WVK-11	13.0	8.2	9.5	184	4800
WVK-11-0.5-{0.6}	22.1	7.5	3.9	492	5300
WVK-12-A	12.0	8.2	9.2	251	>600
WVK-12-{12.0}	18.7	7.5	8.1	214	>140
WVK-12-E-{2.4}	20.7	7.7	8.8	218	250
WVK-12-E-2.5-{4.0}	15.4	8.2	8.1	254	40
WVK-12-F	12.4	7.9	8.8	230	63
WVK-12-F-{5.0}	17.5	7.5	6.1	274	120
WVK-12-{20.7}	19.1	7.5	7.8	197	150
WVK-12-H	17.6	7.4	8.4	220	140
WVK-12-J	15.0	7.7	8.3	236	200
WVK-13	11.5	8.0	9.0	169	>70
WVK-14	12.3	7.8	7.7	204	>160
WVK-14-{2.2}	16.4	7.6	8.1	202	340
WVK-14-A.5-{1.6}	18.7	7.8	9.2	203	250
WVK-14-B-1	9.9	7.7	8.6	164	60
WVK-16-{3.5}	18.3	7.7	8.4	212	<10
WVK-16-B	12.3	7.6	8.9	205	>400
WVK-16-G-1-{0.4}	22.5	7.6	8.6	264	340
WVK-16-{12.8}	17.2	7.7	8.2	204	130
WVK-16-J-3-{1.0}	20.1	7.5	9.4	307	700
WVK-16-L	17.0	8.0	9.1	213	320
WVK-16-{25.0}	16.8	8.1	9.4	213	190
WVK-16-Q-{1.0}	19.5	8.1	9.8	191	40
WVK-16-S	16.1	8.0	9.2	250	>12000
WVK-16-{33.0}	21.5	7.6	9.4	265	180
WVK-19-C-(DUP1)	18.9	7.8	7.9	294	>1200
WVK-19-C-(DUP2)	18.9	7.8	7.9	294	>700
WVK-22-B	15.0	7.7	9.0	229	1800
WVK-22-B-2	13.5	7.6	9.9	234	1100
WVK-22-B-3	14.5	7.7	9.7	225	2700

TABLE 17: SUMMARY OF WATER QUALITY PARAMETERS AT ALL SITES (continued)

Stream AN-Code	Temperature (°C)	pH	Oxygen (mg/l)	Conductivity (µmhos / cm)	Fecal Coliform (Colonies / 100 ml)
WVK-22-B-5-B	18.8	7.2	7.7	188	1900
WVK-22-{6.0}	19.3	7.6	8.0	267	300
WVK-22-{10.6}	22.2	7.1	5.6	307	900
WVK-22-{14.4}	23.1	7.2	6.3	380	3400
WVK-22-J-{1.3}	24.7	7.1	6.0	204	7800
WVKP-1	10.7	6.9	8.5	523	380
WVKP-1-A	10.7	6.7	9.2	446	320
WVKP-1-A-0.1-{1.6}	19.7	8.0	9.3	335	18
WVKP-1-B	9.5	8.0	9.8	279	56
WVK-29-{4.7}	21.9	7.3	7.5	245	92
WVK-29-{08.5}	22.5	7.3	7.6	240	100
WVKP-4	11.0	6.7	10.2	484	64
WVKP-5	17.5	7.1	9.0	350	1400
WVKP-8	19.6	7.1	7.7	540	700
WVKP-9-A	17.1	7.3	10.0	282	1200
WVKP-13-{1.3}	22.1	7.4	8.7	374	210
WVKP-13-A-1-A	16.1	7.1	9.4	281	3200
WVKP-13-{3.0}	24.2	7.9	7.5	500	3200
WVKP-16-{4.5}	18.5	7.7	8.7	190	420
WVKP-16-B	10.4	7.7	11.1	192	6600
WVKP-16-D	11.4	7.3	10.2	143	330
WVKP-17-{0.3}	16.6	7.4	8.2	180	500
WVKP-17-B-5	14.0	7.7	10.8	161	30
WVKP-17-C-1-A	10.1	7.6	10.7	191	>6000
WVKP-17-C-4	9.4	7.4	10.4	163	60
WVKP-17-C-4.5-{1}	12.6	7.4	7.3	198	140
WVKP-17-E-{2.6}	18.9	7.9	9.2	305	900
WVKP-17-F-1	14.7	7.5	9.0	142	20
WVKP-17-G	15.6	7.7	10.1	156	1000
WVKP-20	13.4	7.3	10.0	159	1600
WVKP-21	12.2	7.3	10.1	194	270
WVK-29-{32.5}	22.1	7.5	6.9	239	600
WVK-29-{35.0}	12.2	7.4	9.1	183	800
WVKP-26	14.5	8.0	10.2	158	700
WVKP-28	17.6	7.9	9.2	158	900
WVKP-28-A-1-{0.7}	17.5	7.7	8.8	193	3200
WVKP-28-B-1	18.9	7.9	8.4	194	10000
WVKP-28-E	18.2	7.8	7.3	276	110

TABLE 17: SUMMARY OF WATER QUALITY PARAMETERS AT ALL SITES (continued)

Stream AN-Code	Temperature (°C)	pH	Oxygen (mg/l)	Conductivity (µmhos / cm)	Fecal Coliform (Colonies / 100 ml)
WVKP-29	13.0	7.7	10.1	184	1200
WVKP-32-.5A	13.0	7.2	7.0	236	20
WVKP-32-{1.0}	19.6	7.5	8.3	156	800
WVKP-33-{0.1}	15.5	7.2	8.3	159	770
WVKP-33-{5.8}	16.2	7.3	8.6	143	42000
WVKP-33-D-{0.8}	15.2	7.3	8.3	136	900
WVKP-33-G	9.6	7.6	10.5	159	60
WVKP-36-B	13.1	7.6	10.1	148	10
WVKP-37-A	11.3	7.5	10.4	347	150
WVK-29-{61.0}	20.0	7.8	9.4	209	220
WVKP-38-.8A	13.4	7.8	10.4	254	100
WVKP-38-D-(DUP1)	20.5	7.7	9.0	120	800
WVKP-38-D-(DUP2)	20.5	7.6	8.9	120	400
WVKP-40	16.5	7.7	10.4	172	<2
WVKP-41-A	15.8	7.5	10.1	189	2000
WVKP-43-{1.6}	17.7	7.5	8.1	175	230
WVKP-43-A	13.2	7.2	9.8	182	420
WVKP-45.5	12.3	7.2	9.6	194	2000
WVK-30	13.0	6.8	7.6	314	>6000
WVK-32-0.1A	15.0	8.4	8.7	248	>6000
WVK-32-A	14.8	8.2	10.4	263	300
WVK-33	9.7	7.6	9.6	224	3400
WVK-36-{2.4}	15.8	7.4	8.5	260	64
WVK-39-A	18.0	7.8	7.3	713	320
WVK-39-{01.6}	14.8	6.7	9.7	101	150
WVK-39-B-{0.1}	16.5	7.9	9.6	188	320
WVK-39-E-3-{0.4}	12.5	6.1	9.1	47	32
WVK-39-E-3-{0.6}	12.1	6.0	9.4	46	70
WVK-39-F	14.0	7.0	9.2	184	220
WVK-39-J	10.7	7.0	9.7	194	1600
WVK-39-{03.6}	11.8	6.5	9.6	69	480
WVK-39-M-1-A-{1.0}	15.0	6.2	8.4	47	56
WVK-39-O	11.3	6.7	9.5	69	28
WVK-39-{12.2}	15.5	6.6	7.9	73	1300
WVK-41-A	10.6	8.0	9.1	454	4100
WVK-41	14.3	8.4	10.5	290	1300
WVK-41-D-1	14.4	7.1	9.5	279	3200
WVK-41-D.5	12.1	4.8	10.1	449	<2

TABLE 17: SUMMARY OF WATER QUALITY PARAMETERS AT ALL SITES (continued)					
Stream AN-Code	Temperature (°C)	pH	Oxygen (mg/l)	Conductivity (µmhos / cm)	Fecal Coliform (Colonies / 100 ml)
WVK-41-D.5-B	10.6	6.9	10.2	429	100
WVK-41-E-1	18.9	7.7	10.1	341	480
WVK-41-E-2-{0.1}	10.2	7.6	10.4	254	>6000
WVK-41-E-2-{1.4}	12.5	7.6	9.8	193	12000
WVK-41-E-2-{1.7}	12.4	7.4	10.1	188	260
WVK-42	13.2	8.4	9.8	553	320

TABLE 18: CHACTERISTICS OF WATER FROM RANDOM SITES AND SITES WITH PREVIOUS OR POTENTIAL WATER QUALTITY PROBLEMS

Stream AN-Code	Acidity Hot (mg/l)	Alkalinity (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Suspsended Solids (mg/l)	Total Phosphorus (mg/l)	Ammonia (mg/l)	Nitrate + Nitrite N (mg/l)
WVK-6						<0.02*	<1	<0.05
WVK-6-A						0.95	<1	<0.05
WVK-9-A-(DUP1)						<0.02	<1	<0.05
WVK-9-A-(DUP2)						<0.02	<1	<0.05
WVK-9-C-{5.4}	<1	59	18	3	14	<0.02	<1	<0.05
WVK-10-A						<0.02		<0.05
WVK-10-F						<0.02		<0.05
WVK-11						<0.02	<1	0.1
WVK-11-0.5-{0.6}	<1	160	10	48	17	0.5	<1	<0.05
WVK-12-A						<0.02		<0.05
WVK-12-{12.0}				7		<0.02		<0.05
WVK-12-E-{2.4}	<1	78	24	4	<5	<0.02	<1	<0.05
WVK-12-E-2.5-{0.4}	<1	117	16	3	7	<0.02	<1	<0.05
WVK-12-F						<0.02		<0.05
WVK-12-F-{5.0}	<1	113	22	3	6	<0.02	<1	<0.05
WVK-12-{20.7}				2		<0.02		<0.05
WVK-12-H						<0.02		<0.05
WVK-13	<1	49	18	9		<0.02	<1	<0.05
WVK-14						0.022		<0.05
WVK-14-{2.2}	<1	80	16	4	5	0.02	<1	<0.05
WVK-14-A.5-{1.6}	<1	74	20	3	<5	0.04	<1	<0.05
WVK-14-B-1	<1	130	18	6		<0.02	<1	<0.05
WVK-16-{3.5}				8		<0.02		<0.05
WVK-16-G-1-{0.4}	<1	104	20	3	<5	<0.02	<1	<0.05
WVK-16-{12.8}				6		<0.02		<0.05
WVK-16-J-3-{1.0}	<1	96	22	9	7	<0.02	<0.50	0.2
WVK-16-{25.0}				2		<0.02		<0.05
WVK-16-Q-{1.0}	<1	79	15	3	8	<0.02	<1	<0.05
WVK-16-S				8		0.04		<0.05
WVK-16-{33.0}	<1	94	16	4	5	<0.02	<0.5	<0.05
WVK-19-C-(DUP1)						<0.02		<0.05
WVK-19-C-(DUP2)						<0.02		<0.05
WVK-22-B						0.06		0.12
WVK-22-B-2						0.04		0.13
WVK-22-B-3						0.04		0.1
WVK-22-B-5-B								
WVK-22-{6.0}	<1	86	28	10	13	0.05	<0.5	0.31

TABLE 18: CHACTERISTICS OF WATER FROM RANDOM SITES AND SITES WITH PREVIOUS OR POTENTIAL WATER QUALTITY PROBLEMS (continued)

Stream AN-Code	Acidity Hot (mg/l)	Alkalinity (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Suspsended Solids (mg/l)	Total Phosphorus (mg/l)	Ammonia (mg/l)	Nitrate + Nitrite N (mg/l)
WVK-22-{10.6}	<1	94	31	18	27	0.16	<0.5	0.29
WVK-22-{14.4}	<1	110	40	28	21	0.27	<0.5	0.3
WVK-22-J-{1.3}	<1	58	25	8	47	0.04	<0.5	0.19
WVKP-1	<1	59	210	5				
WVKP-1-A	<1	36	190	4				
WVKP-1-A-0.1-{1.6}	<1	110	62	3	<5	<0.02	<0.5	0.23
WVK-29-{4.7}	<1	69	32	15	7	<0.02	<0.5	0.19
WVK-29-{08.5}	<1	69	31	10	10	0.04	<0.5	0.18
WVKP-4	<1	18	210					
WVKP-13-{1.3}	<1	65	97					
WVKP-13-{3.0}	<1	86	160	15	7	0.03	<0.5	0.45
WVKP-16-{4.5}	<1	64	26	2	<5	0.03	<0.5	0.12
WVKP-17-{0.3}	<1	73	16	8	<5	0.02	<0.5	0.05
WVKP-17-C-4.5-{1}	<1	73	19	2	7	0.03	<0.5	0.11
WVKP-17-E-{2.6}	<1	110	19	15	14	<0.02	<0.5	0.07
WVKP-20						<0.02	<0.5	0.18
WVK-29-{32.5}	<1	66	13	22	23	0.07	<0.5	24
WVK-29-{35.0}	<1	47	17	6		0.04	<0.5	0.1
WVKP-28	<1	44	16	6		<0.02	<0.50	0.17
WVKP-28-A-1-{0.7}	<1	74	20	2	<5	<0.02	<0.50	0.13
WVKP-28-E				32				
WVKP-32-{1.0}	<1	68	15	1	<5	<0.02	<0.5	<0.05
WVKP-33-{5.8}	<1	48	14	2	5	0.04	<0.5	0.12
WVKP-33-D-{0.8}	<1	40	14	3	5	0.05	<0.5	0.06
WVKP-37-A				23				
WVK-29-{61.0}	<1	65	16	4	11	0.02	<0.5	0.09
WVKP-40						<0.02	<0.5	<0.05
WVKP-41-A						<0.02	<0.5	<0.05
WVKP-43-{1.6}	<1	68	16	7	15	0.05	<0.5	0.08
WVKP-45.5						<0.02	<.50	0.15
WVK-36-{2.4}	<1	76	47	6	42	0.1	<0.5	0.24
WVK-39-E-3-{0.4}	8	5	16	2		0.25	<0.5	0.14
WVK-39-E-3-{0.6}	<1	8	16	1		0.04	<0.5	0.11
WVK-39-M-1-A-{1.0}	1	7	16	3	<5	<0.02	<0.5	0.24
WVK-39-{12.2}	<1	15	19	<1	<5	<0.02	<0.5	0.14
WVK-41-D.5	<1	130	200					
WVK-41-D.5-B	<1	120	47			0.05	<0.5	0.48

TABLE 18: CHACTERISTICS OF WATER FROM RANDOM SITES AND SITES WITH PREVIOUS OR POTENTIAL WATER QUALTITY PROBLEMS (continued)

Stream AN-Code	Acidity Hot (mg/l)	Alkalinity (mg/l)	Sulfate (mg/l)	Chloride (mg/l)	Suspsended Solids (mg/l)	Total Phosphorus (mg/l)	Ammonia (mg/l)	Nitrate + Nitrite N (mg/l)
WVK-41-E-2-{0.1}						0.49	<0.5	0.29
WVK-41-E-2-{1.4}						<0.02	<0.5	0.4
WVK-41-E-2-{1.7}						<0.02	<0.5	0.15

Blank indicates parameter not tested.
< # - indicates below detection limit listed

TABLE 19: WATER QUALITY - METALS FROM RANDOM SITES AND SITES POSSIBLY IMPACTED BY ACID MINE DRAINAGE
(Results listed in mg/l)

Stream AN-Code	Ca Total	Ca Dissolved	Mg	Al Total	Al Dissolved	Cu	Fe	Mn	Zn
WVK-9-C-{5.4}	17	16.1	4.8	0.81	<0.05	<0.01	0.23	0.04	0.05
WVK-11-0.5-{0.6}	49	38.6	10	1.3	<0.05	<0.01	3.2	2.5	0.08
WVK-12-E-{2.4}	24	24.2	5.8	0.72	<0.05	<0.01	0.41	0.13	0.047
WVK-12-E-2.5-{4.0}	28	29.4	7.6	0.64	<0.05	<0.01	0.14	<0.02	0.046
WVK-12-F-{5.0}	30	30.5	7.9	0.59	<0.05	<0.01	0.14	0.07	0.038
WVK-13				0.12			0.07	<0.02	
WVK-14-{2.2}	24	22.6	4.7	0.61	<0.05	<0.01	0.56	0.16	0.037
WVK-14-A.5-{1.6}	22	23.2	5.1	0.5	<0.05	<0.01	0.084	<0.02	0.054
WVK-14-B-1				0.1			0.06	<0.02	
WVK-16-G-1-{0.4}	29	28.9	7	0.64	<0.05	<0.01	0.13	<0.02	0.04
WVK-16-J-3-{1.0}	26	28.1	6.6	0.087	<0.05	<0.005	0.15	<0.020	0.034
WVK-16-Q-{1.0}	21	20.7	4.7	0.7	<0.05	<0.01	0.13	<0.02	0.14
WVK-16-{33.0}	25	25.9	5.6	0.12	<0.05	<0.005	0.11	<0.020	0.074
WVK-22-{6.0}	24	25.3	5.6	0.26	<0.05	<0.005	0.67	0.16	<0.020
WVK-22-{10.6}	25	27.4	5.4	0.44	<0.05	0.005	0.86	0.19	0.25
WVK-22-{14.4}	27	28.3	5.5	0.29	<0.05	<0.005	0.61	0.21	0.27
WVK-22-J-{1.3}	16	16.3	4.7	0.54	<0.05	<0.005	1.3	0.14	0.029
WVKP-1				0.28			5.1	0.5	
WVKP-1-A				1.8			4.4	0.7	
WVKP-1-A-0.1-{1.6}	35	34.6	9.4	0.13	<0.05	<0.005	0.07	<0.020	0.026
WVK-29-{4.7}	24	24.4	5.1	0.26	<0.05	<0.005	0.57	0.22	0.049
WVK-29-{08.5}	24	25.6	5	0.35	<0.05	<0.005	0.62	0.15	0.043
WVKP-4				4.1			0.46	0.88	
WVKP-13-{1.3}				0.14			0.23	0.21	
WVKP-13-{3.0}	55	60	13	0.072	<0.05	<0.005	0.16	0.14	0.2
WVKP-16-{4.5}	19	20.2	4.6	0.18	<0.05	<0.005	0.27	<0.020	<0.020
WVKP-17-{0.3}	19	18.9	4.4	<0.100	<0.05	<0.005	0.2	0.037	<0.020
WVKP-17-C-4.5-{1}	17	17.4	5.3	0.12	<0.05	<0.005	0.2	0.02	<0.020
WVKP-17-E-{2.6}	30	31.6	7.2	<0.10	<0.05	<0.005	0.094	0.033	<0.02
WVK-29-{32.5}	20	23.7	4.2	0.54	<0.05	<0.005	0.87	0.1	0.053
WVK-29-{35.0}				0			0	0	
WVKP-28				<0.100			0.11	<0.020	
WVKP-28-A-1-{0.7}	23	23.6	4.4	0.17	<0.05	<0.005	0.25	0.16	0.023
WVKP-32-{1.0}	19	19.6	3.9	<0.100	<0.05	<0.005	0.17	0.078	0.027
WVKP-33-{5.8}	12	14.4	3.1	0.16	<0.05	<0.005	0.35	0.05	<0.020

TABLE 19: WATER QUALITY - METALS FROM RANDOM SITES AND SITES POSSIBLY IMPACTED BY ACID MINE DRAINAGE (continued)
(Results listed in mg/l)

Stream AN-Code	Ca Total	Ca Dissolved	Mg	Al Total	Al Dissolved	Cu	Fe	Mn	Zn
WVKP-33-D-{0.8}	9.6	10..2	3.2	0.19	<0.05	<0.005	0.26	<0.020	<0.020
WVK-29-{61.0}	18	23.2	4	0.19	<0.05	<0.005	0.41	0.078	<0.02
WVKP-43-{1.6}	18	19.2	4.1	0.41	<0.05	<0.005	0.85	0.19	0.028
WVK-36-{2.4}	21	20.3	9.3	0.63	<0.05	0.006	0.96	0.065	0.034
WVK-39-E-3-{0.4}				<0.050			0.17	<0.020	
WVK-39-E-3-{0.6}				0.15			0.24	0.026	
WVK-39-M-1-A-{1.0}	2.7	3.8	2.2	0.086	<0.05	<0.005	0.21	0.024	<0.020
WVK-39-{12.2}	5.7	5.26	3.2	0.081	<0.05	<0.005	0.27	0.033	0.057
WVK-41-D.5				3.6			0.68	1.2	
WVK-41-D.5-B				0.63		<0.005			0.14
WVK-41-E-2-{1.4}									
WVK-41-E-2-{1.7}									

Blank indicates data not collected
<# indicates below detection limit

Ca = Calcium
Mg = Magnesium
Al = Aluminum
Cu = Copper
Fe = Iron
Mn = Manganese
Zn = Zinc

TABLE 20: BENTHIC MACROINVERTEBRATE METRICS AND BIOSCORE

Stream AN-Code	Total Taxa	EPT Taxa	HBI - Modified	% Dominant Taxa	# Intolerant Taxa	Bioscore
WVK-6	9	6	3.45	47.67	4	63.64
WVK-9-A-(DUP1)	12	6	5.33	46.41	3	54.55
WVK-9-A-(DUP2)	17	10	5.51	48.61	5	81.82
WVK-9-C-{5.4}	14	7	4.11	34.95	4	54.55
WVK-10-A	15	9	4.36	26.41	5	90.91
WVK-10-F	15	9	4.53	26.79	6	90.91
WVK-11	14	8	5.35	51.84	4	54.55
WVK-12-{12.0}	14	8	3.83	38.89	6	72.73
WVK-12-A	17	9	4.76	26.70	5	90.91
WVK-12-E-{2.4}	20	7	5.86	28.00	2	63.64
WVK-12-E-2.5-{0.4}	13	8	3.89	23.08	4	72.73
WVK-12-F	15	9	5.34	55.38	4	72.73
WVK-12-F-{5.0}	16	5	4.21	35.22	1	54.55
WVK-12-{20.7}	10	6	3.82	36.24	4	63.64
WVK-12-H	17	10	3.56	23.15	5	100.00
WVK-12-J	17	10	3.47	31.40	8	100.00
WVK-13	15	9	3.94	33.86	5	90.91
WVK-14	12	8	4.64	35.32	6	63.64
WVK-14-{2.2}	10	4	3.68	55.92	1	45.45
WVK-14-A.5-{1.6}	16	8	3.72	49.71	4	72.73
WVK-14-B-1	18	12	3.02	31.72	7	100.00
WVK-16-B	13	8	5.55	53.96	5	63.64
WVK-16-G-1-{0.4}	15	9	4.74	36.78	4	72.73
WVK-16-{12.8}	17	10	3.57	43.59	6	90.91
WVK-16-J-3-{1.0}	11	3	6.29	66.34	1	27.27
WVK-16-L	16	9	3.14	39.23	6	90.91
WVK-16-{25.0}	14	8	3.38	39.05	5	72.73
WVK-16-Q-{1.0}	10	7	4.10	31.18	4	63.64
WVK-16-S	18	12	5.10	32.57	6	90.91
WVK-16-{33.0}	13	5	4.51	27.10	3	63.64
WVK-19-C-(DUP1)	11	7	5.23	39.87	4	54.55
WVK-19-C-(DUP2)	12	8	5.28	38.41	5	63.64
WVK-22-B	15	6	5.37	47.95	3	63.64
WVK-22-B-2	11	5	6.09	64.68	1	45.45
WVK-22-B-3	12	7	6.70	88.06	3	45.45
WVK-22-B-5-B	8	3	7.45	44.74	0	27.27
WVK-22-{6.0}	12	4	6.12	47.06	1	36.36
WVK-22-{10.6}	10	1	5.82	48.33	0	36.36
WVK-22-{14.4}	6	1	6.37	54.01	0	27.27
WVK-22-J-{1.3}	10	5	5.67	40.63	2	45.45

TABLE 20: BENTHIC MACROINVERTEBRATE METRICS AND BIOSCORE (continued)						
Stream AN-Code	**Total Taxa**	**EPT Taxa**	**HBI - Modified**	**% Dominant Taxa**	**# Intolerant Taxa**	**Bioscore**
WVKP-1	11	6	3.76	21.57	2	63.64
WVKP-1-A	9	4	1.47	58.82	3	54.55
WVKP-1-A-0.1-{1.6}	13	6	6.46	36.26	3	54.55
WVKP-1-B	14	11	4.67	34.16	7	72.73
WVKP-4	6	1	4.46	46.15	2	27.27
WVKP-5	7	3	6.62	76.47	1	18.18
WVKP-8	8	5	2.80	66.67	4	54.55
WVKP-9-A	5	3	7.69	54.41	2	18.18
WVKP-13-{1.3}	7	3	6.63	54.17	1	27.27
WVKP-13-A-1-A	14	9	5.05	42.66	5	72.73
WVKP-13-{3.0}	5	0	5.85	51.92	0	27.27
WVKP-16-{4.5}	16	9	4.25	24.76	5	90.91
WVKP-16-B	9	2	7.07	75.34	0	18.18
WVKP-16-D	18	12	4.04	52.34	8	81.82
WVKP-17-B-5	16	10	3.38	34.96	6	90.91
WVKP-17-C-1-A	13	9	3.90	32.39	7	90.91
WVKP-17-C-4	12	8	4.47	46.84	5	63.64
WVKP-17-C-4.5-{1}	10	6	5.23	57.66	3	54.55
WVKP-17-E-{2.6}	10	4	3.11	56.32	2	45.45
WVKP-17-F-1	11	8	4.13	56.72	5	63.64
WVKP-17-G	19	12	3.02	33.41	8	100.00
WVKP-20	15	9	5.51	57.27	6	81.82
WVKP-21	18	11	4.73	64.72	8	81.82
WVKP-26	6	1	6.89	92.31	0	9.09
WVKP-28	17	12	4.35	33.80	6	90.91
WVKP-28-A-1-{0.7}	13	9	4.12	21.43	5	81.82
WVKP-28-B-1	19	13	4.27	36.67	6	81.82
WVKP-28-E	10	5	5.86	60.87	2	45.45
WVKP-29	18	11	5.07	51.69	6	81.82
WVKP-32-.5A	18	12	3.88	43.41	6	90.91
WVKP-32-{1.0}	16	9	3.66	26.82	5	100.00
WVKP-33-{5.8}	10	7	2.90	50.00	4	63.64
WVKP-33-D-{0.8}	13	7	3.83	23.08	6	81.82
WVKP-33-G	12	5	5.10	63.89	2	45.45
WVKP-36-B	14	10	4.19	65.32	6	72.73
WVKP-37-A	14	10	2.92	21.84	8	90.91
WVK-29-{61.0}	10	4	4.87	34.74	1	36.36
WVKP-38-.8A	13	9	3.39	35.05	5	81.82
WVKP-38-D-(DUP1)	16	10	3.60	34.12	5	90.91

TABLE 20: BENTHIC MACROINVERTEBRATE METRICS AND BIOSCORE (continued)

Stream AN-Code	Total Taxa	EPT Taxa	HBI - Modified	% Dominant Taxa	# Intolerant Taxa	Bioscore
WVKP-38-D-(DUP2)	15	9	4.05	23.68	6	90.91
WVKP-40	14	9	4.02	34.27	5	72.73
WVKP-41-A	15	9	4.13	32.76	5	90.91
WVKP-43-{1.6}	10	7	4.30	31.15	3	63.64
WVKP-43-A	15	10	3.96	34.62	6	81.82
WVKP-45.5	21	13	4.74	26.97	6	90.91
WVK-30	3	0	7.34	87.64	0	9.09
WVK-32-0.1A	9	2	6.89	78.95	1	18.18
WVK-32-A	8	3	6.71	66.99	1	27.27
WVK-33	4	2	7.20	89.43	1	9.09
WVK-36-{2.4}	13	8	3.64	40.82	4	63.64
WVK-39-A	6	1	7.91	43.81	0	18.18
WVK-39-E-3-{0.4}	17	10	3.54	35.82	5	90.91
WVK-39-E-3-{0.6}	20	12	2.98	18.35	7	100.00
WVK-39-F	11	6	6.82	81.18	4	36.36
WVK-39-J	7	2	6.90	93.04	1	9.09
WVK-39-{09.4}	13	8	3.82	48.00	6	72.73
WVK-39-M-1-A-{1.0}	17	13	3.00	22.96	6	100.00
WVK-39-O	17	12	3.45	31.60	6	100.00
WVK-39-{12.2}	12	8	3.21	47.74	3	63.64
WVK-41-A	2	0	9.69	89.55	0	9.09
WVK-41	4	1	7.03	85.00	0	9.09
WVK-41-D-1	7	2	8.08	43.75	1	18.18
WVK-41-D.5	2	0	6.89	97.73	1	9.09
WVK-41-D.5-B	7	3	6.67	86.08	1	18.18
WVK-41-E-1	14	7	5.75	51.28	4	54.55
WVK-41-E-2-{0.1}	7	1	9.04	73.45	1	9.09
WVK-41-E-2-{1.4}	13	8	9.24	80.11	4	36.36
WVK-41-E-2-{1.7}	12	7	3.62	32.93	4	72.73
WVK-42	5	1	6.96	95.38	0	9.09

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Fivemile Creek WVK-6 5/13/97	49	Baetidae	Ephemeroptera	4
	7	Heptageniidae	Ephemeroptera	4
	1	Elmidae	Coleoptera	4
	2	Capniidae/Leuctridae	Plecoptera	1
	4	Nemouridae	Plecoptera	2
	82	Perlidae	Plecoptera	1
	9	Perlodidae	Plecoptera	2
	2	Ceratopogonidae	Diptera	6
	16	Chironomidae	Diptera	6
Upper Ninemile Creek WVK-9-A-(DUP1) 5/13/97	2	Oligochaeta		10
	1	Hydrobiidae	Operculate Snails	3
	2	Asellidae	Isopoda	8
	280	Baetidae	Ephemeroptera	4
	4	Caenidae	Ephemeroptera	4
	1	Ephemerellidae	Ephemeroptera	4
	46	Heptageniidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	20	Hydroptilidae	Tricoptera	6
	2	Capniidae/Leuctridae	Plecoptera	1
	3	Nemouridae	Plecoptera	2
	6	Perlidae	Plecoptera	1
	4	Perlodidae	Plecoptera	2
	5	Elmidae	Coleoptera	4
	2	Tipulidae	Diptera	3
	5	Ceratopogonidae	Diptera	6
	192	Chironomidae	Diptera	6
Upper Ninemile Creek WVK-9-A-(DUP2) 5/13/97	1	Oligochaeta		10
	3	Asellidae	Isopoda	8
	181	Baetidae	Ephemeroptera	4
	47	Heptageniidae	Ephemeroptera	4
	9	Hydroptilidae	Tricoptera	6
	6	Capniidae/Leuctridae	Plecoptera	1
	11	Perlidae	Plecoptera	1
	5	Perlodidae	Plecoptera	2
	1	Dytiscidae	Coleoptera	5
	2	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	123	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Lower Ninemile Creek WVK-9-C-{5.4} 6/9/97	3	Oligochaeta		10
	11	Cambaridae	Decapoda - Crayfish	5
	5	Asellidae	Isopoda	8
	2	Gammaridae	Amphipoda	4
	1	Ephemerellidae	Ephemeroptera	4
	18	Heptageniidae	Ephemeroptera	4
	36	Leptophlebiidae	Ephemeroptera	2
	1	Limnephilidae	Tricoptera	4
	8	Capniidae/Leuctridae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	5	Tipulidae	Diptera	3
	2	Tabanidae	Diptera	6
	9	Chironomidae	Diptera	6
Cooper Creek WVK-10-A 5/13/97	2	Cambaridae	Decapoda - Crayfish	5
	69	Baetidae	Ephemeroptera	4
	89	Heptageniidae	Ephemeroptera	4
	4	Leptophlebiidae	Ephemeroptera	2
	1	Hydroptilidae	Tricoptera	6
	11	Capniidae/Leuctridae	Plecoptera	1
	9	Chloroperlidae	Plecoptera	1
	10	Nemouridae	Plecoptera	2
	26	Perlidae	Plecoptera	1
	12	Perlodidae	Plecoptera	2
	4	Elmidae	Coleoptera	4
	24	Psephenidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	72	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Barnett Fork WVK-10-F 5/14/97	1	Hirudinidae	Leeches	7
	35	Asellidae	Isopoda	8
	1	Gammaridae	Amphipoda	4
	67	Baetidae	Ephemeroptera	4
	5	Oligochaeta		10
	4	Ephemerellidae	Ephemeroptera	4
	105	Heptageniidae	Ephemeroptera	4
	18	Leptophlebiidae	Ephemeroptera	2
	4	Ameletidae	Ephemeroptera	0
	6	Capniidae/Leuctridae	Plecoptera	1
	40	Nemouridae	Plecoptera	2
	21	Perlidae	Plecoptera	1
	18	Perlodidae	Plecoptera	2
	4	Tipulidae	Diptera	3
	63	Chironomidae	Diptera	6
Pond Branch WVK-11 5/13/97	5	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	7	Baetidae	Ephemeroptera	4
	11	Ephemeridae	Ephemeroptera	4
	53	Heptageniidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	15	Capniidae/Leuctridae	Plecoptera	1
	5	Nemouridae	Plecoptera	2
	10	Perlidae	Plecoptera	1
	23	Perlodidae	Plecoptera	2
	13	Elmidae	Coleoptera	4
	7	Tipulidae	Diptera	3
	6	Ceratopogonidae	Diptera	6
	169	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Unnamed tributary of Pond Branch WVK-11-0.5-{0.6} 6/9/97	17	Oligochaeta		10
	83	Sphaeriidae	Unionida	8
	64	Physidae	Non Operculate Snail	8
	1	Asellidae	Isopoda	8
	2	Baetidae	Ephemeroptera	4
	1	Libellulidae	Odonata - Anisoptera	9
	2	Dytiscidae	Coleoptera	5
	2	Haliplidae	Coleoptera	5
	1	Corixidae	Hemiptera	5
	1	Tipulidae	Diptera	3
	3	Culicidae	Diptera	8
	4	Chironomidae	Diptera	6
	4	Sciomyzidae	Diptera	10
Rocky Fork WVK-12-A 5/14/97	51	Baetidae	Ephemeroptera	4
	1	Caenidae	Ephemeroptera	4
	2	Ephemerellidae	Ephemeroptera	4
	27	Heptageniidae	Ephemeroptera	4
	5	Leptophlebiidae	Ephemeroptera	2
	5	Capniidae/Leuctridae	Plecoptera	1
	5	Nemouridae	Plecoptera	2
	11	Perlidae	Plecoptera	1
	10	Perlodidae	Plecoptera	2
	1	Gomphidae	Odonata - Anisoptera	1
	1	Dryopidae	Coleoptera	5
	9	Elmidae	Coleoptera	4
	3	Psephenidae	Coleoptera	4
	5	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	3	Simuliidae	Diptera	6
	51	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Thirteen Mile Creek WVK-12-{12.0} 5/19/97	7	Corbiculidae	Unionida	8
	22	Baetidae	Ephemeroptera	4
	2	Ephemerellidae	Ephemeroptera	4
	22	Heptageniidae	Ephemeroptera	4
	3	Isonychiidae	Ephemeroptera	2
	1	Capniidae/Leuctridae	Plecoptera	1
	2	Chloroperlidae	Plecoptera	1
	77	Perlidae	Plecoptera	1
	11	Perlodidae	Plecoptera	2
	9	Elmidae	Coleoptera	4
	4	Tipulidae	Diptera	3
	2	Ceratopogonidae	Diptera	6
	4	Simuliidae	Diptera	6
	32	Chironomidae	Diptera	6
Mudlick Fork WVK-12-E-{2.4} 6/10/97	8	Oligochaeta		10
	9	Corbiculidae	Unionida	8
	3	Cambaridae	Decapoda - Crayfish	5
	1	Gammaridae	Amphipoda	4
	7	Baetidae	Ephemeroptera	4
	1	Caenidae	Ephemeroptera	4
	8	Heptageniidae	Ephemeroptera	4
	4	Leptophlebiidae	Ephemeroptera	2
	2	Isonychiidae	Ephemeroptera	2
	2	Hydropsychidae	Tricoptera	6
	6	Perlidae	Plecoptera	1
	1	Aeshnidae	Odonata - Anisoptera	3
	5	Gomphidae	Odonata - Anisoptera	1
	2	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	2	Tipulidae	Diptera	3
	4	Ceratopogonidae	Diptera	6
	35	Simuliidae	Diptera	6
	23	Chironomidae	Diptera	6
	1	Stratiomyidae	Diptera	7

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Unnamed tributary of Mudlick Fork WVK-12-E-2.5-{0.4} 6/11/97	1	Turbellaria		4
	21	Baetidae	Ephemeroptera	4
	18	Heptageniidae	Ephemeroptera	4
	16	Leptophlebiidae	Ephemeroptera	2
	1	Ameletidae	Ephemeroptera	0
	1	Hydropsychidae	Tricoptera	6
	24	Capniidae/Leuctridae	Plecoptera	1
	3	Nemouridae	Plecoptera	2
	40	Perlidae	Plecoptera	1
	8	Elmidae	Coleoptera	4
	4	Tipulidae	Diptera	3
	3	Ceratopogonidae	Diptera	6
	42	Chironomidae	Diptera	6
Poplar Fork WVK-12-F 5/14/97	3	Oligochaeta		10
	3	Baetidae	Ephemeroptera	4
	12	Heptageniidae	Ephemeroptera	4
	2	Leptophlebiidae	Ephemeroptera	2
	2	Hydropsychidae	Tricoptera	6
	1	Philopotamidae	Tricoptera	3
	2	Capniidae/Leuctridae	Plecoptera	1
	2	Nemouridae	Plecoptera	2
	44	Perlidae	Plecoptera	1
	2	Perlodidae	Plecoptera	2
	5	Elmidae	Coleoptera	4
	2	Tipulidae	Diptera	3
	6	Ceratopogonidae	Diptera	6
	108	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Poplar Fork WVK-12-F-{5.0} 6/16/97	3	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	5	Asellidae	Isopoda	8
	3	Baetidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	25	Hydropsychidae	Tricoptera	6
	4	Philopotamidae	Tricoptera	3
	56	Perlidae	Plecoptera	1
	1	Aeshnidae	Odonata - Anisoptera	3
	2	Gomphidae	Odonata - Anisoptera	1
	33	Elmidae	Coleoptera	4
	4	Psephenidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	1	Simuliidae	Diptera	6
	16	Chironomidae	Diptera	6
Thirteenmile Creek WVK-12-{20.7} 5/19/97	27	Baetidae	Ephemeroptera	4
	3	Ephemerellidae	Ephemeroptera	4
	5	Heptageniidae	Ephemeroptera	4
	2	Capniidae/Leuctridae	Plecoptera	1
	14	Nemouridae	Plecoptera	2
	54	Perlidae	Plecoptera	1
	11	Elmidae	Coleoptera	4
	2	Ceratopogonidae	Diptera	6
	14	Simuliidae	Diptera	6
	17	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Baker Branch WVK-12-H 5/19/97	1	Unionidae	Unionida	4
	25	Baetidae	Ephemeroptera	4
	3	Ephemerellidae	Ephemeroptera	4
	9	Heptageniidae	Ephemeroptera	4
	1	Hydroptilidae	Tricoptera	6
	6	Philopotamidae	Tricoptera	3
	1	Limnephilidae	Tricoptera	4
	7	Capniidae/Leuctridae	Plecoptera	1
	9	Nemouridae	Plecoptera	2
	24	Perlidae	Plecoptera	1
	5	Perlodidae	Plecoptera	2
	3	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	1	Simuliidae	Diptera	6
	10	Chironomidae	Diptera	6
Bee Run WVK-12-J 5/19/97	1	Oligochaeta		10
	4	Cambaridae	Decapoda - Crayfish	5
	19	Asellidae	Isopoda	8
	62	Baetidae	Ephemeroptera	4
	77	Ephemerellidae	Ephemeroptera	4
	130	Heptageniidae	Ephemeroptera	4
	16	Leptophlebiidae	Ephemeroptera	2
	8	Ameletidae	Ephemeroptera	0
	1	Rhyacophilidae	Tricoptera	0
	46	Capniidae/Leuctridae	Plecoptera	1
	4	Chloroperlidae	Plecoptera	1
	10	Nemouridae	Plecoptera	2
	15	Perlodidae	Plecoptera	2
	3	Elmidae	Coleoptera	4
	1	Corydalidae	Megaloptera	5
	2	Tipulidae	Diptera	3
	15	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Little Sixteenmile Creek WVK-13 5/12/97	85	Baetidae	Ephemeroptera	4
	38	Ephemerellidae	Ephemeroptera	4
	77	Heptageniidae	Ephemeroptera	4
	5	Leptophlebiidae	Ephemeroptera	2
	1	Limnephilidae	Tricoptera	4
	5	Capniidae/Leuctridae	Plecoptera	1
	5	Chloroperlidae	Plecoptera	1
	8	Nemouridae	Plecoptera	2
	5	Perlodidae	Plecoptera	2
	1	Gomphidae	Odonata - Anisoptera	1
	1	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	4	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	14	Chironomidae	Diptera	6
Sixteenmile Creek WVK-14 5/14/97	28	Baetidae	Ephemeroptera	4
	4	Ephemerellidae	Ephemeroptera	4
	22	Heptageniidae	Ephemeroptera	4
	1	Isonychiidae	Ephemeroptera	2
	11	Capniidae/Leuctridae	Plecoptera	1
	2	Nemouridae	Plecoptera	2
	40	Perlidae	Plecoptera	1
	4	Perlodidae	Plecoptera	2
	5	Elmidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	10	Ceratopogonidae	Diptera	6
	71	Chironomidae	Diptera	6
Sixteen Mile Creek WVK-14-{2.2} 6/10/97	10	Baetidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	11	Hydropsychidae	Tricoptera	6
	85	Perlidae	Plecoptera	1
	1	Aeshnidae	Odonata - Anisoptera	3
	1	Elmidae	Coleoptera	4
	6	Tipulidae	Diptera	3
	2	Ceratopogonidae	Diptera	6
	3	Simuliidae	Diptera	6
	32	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Unnamed Tributary of Sixteenmile Creek WVK-14-A.5-{1.6} 6/9/97	3	Hirudinidae	Leeches	7
	3	Cambaridae	Decapoda - Crayfish	5
	1	Oligochaeta		10
	2	Baetidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	10	Hydropsychidae	Tricoptera	6
	2	Limnephilidae	Tricoptera	4
	1	Capniidae/Leuctridae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	85	Perlidae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	21	Elmidae	Coleoptera	4
	5	Psephenidae	Coleoptera	4
	6	Tipulidae	Diptera	3
	28	Chironomidae	Diptera	6
Unnamed Tributary of Fivefork Branch WVK-14-B-1 5/12/97	2	Oligochaeta		10
	1	Gammaridae	Amphipoda	4
	21	Baetidae	Ephemeroptera	4
	46	Ephemerellidae	Ephemeroptera	4
	6	Ephemeridae	Ephemeroptera	4
	17	Heptageniidae	Ephemeroptera	4
	11	Leptophlebiidae	Ephemeroptera	2
	1	Ameletidae	Ephemeroptera	0
	1	Rhyacophilidae	Tricoptera	0
	3	Limnephilidae	Tricoptera	4
	8	Capniidae/Leuctridae	Plecoptera	1
	9	Chloroperlidae	Plecoptera	1
	4	Nemouridae	Plecoptera	2
	2	Perlodidae	Plecoptera	2
	1	Elmidae	Coleoptera	4
	7	Tipulidae	Diptera	3
	1	Empididae	Diptera	6
	4	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Jakes Branch WVK-16-B 5/21/97	1	Gammaridae	Amphipoda	4
	20	Baetidae	Ephemeroptera	4
	2	Ephemerellidae	Ephemeroptera	4
	25	Heptageniidae	Ephemeroptera	4
	2	Leptophlebiidae	Ephemeroptera	2
	4	Capniidae/Leuctridae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	4	Perlodidae	Plecoptera	2
	1	Elmidae	Coleoptera	4
	2	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	75	Chironomidae	Diptera	6
Left Fork Turkey Branch WVK-16-G-1-{0.4} 6/16/97	1	Cambaridae	Decapoda - Crayfish	5
	13	Baetidae	Ephemeroptera	4
	50	Heptageniidae	Ephemeroptera	4
	4	Leptophlebiidae	Ephemeroptera	2
	2	Isonychiidae	Ephemeroptera	2
	19	Hydropsychidae	Tricoptera	6
	1	Polycentropodidae	Tricoptera	6
	33	Capniidae/Leuctridae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	10	Perlidae	Plecoptera	1
	8	Elmidae	Coleoptera	4
	6	Psephenidae	Coleoptera	4
	4	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	89	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Eighteenmile Creek WVK-16-{12.8} 5/21/97	1	Oligochaeta		10
	3	Baetidae	Ephemeroptera	4
	1	Ephemerellidae	Ephemeroptera	4
	19	Heptageniidae	Ephemeroptera	4
	3	Leptophlebiidae	Ephemeroptera	2
	1	Hydropsychidae	Tricoptera	6
	10	Capniidae/Leuctridae	Plecoptera	1
	2	Chloroperlidae	Plecoptera	1
	2	Nemouridae	Plecoptera	2
	68	Perlidae	Plecoptera	1
	3	Perlodidae	Plecoptera	2
	3	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	2	Ceratopogonidae	Diptera	6
	2	Simuliidae	Diptera	6
	34	Chironomidae	Diptera	6
Saltlick Creek WVK-16-J-3-{1.0} 6/19/97	1	Nematoda		5
	1	Hirudinidae	Leeches	7
	1	Oligochaeta		10
	2	Cambaridae	Decapoda - Crayfish	5
	4	Baetidae	Ephemeroptera	4
	16	Hydropsychidae	Tricoptera	6
	3	Perlidae	Plecoptera	1
	1	Dryopidae	Coleoptera	5
	4	Elmidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	67	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Sulug Creek WVK-16-L 5/20/97	1	Turbellaria		4
	1	Oligochaeta		10
	3	Cambaridae	Decapoda - Crayfish	5
	24	Baetidae	Ephemeroptera	4
	11	Ephemerellidae	Ephemeroptera	4
	162	Heptageniidae	Ephemeroptera	4
	21	Leptophlebiidae	Ephemeroptera	2
	3	Hydroptilidae	Tricoptera	6
	50	Capniidae/Leuctridae	Plecoptera	1
	88	Nemouridae	Plecoptera	2
	19	Perlidae	Plecoptera	1
	7	Perlodidae	Plecoptera	2
	1	Dryopidae	Coleoptera	5
	1	Corydalidae	Megaloptera	5
	7	Tipulidae	Diptera	3
	14	Chironomidae	Diptera	6
Eighteenmile Creek WVK-16-{25.0} 5/21/97	2	Baetidae	Ephemeroptera	4
	9	Ephemerellidae	Ephemeroptera	4
	21	Heptageniidae	Ephemeroptera	4
	3	Hydropsychidae	Tricoptera	6
	7	Capniidae/Leuctridae	Plecoptera	1
	5	Nemouridae	Plecoptera	2
	66	Perlidae	Plecoptera	1
	13	Perlodidae	Plecoptera	2
	5	Elmidae	Coleoptera	4
	2	Psephenidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	2	Simuliidae	Diptera	6
	30	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Harris Branch WVK-16-Q-{1.0} 6/11/97	4	Asellidae	Isopoda	8
	29	Baetidae	Ephemeroptera	4
	7	Heptageniidae	Ephemeroptera	4
	6	Leptophlebiidae	Ephemeroptera	2
	8	Capniidae/Leuctridae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	22	Perlidae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	1	Psephenidae	Coleoptera	4
	14	Chironomidae	Diptera	6
Cottrell Run WVK-16-S 5/20/97	8	Oligochaeta		10
	155	Asellidae	Isopoda	8
	116	Baetidae	Ephemeroptera	4
	1	Caenidae	Ephemeroptera	4
	3	Ephemerellidae	Ephemeroptera	4
	200	Heptageniidae	Ephemeroptera	4
	17	Leptophlebiidae	Ephemeroptera	2
	2	Hydropsychidae	Tricoptera	6
	2	Hydroptilidae	Tricoptera	6
	1	Psycomyiidae	Tricoptera	2
	5	Capniidae/Leuctridae	Plecoptera	1
	2	Nemouridae	Plecoptera	2
	52	Perlidae	Plecoptera	1
	20	Perlodidae	Plecoptera	2
	4	Elmidae	Coleoptera	4
	2	Hydrophilidae	Coleoptera	5
	1	Tipulidae	Diptera	3
	23	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Eighteenmile Creek WVK-16-{33.0} 6/16/97	1	Cambaridae	Decapoda - Crayfish	5
	2	Baetidae	Ephemeroptera	4
	5	Heptageniidae	Ephemeroptera	4
	21	Hydropsychidae	Tricoptera	6
	1	Nemouridae	Plecoptera	2
	29	Perlidae	Plecoptera	1
	10	Elmidae	Coleoptera	4
	6	Psephenidae	Coleoptera	4
	1	Corydalidae	Megaloptera	5
	2	Tipulidae	Diptera	3
	2	Ceratopogonidae	Diptera	6
	1	Tabanidae	Diptera	6
	26	Chironomidae	Diptera	6
Left Fork Five & Twenty Mile Creek WVK-19-C-(DUP1) 5/20/97	63	Baetidae	Ephemeroptera	4
	14	Heptageniidae	Ephemeroptera	4
	3	Leptophlebiidae	Ephemeroptera	2
	4	Chloroperlidae	Plecoptera	1
	2	Nemouridae	Plecoptera	2
	8	Perlidae	Plecoptera	1
	2	Perlodidae	Plecoptera	2
	1	Elmidae	Coleoptera	4
	2	Tipulidae	Diptera	3
	1	Simuliidae	Diptera	6
	58	Chironomidae	Diptera	6
Left Fork Five & Twenty Mile Creek WVK-19-C-(DUP2) 5/20/97	1	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	58	Baetidae	Ephemeroptera	4
	1	Ephemerellidae	Ephemeroptera	4
	27	Heptageniidae	Ephemeroptera	4
	3	Leptophlebiidae	Ephemeroptera	2
	2	Capniidae/Leuctridae	Plecoptera	1
	2	Chloroperlidae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	3	Perlidae	Plecoptera	1
	1	Simuliidae	Diptera	6
	51	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Poplar Fork WVK-22-B 5/28/97	1	Oligochaeta		10
	4	Asellidae	Isopoda	8
	3	Baetidae	Ephemeroptera	4
	6	Heptageniidae	Ephemeroptera	4
	5	Leptophlebiidae	Ephemeroptera	2
	7	Hydropsychidae	Tricoptera	6
	3	Capniidae/Leuctridae	Plecoptera	1
	25	Perlidae	Plecoptera	1
	11	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	1	Corydalidae	Megaloptera	5
	2	Tipulidae	Diptera	3
	6	Simuliidae	Diptera	6
	1	Tabanidae	Diptera	6
	70	Chironomidae	Diptera	6
Cow Creek WVK-22-B-2 5/28/97	29	Baetidae	Ephemeroptera	4
	1	Caenidae	Ephemeroptera	4
	4	Heptageniidae	Ephemeroptera	4
	1	Hydropsychidae	Tricoptera	6
	11	Perlidae	Plecoptera	1
	2	Gomphidae	Odonata - Anisoptera	1
	15	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	4	Tipulidae	Diptera	3
	3	Ceratopogonidae	Diptera	6
	130	Chironomidae	Diptera	6
Long Branch WVK-22-B-3 5/28/97	3	Asellidae	Isopoda	8
	5	Baetidae	Ephemeroptera	4
	1	Caenidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	1	Hydropsychidae	Tricoptera	6
	1	Chloroperlidae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	3	Perlidae	Plecoptera	1
	1	Elmidae	Coleoptera	4
	4	Tipulidae	Diptera	3
	3	Simuliidae	Diptera	6
	177	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Unnamed Tributary of Crooked Creek WVK-22-B-5-B 5/28/97	31	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	2	Caenidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	6	Elmidae	Coleoptera	4
	21	Simuliidae	Diptera	6
	51	Chironomidae	Diptera	6
Hurricane Creek WVK-22-{6.0} 6/11/97	1	Oligochaeta		10
	12	Corbiculidae	Unionida	8
	1	Asellidae	Isopoda	8
	1	Gammaridae	Amphipoda	4
	1	Caenidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	26	Hydropsychidae	Tricoptera	6
	6	Perlidae	Plecoptera	1
	2	Aeshnidae	Odonata - Anisoptera	3
	1	Gomphidae	Odonata - Anisoptera	1
	11	Elmidae	Coleoptera	4
	56	Chironomidae	Diptera	6
Hurricane Creek WVK-22-{10.6} 6/24/97	1	Oligochaeta		10
	1	Corbiculidae	Unionida	8
	1	Cambaridae	Decapoda - Crayfish	5
	58	Hydropsychidae	Tricoptera	6
	5	Elmidae	Coleoptera	4
	1	Gyrinidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	1	Empididae	Diptera	6
	10	Simuliidae	Diptera	6
	41	Chironomidae	Diptera	6
Hurricane Creek WVK-22-{14.4} 6/24/97	1	Oligochaeta		10
	2	Corbiculidae	Unionida	8
	10	Hydropsychidae	Tricoptera	6
	1	Elmidae	Coleoptera	4
	101	Simuliidae	Diptera	6
	72	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Rider Creek WVK-22-J-{1.3} 6/19/97	9	Oligochaeta		10
	52	Baetidae	Ephemeroptera	4
	2	Caenidae	Ephemeroptera	4
	1	Isonychiidae	Ephemeroptera	2
	14	Hydropsychidae	Tricoptera	6
	4	Perlidae	Plecoptera	1
	1	Gomphidae	Odonata - Anisoptera	1
	1	Dryopidae	Coleoptera	5
	18	Elmidae	Coleoptera	4
	26	Chironomidae	Diptera	6
Heizer Creek WVKP-1 5/14/97	8	Baetidae	Ephemeroptera	4
	2	Heptageniidae	Ephemeroptera	4
	3	Hydropsychidae	Tricoptera	6
	1	Polycentropodidae	Tricoptera	6
	10	Chloroperlidae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	1	Dryopidae	Coleoptera	5
	2	Elmidae	Coleoptera	4
	4	Psephenidae	Coleoptera	4
	11	Tipulidae	Diptera	3
	8	Chironomidae	Diptera	6
Manilla Creek WVKP-1-A 5/14/97	3	Cambaridae	Decapoda - Crayfish	5
	1	Rhyacophilidae	Tricoptera	0
	3	Capniidae/Leuctridae	Plecoptera	1
	20	Chloroperlidae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	1	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	1	Tabanidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Unnamed Tributary of Manilla Creek WVKP-1-A-0.1-{1.6} 6/11/97	1	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	31	Asellidae	Isopoda	8
	5	Baetidae	Ephemeroptera	4
	4	Leptophlebiidae	Ephemeroptera	2
	7	Hydropsychidae	Tricoptera	6
	2	Capniidae/Leuctridae	Plecoptera	1
	2	Chloroperlidae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	1	Gomphidae	Odonata - Anisoptera	1
	1	Elmidae	Coleoptera	4
	2	Psephenidae	Coleoptera	4
	33	Chironomidae	Diptera	6
Bigger Branch WVKP-1-B 5/15/97	86	Baetidae	Ephemeroptera	4
	33	Ephemerellidae	Ephemeroptera	4
	18	Heptageniidae	Ephemeroptera	4
	14	Leptophlebiidae	Ephemeroptera	2
	3	Ameletidae	Ephemeroptera	0
	3	Hydropsychidae	Tricoptera	6
	4	Capniidae/Leuctridae	Plecoptera	1
	8	Chloroperlidae	Plecoptera	1
	7	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	7	Perlodidae	Plecoptera	2
	1	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	85	Chironomidae	Diptera	6
Pocatalico River WVK-29-{4.7} 6/17/97	1	Lymnaeidae	Non Operculate Snail	7
	1	Planariidae	Flatworms	8
	3	Baetidae	Ephemeroptera	4
	1	Coenagrionidae	Odonata - Zygoptera	9
	3	Elmidae	Coleoptera	4
	1	Ceratopogonidae	Diptera	6
	6	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Harmond Creek WVKP-4 5/14/97	1	Capniidae/Leuctridae	Plecoptera	1
	12	Elmidae	Coleoptera	4
	5	Psephenidae	Coleoptera	4
	1	Corydalidae	Megaloptera	5
	4	Tipulidae	Diptera	3
	3	Chironomidae	Diptera	6
Rocky Fork WVKP-5 5/19/97	6	Oligochaeta		10
	4	Heptageniidae	Ephemeroptera	4
	2	Leptophlebiidae	Ephemeroptera	2
	5	Perlidae	Plecoptera	1
	2	Elmidae	Coleoptera	4
	1	Simuliidae	Diptera	6
	65	Chironomidae	Diptera	6
Schoolhouse Branch WVKP-8 5/19/97	9	Gammaridae	Amphipoda	4
	1	Ephemerellidae	Ephemeroptera	4
	11	Heptageniidae	Ephemeroptera	4
	2	Capniidae/Leuctridae	Plecoptera	1
	66	Nemouridae	Plecoptera	2
	2	Perlodidae	Plecoptera	2
	1	Tipulidae	Diptera	3
	8	Chironomidae	Diptera	6
Spring Branch WVKP-9-A 5/19/97	37	Oligochaeta		10
	8	Ephemerellidae	Ephemeroptera	4
	2	Heptageniidae	Ephemeroptera	4
	3	Capniidae/Leuctridae	Plecoptera	1
	18	Chironomidae	Diptera	6
Tupper Creek WVKP-13-{1.3} 5/19/97	3	Oligochaeta		10
	3	Cambaridae	Decapoda - Crayfish	5
	2	Caenidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	1	Sialidae	Megaloptera	4
	13	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Turkeypen Branch WVKP-13-A-1-A 5/20/97	10	Oligochaeta		10
	3	Gammaridae	Amphipoda	4
	51	Baetidae	Ephemeroptera	4
	20	Ephemerellidae	Ephemeroptera	4
	48	Heptageniidae	Ephemeroptera	4
	9	Leptophlebiidae	Ephemeroptera	2
	2	Hydropsychidae	Tricoptera	6
	33	Capniidae/Leuctridae	Plecoptera	1
	19	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	5	Perlodidae	Plecoptera	2
	6	Elmidae	Coleoptera	4
	4	Tipulidae	Diptera	3
	157	Chironomidae	Diptera	6
Tupper Creek WVKP-13-{3.0} 6/24/97	1	Oligochaeta		10
	27	Elmidae	Coleoptera	4
	6	Ceratopogonidae	Diptera	6
	3	Simuliidae	Diptera	6
	15	Chironomidae	Diptera	6
Grapevine Creek WVKP-16-{4.5} 6/10/97	3	Cambaridae	Decapoda - Crayfish	5
	20	Baetidae	Ephemeroptera	4
	6	Ephemerellidae	Ephemeroptera	4
	3	Heptageniidae	Ephemeroptera	4
	5	Leptophlebiidae	Ephemeroptera	2
	1	Isonychiidae	Ephemeroptera	2
	4	Hydropsychidae	Tricoptera	6
	10	Capniidae/Leuctridae	Plecoptera	1
	8	Perlidae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	1	Gomphidae	Odonata - Anisoptera	1
	26	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	2	Tipulidae	Diptera	3
	1	Simuliidae	Diptera	6
	13	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Broadtree Run WVKP-16-B 5/12/97	25	Oligochaeta		10
	1	Caenidae	Ephemeroptera	4
	3	Leptophlebiidae	Ephemeroptera	2
	8	Elmidae	Coleoptera	4
	3	Psephenidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	1	Ephydridae	Diptera	7
	10	Simuliidae	Diptera	6
	165	Chironomidae	Diptera	6
Vance Hollow WVKP-16-D 5/12/97	1	Cambaridae	Decapoda - Crayfish	5
	257	Baetidae	Ephemeroptera	4
	54	Ephemerellidae	Ephemeroptera	4
	23	Heptageniidae	Ephemeroptera	4
	15	Leptophlebiidae	Ephemeroptera	2
	17	Isonychiidae	Ephemeroptera	2
	2	Hydropsychidae	Tricoptera	6
	1	Rhyacophilidae	Tricoptera	0
	22	Capniidae/Leuctridae	Plecoptera	1
	16	Chloroperlidae	Plecoptera	1
	23	Nemouridae	Plecoptera	2
	2	Perlidae	Plecoptera	1
	2	Perlodidae	Plecoptera	2
	9	Elmidae	Coleoptera	4
	6	Psephenidae	Coleoptera	4
	6	Tipulidae	Diptera	3
	3	Ceratopogonidae	Diptera	6
	32	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
First Creek of Middle Fork WVKP-17-B-5 5/13/97	1	Oligochaeta		10
	93	Baetidae	Ephemeroptera	4
	56	Ephemerellidae	Ephemeroptera	4
	9	Heptageniidae	Ephemeroptera	4
	6	Hydropsychidae	Tricoptera	6
	1	Philopotamidae	Tricoptera	3
	3	Capniidae/Leuctridae	Plecoptera	1
	43	Chloroperlidae	Plecoptera	1
	6	Nemouridae	Plecoptera	2
	3	Perlidae	Plecoptera	1
	2	Perlodidae	Plecoptera	2
	6	Elmidae	Coleoptera	4
	11	Psephenidae	Coleoptera	4
	9	Tipulidae	Diptera	3
	2	Simuliidae	Diptera	6
	15	Chironomidae	Diptera	6
Dan Slater Hollow WVKP-17-C-1-A 5/14/97	9	Oligochaeta		10
	1	Baetidae	Ephemeroptera	4
	57	Ephemerellidae	Ephemeroptera	4
	55	Heptageniidae	Ephemeroptera	4
	4	Leptophlebiidae	Ephemeroptera	2
	1	Rhyacophilidae	Tricoptera	0
	4	Capniidae/Leuctridae	Plecoptera	1
	3	Chloroperlidae	Plecoptera	1
	4	Nemouridae	Plecoptera	2
	5	Perlodidae	Plecoptera	2
	1	Elmidae	Coleoptera	4
	1	Corydalidae	Megaloptera	5
	31	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Railroad Hollow WVKP-17-C-4 5/14/97	2	Oligochaeta		10
	74	Baetidae	Ephemeroptera	4
	18	Ephemerellidae	Ephemeroptera	4
	19	Heptageniidae	Ephemeroptera	4
	10	Leptophlebiidae	Ephemeroptera	2
	1	Rhyacophilidae	Tricoptera	0
	4	Capniidae/Leuctridae	Plecoptera	1
	4	Nemouridae	Plecoptera	2
	3	Perlidae	Plecoptera	1
	1	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	21	Chironomidae	Diptera	6
Unnamed Tributary of Allens Fork WVKP-17-C-4.5-{1} 6/10/97	2	Cambaridae	Decapoda - Crayfish	5
	5	Baetidae	Ephemeroptera	4
	13	Heptageniidae	Ephemeroptera	4
	6	Leptophlebiidae	Ephemeroptera	2
	1	Limnephilidae	Tricoptera	4
	14	Capniidae/Leuctridae	Plecoptera	1
	2	Perlidae	Plecoptera	1
	2	Tipulidae	Diptera	3
	64	Chironomidae	Diptera	6
	2	Dixidae	Diptera	1
Dudden Fork WVKP-17-E-{2.6} 6/12/97	3	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	5	Baetidae	Ephemeroptera	4
	9	Hydropsychidae	Tricoptera	6
	4	Capniidae/Leuctridae	Plecoptera	1
	49	Perlidae	Plecoptera	1
	1	Gomphidae	Odonata - Anisoptera	1
	6	Psephenidae	Coleoptera	4
	7	Tipulidae	Diptera	3
	2	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Loom Tree Hollow WVKP-17-F-1 5/13/97	2	Oligochaeta		10
	173	Baetidae	Ephemeroptera	4
	35	Ephemeridae	Ephemeroptera	4
	37	Heptageniidae	Ephemeroptera	4
	11	Leptophlebiidae	Ephemeroptera	2
	1	Ameletidae	Ephemeroptera	0
	19	Capniidae/Leuctridae	Plecoptera	1
	4	Chloroperlidae	Plecoptera	1
	8	Nemouridae	Plecoptera	2
	4	Tipulidae	Diptera	3
	11	Chironomidae	Diptera	6
Faber Hollow WVKP-17-G 5/13/97	1	Nemertea		6
	58	Baetidae	Ephemeroptera	4
	149	Ephemerellidae	Ephemeroptera	4
	60	Heptageniidae	Ephemeroptera	4
	21	Leptophlebiidae	Ephemeroptera	2
	1	Glossosomatidae	Tricoptera	0
	1	Hydropsychidae	Tricoptera	6
	1	Rhyacophilidae	Tricoptera	0
	57	Capniidae/Leuctridae	Plecoptera	1
	11	Chloroperlidae	Plecoptera	1
	19	Nemouridae	Plecoptera	2
	12	Perlidae	Plecoptera	1
	6	Perlodidae	Plecoptera	2
	1	Gomphidae	Odonata - Anisoptera	1
	4	Elmidae	Coleoptera	4
	2	Psephenidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	38	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Raccoon Creek] WVKP-20 5/12/97	1	Oligochaeta		10
	1	Gammaridae	Amphipoda	4
	36	Baetidae	Ephemeroptera	4
	30	Ephemerellidae	Ephemeroptera	4
	7	Heptageniidae	Ephemeroptera	4
	2	Leptophlebiidae	Ephemeroptera	2
	2	Isonychiidae	Ephemeroptera	2
	4	Capniidae/Leuctridae	Plecoptera	1
	2	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	2	Perlodidae	Plecoptera	2
	4	Psephenidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	1	Simuliidae	Diptera	6
	126	Chironomidae	Diptera	6
Pernel Branch WVKP-21 5/12/97	1	Oligochaeta		10
	2	Cambaridae	Decapoda - Crayfish	5
	3	Gammaridae	Amphipoda	4
	310	Baetidae	Ephemeroptera	4
	22	Ephemerellidae	Ephemeroptera	4
	4	Heptageniidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	4	Glossosomatidae	Tricoptera	0
	15	Hydroptilidae	Tricoptera	6
	8	Capniidae/Leuctridae	Plecoptera	1
	9	Chloroperlidae	Plecoptera	1
	23	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	2	Perlodidae	Plecoptera	2
	2	Elmidae	Coleoptera	4
	1	Corydalidae	Megaloptera	5
	3	Tipulidae	Diptera	3
	68	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Pocatalico River WVK-29-{32.5} 6/18/97	1	Oligochaeta		10
	1	Corbiculidae	Unionida	8
	1	Cambaridae	Decapoda - Crayfish	5
	1	Caenidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	1	Potamanthidae	Ephemeroptera	4
	1	Isonychiidae	Ephemeroptera	2
	1	Perlidae	Plecoptera	1
	1	Aeshnidae	Odonata - Anisoptera	3
	1	Corduliidae	Odonata - Anisoptera	5
	1	Dryopidae	Coleoptera	5
	6	Elmidae	Coleoptera	4
	1	Ceratopogonidae	Diptera	6
	12	Chironomidae	Diptera	6
Camp Creek WVKP-26 5/12/97	2	Oligochaeta		10
	6	Baetidae	Ephemeroptera	4
	1	Elmidae	Coleoptera	4
	2	Tipulidae	Diptera	3
	2	Simuliidae	Diptera	6
	156	Chironomidae	Diptera	6
Green Creek WVKP-28 5/28/97	48	Baetidae	Ephemeroptera	4
	1	Baetiscidae	Ephemeroptera	3
	15	Ephemerellidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	2	Leptophlebiidae	Ephemeroptera	2
	3	Isonychiidae	Ephemeroptera	2
	2	Hydropsychidae	Tricoptera	6
	1	Philopotamidae	Tricoptera	3
	6	Capniidae/Leuctridae	Plecoptera	1
	2	Chloroperlidae	Plecoptera	1
	3	Nemouridae	Plecoptera	2
	8	Perlidae	Plecoptera	1
	1	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	13	Tipulidae	Diptera	3
	5	Simuliidae	Diptera	6
	30	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Hunt Fork WVKP-28-A-1-{0.7} 6/12/97	3	Oligochaeta		10
	1	Hydrobiidae	Operculate Snails	3
	9	Baetidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	1	Hydropsychidae	Tricoptera	6
	7	Capniidae/Leuctridae	Plecoptera	1
	1	Chloroperlidae	Plecoptera	1
	2	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	7	Perlodidae	Plecoptera	2
	1	Elmidae	Coleoptera	4
	7	Chironomidae	Diptera	6
Bear Branch WVKP-28-B-1 5/28/97	1	Oligochaeta		10
	1	Planariidae	Flatworms	8
	2	Cambaridae	Decapoda - Crayfish	5
	33	Baetidae	Ephemeroptera	4
	3	Ephemerellidae	Ephemeroptera	4
	2	Heptageniidae	Ephemeroptera	4
	2	Leptophlebiidae	Ephemeroptera	2
	4	Hydropsychidae	Tricoptera	6
	2	Hydroptilidae	Tricoptera	6
	1	Rhyacophilidae	Tricoptera	0
	1	Philopotamidae	Tricoptera	3
	3	Polycentropodidae	Tricoptera	6
	10	Capniidae/Leuctridae	Plecoptera	1
	3	Chloroperlidae	Plecoptera	1
	1	Nemouridae	Plecoptera	2
	2	Perlidae	Plecoptera	1
	3	Elmidae	Coleoptera	4
	6	Tipulidae	Diptera	3
	10	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Anderson Lick Run WVKP-28-E 5/28/97	3	Oligochaeta		10
	4	Baetidae	Ephemeroptera	4
	2	Heptageniidae	Ephemeroptera	4
	13	Hydropsychidae	Tricoptera	6
	9	Nemouridae	Plecoptera	2
	7	Perlidae	Plecoptera	1
	1	Elmidae	Coleoptera	4
	2	Veliidae	Hemiptera	6
	4	Tipulidae	Diptera	3
	70	Chironomidae	Diptera	6
Straight Creek WVKP-29 5/12/97	2	Oligochaeta		10
	3	Cambaridae	Decapoda - Crayfish	5
	3	Baetidae	Ephemeroptera	4
	28	Ephemerellidae	Ephemeroptera	4
	17	Heptageniidae	Ephemeroptera	4
	4	Leptophlebiidae	Ephemeroptera	2
	1	Tricorythidae	Ephemeroptera	4
	2	Hydropsychidae	Tricoptera	6
	4	Capniidae/Leuctridae	Plecoptera	1
	3	Chloroperlidae	Plecoptera	1
	3	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	7	Perlodidae	Plecoptera	2
	1	Gomphidae	Odonata - Anisoptera	1
	3	Psephenidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	92	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Sugar Camp Hollow WVKP-32-.5A 5/28/97	2	Oligochaeta		10
	79	Baetidae	Ephemeroptera	4
	12	Ephemerellidae	Ephemeroptera	4
	7	Heptageniidae	Ephemeroptera	4
	15	Leptophlebiidae	Ephemeroptera	2
	11	Glossosomatidae	Tricoptera	0
	1	Hydroptilidae	Tricoptera	6
	3	Philopotamidae	Tricoptera	3
	1	Limnephilidae	Tricoptera	4
	23	Capniidae/Leuctridae	Plecoptera	1
	3	Chloroperlidae	Plecoptera	1
	3	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	1	Gomphidae	Odonata - Anisoptera	1
	2	Elmidae	Coleoptera	4
	2	Gerridae	Hemiptera	8
	2	Tipulidae	Diptera	3
	14	Chironomidae	Diptera	6
Wolf Creek WVKP-32-{1.0} 6/12/97	3	Cambaridae	Decapoda - Crayfish	5
	7	Baetidae	Ephemeroptera	4
	14	Heptageniidae	Ephemeroptera	4
	4	Leptophlebiidae	Ephemeroptera	2
	8	Isonychiidae	Ephemeroptera	2
	2	Hydropsychidae	Tricoptera	6
	2	Philopotamidae	Tricoptera	3
	19	Capniidae/Leuctridae	Plecoptera	1
	4	Chloroperlidae	Plecoptera	1
	48	Perlidae	Plecoptera	1
	1	Gomphidae	Odonata - Anisoptera	1
	6	Dryopidae	Coleoptera	5
	19	Elmidae	Coleoptera	4
	1	Corydalidae	Megaloptera	5
	7	Tipulidae	Diptera	3
	34	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Flat Fork WVKP-33-{5.8} 6/9/97	1	Ephemerellidae	Ephemeroptera	4
	10	Heptageniidae	Ephemeroptera	4
	2	Isonychiidae	Ephemeroptera	2
	1	Hydropsychidae	Tricoptera	6
	1	Philopotamidae	Tricoptera	3
	1	Capniidae/Leuctridae	Plecoptera	1
	21	Perlidae	Plecoptera	1
	3	Elmidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	1	Tabanidae	Diptera	6
Coon Run WVKP-33-D-{0.8} 6/9/97	11	Baetidae	Ephemeroptera	4
	12	Leptophlebiidae	Ephemeroptera	2
	3	Hydropsychidae	Tricoptera	6
	3	Capniidae/Leuctridae	Plecoptera	1
	1	Chloroperlidae	Plecoptera	1
	3	Nemouridae	Plecoptera	2
	2	Perlidae	Plecoptera	1
	5	Elmidae	Coleoptera	4
	2	Corydalidae	Megaloptera	5
	2	Saldidae	Hemiptera	0
	1	Veliidae	Hemiptera	6
	1	Tipulidae	Diptera	3
	6	Chironomidae	Diptera	6
Cabbage Fork WVKP-33-G 5/22/97	2	Nematoda		5
	2	Oligochaeta		10
	92	Baetidae	Ephemeroptera	4
	4	Ephemerellidae	Ephemeroptera	4
	2	Heptageniidae	Ephemeroptera	4
	2	Leptophlebiidae	Ephemeroptera	2
	1	Perlodidae	Plecoptera	2
	8	Elmidae	Coleoptera	4
	8	Psephenidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	19	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Boner Hollow WVKP-36-B 5/22/97	1	Turbellaria		4
	1	Cambaridae	Decapoda - Crayfish	5
	81	Baetidae	Ephemeroptera	4
	16	Ephemerellidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	5	Leptophlebiidae	Ephemeroptera	2
	1	Glossosomatidae	Tricoptera	0
	5	Philopotamidae	Tricoptera	3
	1	Capniidae/Leuctridae	Plecoptera	1
	4	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	4	Elmidae	Coleoptera	4
	2	Tipulidae	Diptera	3
Snake Hollow WVKP-37-A 5/22/97	14	Baetidae	Ephemeroptera	4
	5	Ephemerellidae	Ephemeroptera	4
	5	Ameletidae	Ephemeroptera	0
	2	Hydroptilidae	Tricoptera	6
	1	Philopotamidae	Tricoptera	3
	19	Capniidae/Leuctridae	Plecoptera	1
	1	Chloroperlidae	Plecoptera	1
	19	Nemouridae	Plecoptera	2
	3	Perlidae	Plecoptera	1
	4	Perlodidae	Plecoptera	2
	2	Elmidae	Coleoptera	4
	2	Corydalidae	Megaloptera	5
	2	Tipulidae	Diptera	3
	12	Ceratopogonidae	Diptera	6
Pocatalico River WVK-29-{61.0} 6/10/97	1	Nemertea		6
	2	Oligochaeta		10
	3	Cambaridae	Decapoda - Crayfish	5
	7	Baetidae	Ephemeroptera	4
	21	Heptageniidae	Ephemeroptera	4
	3	Hydropsychidae	Tricoptera	6
	22	Perlidae	Plecoptera	1
	2	Elmidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	33	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Greathouse Hollow WVKP-38-.8A 5/22/97	1	Cambaridae	Decapoda - Crayfish	5
	21	Baetidae	Ephemeroptera	4
	11	Ephemerellidae	Ephemeroptera	4
	8	Heptageniidae	Ephemeroptera	4
	34	Leptophlebiidae	Ephemeroptera	2
	2	Glossosomatidae	Tricoptera	0
	2	Hydropsychidae	Tricoptera	6
	1	Rhyacophilidae	Tricoptera	0
	1	Capniidae/Leuctridae	Plecoptera	1
	11	Nemouridae	Plecoptera	2
	1	Psephenidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	3	Chironomidae	Diptera	6
Hollywood Fork WVKP-38-D-(DUP1) 5/22/97	1	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	16	Baetidae	Ephemeroptera	4
	29	Ephemerellidae	Ephemeroptera	4
	2	Heptageniidae	Ephemeroptera	4
	3	Leptophlebiidae	Ephemeroptera	2
	1	Ameletidae	Ephemeroptera	0
	1	Hydropsychidae	Tricoptera	6
	1	Limnephilidae	Tricoptera	4
	2	Chloroperlidae	Plecoptera	1
	4	Perlidae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	19	Elmidae	Coleoptera	4
	2	Psephenidae	Coleoptera	4
	1	Tabanidae	Diptera	6
	1	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Hollywood Fork WVKP-38-D-(DUP2) 5/22/97	24	Baetidae	Ephemeroptera	4
	20	Ephemerellidae	Ephemeroptera	4
	5	Leptophlebiidae	Ephemeroptera	2
	5	Hydropsychidae	Tricoptera	6
	1	Hydroptilidae	Tricoptera	6
	6	Chloroperlidae	Plecoptera	1
	3	Nemouridae	Plecoptera	2
	4	Perlidae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	2	Gomphidae	Odonata - Anisoptera	1
	27	Elmidae	Coleoptera	4
	2	Psephenidae	Coleoptera	4
	1	Corydalidae	Megaloptera	5
	1	Tipulidae	Diptera	3
	12	Chironomidae	Diptera	6
Round Knob Run WVKP-40 5/21/97	85	Baetidae	Ephemeroptera	4
	12	Ephemerellidae	Ephemeroptera	4
	35	Heptageniidae	Ephemeroptera	4
	8	Leptophlebiidae	Ephemeroptera	2
	1	Hydropsychidae	Tricoptera	6
	14	Capniidae/Leuctridae	Plecoptera	1
	5	Nemouridae	Plecoptera	2
	40	Perlidae	Plecoptera	1
	8	Perlodidae	Plecoptera	2
	3	Elmidae	Coleoptera	4
	2	Psephenidae	Coleoptera	4
	2	Tipulidae	Diptera	3
	1	Simuliidae	Diptera	6
	32	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Slab Fork WVKP-41-A 5/21/97	1	Cambaridae	Decapoda - Crayfish	5
	12	Baetidae	Ephemeroptera	4
	27	Ephemerellidae	Ephemeroptera	4
	12	Heptageniidae	Ephemeroptera	4
	6	Leptophlebiidae	Ephemeroptera	2
	2	Isonychiidae	Ephemeroptera	2
	1	Hydropsychidae	Tricoptera	6
	18	Capniidae/Leuctridae	Plecoptera	1
	20	Perlidae	Plecoptera	1
	7	Perlodidae	Plecoptera	2
	6	Elmidae	Coleoptera	4
	2	Psephenidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	2	Ceratopogonidae	Diptera	6
	57	Chironomidae	Diptera	6
Laurel Fork WVKP-43-{1.6} 6/12/97	19	Baetidae	Ephemeroptera	4
	4	Heptageniidae	Ephemeroptera	4
	4	Leptophlebiidae	Ephemeroptera	2
	13	Hydropsychidae	Tricoptera	6
	1	Chloroperlidae	Plecoptera	1
	38	Perlidae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	8	Elmidae	Coleoptera	4
	5	Tipulidae	Diptera	3
	29	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Smith Run WVKP-43-A 5/21/97	4	Oligochaeta		10
	54	Baetidae	Ephemeroptera	4
	34	Ephemerellidae	Ephemeroptera	4
	7	Heptageniidae	Ephemeroptera	4
	1	Leptophlebiidae	Ephemeroptera	2
	1	Hydropsychidae	Tricoptera	6
	1	Limnephilidae	Tricoptera	4
	1	Capniidae/Leuctridae	Plecoptera	1
	15	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	6	Perlodidae	Plecoptera	2
	27	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	1	Corydalidae	Megaloptera	5
	2	Chironomidae	Diptera	6
Vineyard Run WVKP-45.5 5/21/97	13	Oligochaeta		10
	53	Baetidae	Ephemeroptera	4
	3	Ephemerellidae	Ephemeroptera	4
	122	Heptageniidae	Ephemeroptera	4
	53	Leptophlebiidae	Ephemeroptera	2
	1	Siphlonuridae	Ephemeroptera	7
	11	Isonychiidae	Ephemeroptera	2
	3	Hydropsychidae	Tricoptera	6
	3	Hydroptilidae	Tricoptera	6
	1	Philopotamidae	Tricoptera	3
	8	Capniidae/Leuctridae	Plecoptera	1
	14	Nemouridae	Plecoptera	2
	20	Perlidae	Plecoptera	1
	10	Perlodidae	Plecoptera	2
	17	Elmidae	Coleoptera	4
	39	Psephenidae	Coleoptera	4
	1	Staphylinidae	Coleoptera	0
	2	Tipulidae	Diptera	3
	4	Ceratopogonidae	Diptera	6
	1	Simuliidae	Diptera	6
	140	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Armour Creek WVK-30 5/15/97	21	Oligochaeta		10
	1	Elmidae	Coleoptera	4
	156	Chironomidae	Diptera	6
Vintroux Hollow WVK-32-0.1A 5/15/97	13	Oligochaeta		10
	5	Gammaridae	Amphipoda	4
	5	Ephemerellidae	Ephemeroptera	4
	1	Hydropsychidae	Tricoptera	6
	2	Elmidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	2	Ceratopogonidae	Diptera	6
	1	Simuliidae	Diptera	6
	120	Chironomidae	Diptera	6
Rockstep Run WVK-32-A 5/15/97	12	Oligochaeta		10
	1	Baetidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	4	Nemouridae	Plecoptera	2
	6	Elmidae	Coleoptera	4
	4	Psephenidae	Coleoptera	4
	110	Simuliidae	Diptera	6
	280	Chironomidae	Diptera	6
Gallatin Branch WVK-33 5/14/97	11	Oligochaeta		10
	1	Leptophlebiidae	Ephemeroptera	2
	1	Nemouridae	Plecoptera	2
	110	Chironomidae	Diptera	6
Finney Branch WVK-36-{2.4} 6/11/97	6	Cambaridae	Decapoda - Crayfish	5
	9	Baetidae	Ephemeroptera	4
	40	Heptageniidae	Ephemeroptera	4
	17	Leptophlebiidae	Ephemeroptera	2
	1	Ameletidae	Ephemeroptera	0
	1	Hydropsychidae	Tricoptera	6
	3	Nemouridae	Plecoptera	2
	14	Perlidae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	1	Gomphidae	Odonata - Anisoptera	1
	3	Elmidae	Coleoptera	4
	1	Tipulidae	Diptera	3
	1	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Ward Hollow WVK-39-A 5/13/97	43	Oligochaeta		10
	3	Cambaridae	Decapoda - Crayfish	5
	5	Hydropsychidae	Tricoptera	6
	2	Lampyridae	Coleoptera	0
	3	Tipulidae	Diptera	3
	5	Simuliidae	Diptera	6
	46	Chironomidae	Diptera	6
Davis Creek WVK-39-{01.6} 5/6/97	1	Oligochaeta		10
	2	Baetiscidae	Ephemeroptera	3
	1	Caenidae	Ephemeroptera	4
	5	Ephemerellidae	Ephemeroptera	4
	2	Heptageniidae	Ephemeroptera	4
	2	Nemouridae	Plecoptera	2
	1	Gomphidae	Odonata - Anisoptera	1
	1	Veliidae	Hemiptera	6
	21	Chironomidae	Diptera	6
Trace Fork WVK-39-B-{0.1} 5/6/97	1	Cambaridae	Decapoda - Crayfish	5
	1	Caenidae	Ephemeroptera	4
	6	Ephemerellidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	2	Calopterygidae	Odonata - Zygoptera	5
	1	Tipulidae	Diptera	3
	1	Empididae	Diptera	6
	38	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Bays Fork WVK-39-E-3-{0.4} 5/8/97	3	Cambaridae	Decapoda - Crayfish	5
	13	Baetidae	Ephemeroptera	4
	48	Ephemerellidae	Ephemeroptera	4
	2	Heptageniidae	Ephemeroptera	4
	7	Leptophlebiidae	Ephemeroptera	2
	4	Philopotamidae	Tricoptera	3
	2	Limnephilidae	Tricoptera	4
	10	Capniidae/Leuctridae	Plecoptera	1
	2	Chloroperlidae	Plecoptera	1
	2	Nemouridae	Plecoptera	2
	1	Perlodidae	Plecoptera	2
	4	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	2	Ptilodactylidae	Coleoptera	5
	4	Tipulidae	Diptera	3
	16	Simuliidae	Diptera	6
	13	Chironomidae	Diptera	6
Bays Fork WVK-39-E-3-{0.6} 5/11/97	3	Baetidae	Ephemeroptera	4
	16	Ephemerellidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	16	Leptophlebiidae	Ephemeroptera	2
	1	Hydropsychidae	Tricoptera	6
	2	Limnephilidae	Tricoptera	4
	2	Polycentropodidae	Tricoptera	6
	20	Capniidae/Leuctridae	Plecoptera	1
	5	Chloroperlidae	Plecoptera	1
	6	Nemouridae	Plecoptera	2
	1	Perlidae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	1	Gomphidae	Odonata - Anisoptera	1
	1	Dryopidae	Coleoptera	5
	1	Staphylinidae	Coleoptera	0
	1	Corydalidae	Megaloptera	5
	14	Tipulidae	Diptera	3
	2	Empididae	Diptera	6
	8	Simuliidae	Diptera	6
	7	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Rays Branch WVK-39-F 5/11/97	23	Oligochaeta		10
	4	Baetidae	Ephemeroptera	4
	13	Ephemerellidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	2	Capniidae/Leuctridae	Plecoptera	1
	4	Nemouridae	Plecoptera	2
	1	Perlodidae	Plecoptera	2
	1	Tipulidae	Diptera	3
	1	Ceratopogonidae	Diptera	6
	4	Simuliidae	Diptera	6
	233	Chironomidae	Diptera	6
Coal Hollow WVK-39-J 5/13/97	2	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	2	Baetidae	Ephemeroptera	4
	1	Nemouridae	Plecoptera	2
	2	Tipulidae	Diptera	3
	3	Simuliidae	Diptera	6
	147	Chironomidae	Diptera	6
Davis Creek WVK-39-{09.4} 5/13/97	4	Oligochaeta		10
	9	Baetidae	Ephemeroptera	4
	96	Ephemerellidae	Ephemeroptera	4
	7	Heptageniidae	Ephemeroptera	4
	1	Isonychiidae	Ephemeroptera	2
	8	Hydropsychidae	Tricoptera	6
	2	Rhyacophilidae	Tricoptera	0
	11	Capniidae/Leuctridae	Plecoptera	1
	2	Perlodidae	Plecoptera	2
	1	Corydalidae	Megaloptera	5
	2	Tipulidae	Diptera	3
	6	Simuliidae	Diptera	6
	51	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Hoffman Hollow WVK-39-M-1-A-{1.0} 6/12/97	10	Baetidae	Ephemeroptera	4
	3	Ephemerellidae	Ephemeroptera	4
	7	Heptageniidae	Ephemeroptera	4
	27	Leptophlebiidae	Ephemeroptera	2
	3	Hydropsychidae	Tricoptera	6
	1	Rhyacophilidae	Tricoptera	0
	19	Philopotamidae	Tricoptera	3
	1	Lepidostomatidae	Tricoptera	1
	1	Limnephilidae	Tricoptera	4
	1	Polycentropodidae	Tricoptera	6
	31	Capniidae/Leuctridae	Plecoptera	1
	1	Perlidae	Plecoptera	1
	7	Perlodidae	Plecoptera	2
	2	Dryopidae	Coleoptera	5
	6	Elmidae	Coleoptera	4
	9	Tipulidae	Diptera	3
	6	Chironomidae	Diptera	6
Shrewsbury Hollow WVK-39-O 5/13/97	3	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	1	Baetidae	Ephemeroptera	4
	9	Ephemerellidae	Ephemeroptera	4
	4	Heptageniidae	Ephemeroptera	4
	7	Leptophlebiidae	Ephemeroptera	2
	32	Hydroptilidae	Tricoptera	6
	6	Rhyacophilidae	Tricoptera	0
	19	Philopotamidae	Tricoptera	3
	1	Lepidostomatidae	Tricoptera	1
	1	Limnephilidae	Tricoptera	4
	67	Capniidae/Leuctridae	Plecoptera	1
	6	Nemouridae	Plecoptera	2
	1	Perlodidae	Plecoptera	2
	12	Simuliidae	Diptera	6
	1	Tabanidae	Diptera	6
	41	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Davis Creek WVK-39-{12.2} 6/12/97	22	Baetidae	Ephemeroptera	4
	7	Ephemerellidae	Ephemeroptera	4
	5	Heptageniidae	Ephemeroptera	4
	4	Leptophlebiidae	Ephemeroptera	2
	1	Hydropsychidae	Tricoptera	6
	8	Polycentropodidae	Tricoptera	6
	74	Capniidae/Leuctridae	Plecoptera	1
	1	Perlodidae	Plecoptera	2
	1	Elmidae	Coleoptera	4
	4	Tipulidae	Diptera	3
	8	Simuliidae	Diptera	6
	20	Chironomidae	Diptera	6
Woodward Branch WVK-41-A 5/16/97	60	Oligochaeta		10
	7	Chironomidae	Diptera	6
Twomile Creek WVK-41 5/13/97	2	Oligochaeta		10
	1	Baetidae	Ephemeroptera	4
	3	Simuliidae	Diptera	6
	34	Chironomidae	Diptera	6
Unnamed Tributary of Left Fork of Twomile WVK-41-D-1 5/13/97	2	Turbellaria		4
	82	Oligochaeta		10
	1	Ephemerellidae	Ephemeroptera	4
	1	Heptageniidae	Ephemeroptera	4
	1	Tipulidae	Diptera	3
	21	Simuliidae	Diptera	6
	84	Chironomidae	Diptera	6
Rich Fork of Twomile WVK-41-D.5 5/15/97	1	Corydalidae	Megaloptera	5
	43	Chironomidae	Diptera	6
Craigs Branch WVK-41-D.5-B 5/15/97	1	Oligochaeta		10
	1	Baetidae	Ephemeroptera	4
	4	Heptageniidae	Ephemeroptera	4
	3	Nemouridae	Plecoptera	2
	1	Coenagrionidae	Odonata - Zygoptera	9
	1	Simuliidae	Diptera	6
	68	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)				
Stream Name, Stream AN-Code And Date Sampled	**Count**	**Family (Taxa)**	**Order**	**Tolerance Value**
Edens Fork WVK-41-E-1 5/20/97	9	Oligochaeta		10
	2	Cambaridae	Decapoda - Crayfish	5
	9	Baetidae	Ephemeroptera	4
	1	Caenidae	Ephemeroptera	4
	8	Ephemerellidae	Ephemeroptera	4
	17	Heptageniidae	Ephemeroptera	4
	6	Capniidae/Leuctridae	Plecoptera	1
	3	Nemouridae	Plecoptera	2
	3	Perlodidae	Plecoptera	2
	1	Aeshnidae	Odonata - Anisoptera	3
	13	Elmidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	1	Simuliidae	Diptera	6
	80	Chironomidae	Diptera	6
Holmes Branch WVK-41-E-2-{0.1} 5/14/97	1	Turbellaria		4
	368	Oligochaeta		10
	11	Ephemerellidae	Ephemeroptera	4
	8	Elmidae	Coleoptera	4
	1	Psephenidae	Coleoptera	4
	3	Simuliidae	Diptera	6
	109	Chironomidae	Diptera	6
Holmes Branch WVK-41-E-2-{1.4} 6/16/97	1269	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	1	Baetidae	Ephemeroptera	4
	16	Ephemerellidae	Ephemeroptera	4
	3	Heptageniidae	Ephemeroptera	4
	20	Leptophlebiidae	Ephemeroptera	2
	1	Hydropsychidae	Tricoptera	6
	8	Capniidae/Leuctridae	Plecoptera	1
	2	Nemouridae	Plecoptera	2
	2	Perlodidae	Plecoptera	2
	3	Elmidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	255	Chironomidae	Diptera	6

TABLE 21: BENTHIC MACROINVERTEBRATES IDENTIFIED FROM A 100 ORGANISM SUBSAMPLE (continued)

Stream Name, Stream AN-Code And Date Sampled	Count	Family (Taxa)	Order	Tolerance Value
Holmes Branch WVK-41-E-2-{1.7} 5/16/97	1	Turbellaria		4
	5	Asellidae	Isopoda	8
	27	Baetidae	Ephemeroptera	4
	22	Ephemerellidae	Ephemeroptera	4
	5	Heptageniidae	Ephemeroptera	4
	2	Ameletidae	Ephemeroptera	0
	1	Capniidae/Leuctridae	Plecoptera	1
	9	Nemouridae	Plecoptera	2
	5	Perlodidae	Plecoptera	2
	2	Elmidae	Coleoptera	4
	3	Tipulidae	Diptera	3
	9	Chironomidae	Diptera	6
Joplin Branch WVK-42 5/13/97	1	Oligochaeta		10
	1	Cambaridae	Decapoda - Crayfish	5
	2	Hydropsychidae	Tricoptera	6
	2	Simuliidae	Diptera	6
	124	Chironomidae	Diptera	6

TABLE 22: FREQUENCY OF OCCURRENCE OF BENTHIC MACROINVERTEBRATES BY FAMILY			
# Sites	Family Taxa	Order	Tolerance Value
110	Chironomidae	Diptera	6
88	Baetidae	Ephemeroptera	4
85	Heptageniidae	Ephemeroptera	4
83	Tipulidae	Diptera	3
82	Elmidae	Coleoptera	4
70	Capniidae/Leuctridae	Plecoptera	1
69	Perlidae	Plecoptera	1
68	Nemouridae	Plecoptera	2
67	Oligochaeta		10
65	Leptophlebiidae	Ephemeroptera	2
59	Ephemerellidae	Ephemeroptera	4
55	Perlodidae	Plecoptera	2
54	Hydropsychidae	Tricoptera	6
43	Simuliidae	Diptera	6
40	Cambaridae	Decapoda - Crayfish	5
39	Psephenidae	Coleoptera	4
35	Ceratopogonidae	Diptera	6
32	Chloroperlidae	Plecoptera	1
18	Gomphidae	Odonata - Anisoptera	1
15	Caenidae	Ephemeroptera	4
15	Corydalidae	Megaloptera	5
15	Isonychiidae	Ephemeroptera	2
15	Philopotamidae	Tricoptera	3
14	Asellidae	Isopoda	8
13	Hydroptilidae	Tricoptera	6
13	Limnephilidae	Tricoptera	4
12	Rhyacophilidae	Tricoptera	0
11	Dytiscidae	Coleoptera	5
11	Gammaridae	Amphipoda	4
10	Ameletidae	Ephemeroptera	0
7	Tabanidae	Diptera	6
6	Aeshnidae	Odonata - Anisoptera	3
6	Corbiculidae	Unionida	8
6	Polycentropodidae	Tricoptera	6
6	Turbellaria		4
5	Glossosomatidae	Tricoptera	0

TABLE 22: FREQUENCY OF OCCURRENCE OF BENTHIC MACROINVERTEBRATES BY FAMILY (continued)			
# Sites	Family Taxa	Order	Tolerance Value
4	Empididae	Diptera	6
3	Ephemeridae	Ephemeroptera	4
3	Hirudinidae	Leeches	7
3	Veliidae	Hemiptera	6
2	Baetiscidae	Ephemeroptera	3
2	Coenagrionidae	Odonata - Zygoptera	9
2	Hydrobiidae	Operculate Snails	3
2	Lepidostomatidae	Tricoptera	1
2	Nematoda		5
2	Nemertea		6
2	Planariidae	Flatworms	8
2	Staphylinidae	Coleoptera	0
1	Calopterygidae	Odonata - Zygoptera	5
1	Corduliidae	Odonata - Anisoptera	5
1	Corixidae	Hemiptera	5
1	Culicidae	Diptera	8
1	Dixidae	Diptera	1
1	Ephydridae	Diptera	7
1	Gerridae	Hemiptera	8
1	Gyrinidae	Coleoptera	4
1	Haliplidae	Coleoptera	5
1	Hydrophilidae	Coleoptera	5
1	Lampyridae	Coleoptera	0
1	Libellulidae	Odonata - Anisoptera	9
1	Lymnaeidae	Non Operculate Snail	7
1	Physidae	Non Operculate Snail	8
1	Potamanthidae	Ephemeroptera	4
1	Psycomyiidae	Tricoptera	2
1	Ptilodactylidae	Coleoptera	5
1	Saldidae	Hemiptera	0
1	Sciomyzidae	Diptera	10
1	Sialidae	Megaloptera	4
1	Siphlonuridae	Ephemeroptera	7
1	Sphaeriidae	Unionida	8
1	Stratiomyidae	Diptera	7
1	Tricorythidae	Ephemeroptera	4
1	Unionidae	Unionida	4

APPENDIX B: STREAM SURVEY FORM

WVDEP WATERSHED ASSESSMENT PROGRAM

STREAM VERIFICATION >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

STREAM NAME:			**A-N CODE:**		**GPS ID #**		
GPS STATION #:		**BASIN:**		**CO. & STATE:**			
QUAD:		**SAMPLED?**	**[ ] yes [ ] no**	**IF NO, WHY?**	**[ ] dry [ ] not wadable [ ] no access**		
SAMPLE TYPE	**[ ] Lab H_2O [ ] Bugs [ ] Habitat [ ] All**		**SAMPLING DEVICE**	**[ ] Surber [ ] D-net [ ] HandPick**			
HABITAT SAMPLED AND # OF EACH	**Riffle / Run**	**Woody Snags**	**Overhanging Veg**	**Aquatic Plants**			
FIELD LAT:		**FIELD LONG:**					
CORRECTED LAT:		**CORRECTED LONG:**					
DATE:	**/ /**	**TIME:**		**TEAM:**			
DIRECTIONS TO STREAM SITE:							
SKETCH OF STREAM REACH AND GENERAL COMMENTS							

PAGE 1 *WVDEP WAP- STREAM ASSESSMENT FORM (5 May 1997)*

WVDEP WATERSHED ASSESSMENT PROGRAM

PHYSICAL CHARACTERIZATION >>>>>>>>>>>			**REVIEWERS INITIALS**	
AVERAGE STREAM WIDTH (meters):	1___ 2___ 3___ = AVG ___		STREAM ORDER:	
STREAM DEPTH (meters):	riffle	run	pool	
LOCAL WATERSHED EROSION:	[ ] none [ ] slight [ ] moderate [ ] heavy			
LOCAL NPS POLLUTION:	[ ] no evidence [ ] some potential sources [ ] obvious sources			
ABUNDANCE OF PERIPHYTON/ALGAE (100 m reach):	[ ] low abundance [ ] moderate abundance [ ] high abundance			

STREAM REACH ACTIVITIES & DISTURBANCES INSERT A ✓ IN EACH [ ] THAT APPLIES (100 m reach)

RESIDENTIAL		RECREATIONAL		AGRICULTURAL		INDUSTRIAL		STREAM MANAGEMENT	
	Residences		Parks, campgrounds		Annual rowcrops		Industrial plants		Liming
	Lawns		Parking lots		Pasture		Surface mine		Rip rap/ bank stabilization
	Private Boat Dock		Boat access/ dock		Hay production		Deep mine		Dredging
	Construction		Swimming		Orchards		Coal prep		Channelization
	Pipes, drains		Fishing		Poultry		Quarries		Fill
	Bridges, culverts		Pipes, drains		Livestock access		Oil/gas wells		Dams, impound - ments
w s	Roads		Foot trails		Irrigation		Power plant	State, county maintained highways	
			ATV, horse, bike trails		Pipes, drains		Logging		Single Lane
			Bridges, culverts		Bridges, culverts		Woodyards/ sawmill		Double Lane
		w s	Roads	w s	Roads		Sanitary landfill		Multi-Lane
Describe other activities or disturbances below:							Waste H_2O treatment	Surface Type	
							Public H_2O treatment		Dirt
							Pipes, drains		Rutted Dirt
							Parking lots		Applied Limestone
							Bridges, culverts		Applied Non-Limestone
							Railroad		Asphalt
						w s	Roads		Concrete

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WVDEP WATERSHED ASSESSMENT PROGRAM

PHYSICAL CHARACTERIZATION >>>>>>>>>>>>>	REVIEWERS INITIALS	

STREAM NAME:		A-N CODE:		STATION NUMBER:		DATE OF VISIT:	

SEDIMENT ODORS		SEDIMENT OILS		SEDIMENT DEPOSITS	
	normal		absent		sludge
	sewage		slight		sawdust
	petroleum		moderate		paper fiber
	chemical		profuse		sand
	anaerobic (septic)				relic shells
	none				marl
	other				silt
					limestone fines
					metal hydroxides (yellow boy, white boy)
					other:

Comments:

FOR THE ABOVE ✓ EACH ☐ THAT APPLIES

INORGANIC SUBSTRATE ($2\ m^2$ of Kicked substrate)	SIZE CLASS	% COMPOSITION
bedrock	smooth surface rock/hardpan (bigger than a car)	
boulder	basketball to car	
cobble	tennisball to basketball	
gravel	ladybug to tennisball	
sand	gritty – up to ladybug	
silt	fine – not gritty	
clay	slick	

Enter estimated % composition for each substrate type.

Describe other substrate types (ie., unusual substrate types - tires, bricks, etc.) and general comments:

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WVDEP WATERSHED ASSESSMENT PROGRAM

WATER QUALITY >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

	PHYSICOCHEMICAL PARAMETERS		STREAM TYPE		WATER ODORS		SURFACE OILS		TURBIDITY
	Temperature °C		cold water		normal		slick		clear
	pH (std. units)		warm water fishable		sewage		sheen		slightly turbid
	dissolved oxygen (mg/l)		warm water non-fishable		petroleum		globs		moderately turbid
	conductivity (µmhos/cm)				chemical		flecks		turbid
	flow				anaerobic (septic)		none		opaque
Hydrolab I.D. # ______					none				water color
Flow Meter I.D. # _____					other				

Record readings in ☐ for corresponding physicochemical parameter. Insert a ✓ in the ☐ for the other categories.

PRECIPITATION STATUS			
CURRENT:		**PAST 24 HOURS (if known):**	

STREAM BANK / RIPARIAN BUFFER ZONE MEASURES >>>>

STREAM BANK / RIPARIAN BUFFER ZONE WIDTH & VEGETATION / COVER TYPE

Vegetation Types : D = deciduous, C = coniferous, M = mixed, N = none

Score Codes: 0 = absent, (0-10%) 2 = moderate (10-40%), 3 = heavy (40-75%) 4 = very heavy (>75%)

LEFT & RIGHT BANK WHILE FACING DOWN-STREAM	DETER-MINED WITHIN THE 1ST 18 M FROM STREAM EDGE	CANOPY (>5m high)			UNDERSTORY (0.5-5 m high)			GROUND COVER (<0.5 m high)			
		VEG TYPE	BIG TREES (>0.3 m DBH)	SMALL TREES (>0.3 m DBH)	VEG TYPE	WOODY SHRUBS, SAPLINGS	NON-WOODY HERBS	WOODY SHRUBS & SEED-LINGS	NON-WOODY HERBS, GRASSES, FERNS, MOSSES	LEAF LITTER	BARREN, BARE SOIL
LEFT (18 m)											
RIGHT (18 m)											

STREAM SURFACE SHADING (%) — Indicate % based on cloudless day in summer at noon. Place a ✓ in the ☐ that applies

	fully exposed (0-25)		partially exposed (25-50)		partially shaded (50-75)		fully shaded (75-100)

General comments (include land cover types outside of 18 m zone on left and right side that may have a major impact on the stream site).

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WVDEP WATERSHED ASSESSMENT PROGRAM

RAPID HABITAT ASSESSMENT: RIFFLE/RUN PREVALENCE							
Reviewer's Initials:							
STREAM NAME:		A-N CODE:		STATION #:		DATE OF VISIT:	

HABITAT PARAMETER	CATEGORY: Optimal	CATEGORY: Sub-optimal	CATEGORY: Marginal	CATEGORY: Poor
1.INSTREAM COVER (FISH)	GREATER THAN 50% MIX OF BOULDER, COBBLE, SUBMERGED LOGS, UNDERCUT BANKS, OR OTHER STABLE HABITATS	30 TO 50% MIX OF BOULDER, COBBLE, OR OTHER STABLE HABITAT; ADEQUATE HABITAT	10 TO 30% MIX OF BOULDER, COBBLE, OR OTHER STABLE HABITAT; HABITAT AVAILABILITY IS LESS THAN DESIREABLE	LESS THAN 10% OF BOULDER, COBBLE OR OTHER STABLE HABITAT; LACK OF HABITAT IS OBVIOUS
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. EPIFAUNAL SUBSTRATE	WELL DEVELOPED RIFFLE & RUN; RIFFLE IS AS WIDE AS STREAM AND ITS LENGTH EXTENDS TWO TIMES THE WIDTH OF THE STREAM; ABUNDANCE OF COBBLE	RIFFLE IS AS WIDE AS STREAM, BUT IS LESS THAN TWO TIMES WIDTH; ABUNDANCE OF COBBLE; BOULDERS AND GRAVEL COMMON	RUN AREA MAY BE LACKING; REDUCED RIFFLE AREA THAT DOES NOT EXTEND ACROSS ENTIRE CROSS SECTION AND IS LESS THAN TWO TIMES THE WIDTH; GRAVEL OR LARGE BOULDERS PREVALENT; COBBLE PRESENT	RIFFLE OR RUN VIRTUALLY NON-EXISTENT; GRAVEL OR LARGE BOULDERS AND BEDROCK PREVALENT; COBBLE LACKING
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. EMBEDDEDNESS	GRAVEL, COBBLE AND BOULDER PARTICLES ARE BETWEEN 0 AND 25% SURROUNDED BY FINE SEDIMENT	GRAVEL, COBBLE AND BOULDER PARTICLES ARE BETWEEN 25 AND 50% SURROUNDED BY FINE SEDIMENT	GRAVEL, COBBLE AND BOULDER PARTICLES ARE BETWEEN 50 AND 75% SURROUNDED BY FINE SEDIMENT	GRAVEL, COBBLE AND BOULDER PARTICLES ARE OVER 75% SURROUNDED BY FINE SEDIMENT
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. VELOCITY/DEPTH REGIMES	SLOW (,0.3 M/S) DEEP (>0.5 M); SLOW, SHALLOW (<0.5 M); FAST (>0.3 M/S), DEEP; FAST, SHALLOW HABITATS ALL PRESENT	ONLY 3 OF 4 HABITAT TYPES PRESENT (IF FAST SHALLOW IS MISSING, SCORE LOWER THAN IF OTHER TYPES ARE MISSING	ONLY 2 OF 4 HABITAT TYPES ARE PRESENT (IF FAST SHALLOW OR SLOW SHALLOW ARE MISSING, SCORE LOW	DOMINATED BY ONE VELOCITY/DEPTH REGIME (USUALLY SLOW DEEP)
SCORES:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. CHANNEL ALTERATION	NO CHANNELIZATION OR DREDGING PRESENT	SOME CHANNELIZATION PRESENT, USUALLY IN AREAS OF BRIDGE ABUTMENTS; EVIDENCE OF PAST CHANNELIZATION, I.E., DREDGING (>THAN PAST 20 YEARS) MAY BE PRESENT BUT NO EVIDENCE OF RECENT CHANNELIZATION	NEW EMBANKMENTS ARE PRESENT ON BOTH BANKS; AND 40 TO 80% OF THE STREAM REACH IS CHANNELIZED AND DISRUPTED	BANKS SHORED WITH GABION OR CEMENT; OVER 80% OF THE STREAM REACH IS CHANNELIZED AND DISRUPTED
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. SEDIMENT DEPOSITION	LITTLE OR NO ENLARGEMETN OF ISLANDS OR POINT BARS AND LESS THAN 5% OF THE BOTTOM IS AFFECTED BY SEDIMENT DEPOSITION	SOME NEW INCREASE IN BAR FORMATION, MOSTLY FROM COARSE GRAVEL; 5T0 30% OF THE BOTTOM IS AFFECTED; SLIGHT DEPOSITION IN POOLS	MODERATE DEPOSITION OF NEW GRAVEL OR COARSE SAND ON OLD AND NEW BARS; 30 TO 50% OF BOTTOM IS AFFECTED; SEDIMENT DEPOSITS AT OBSTRUCTIONS, CONSTRICTIONS, AND BENDS; MODERATE DEPOSITON OF POOLS PREVALENT	HEAVY DEPOSITS OF FINE MATERIAL; INCREASED BAR DEVELOPMENT; MORE THAT 50% OF THE BOTTOM IS CHANGING FREQUENTLY; POOLS ALMOST ABSENT DUE TO SUBSTANTIAL SEDIMENT DEPOSTION
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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RAPID HABITAT ASSESSMENT: RIFFLE/RUN PREVALENCE (continued)

						REVIEWERS INITIALS:	
STREAM NAME:		A-N CODE:		STATION #:		DATE OF VISIT:	

HABITAT PARAMETER	CATEGORY			
	Optimal	Sub-optimal	Marginal	Poor
7. RIFFLE FREQUENCY SCORE:	OCCURRENCE OF RIFFLES IS RELATIVELY FREQUENT; THE DISTANCE BETWEEN RIFFLES DIVIDED BY THE WIDTH OF THE STREAM EQUALS 5 TO 7; VARIETY OF HABITAT	OCCURRENCE OF RIFFLES IS INFREQUENT; DISTANCE BETWEEN RIFFLES DIVIDED BY THE WIDTH OF THE STREAM EQUALS 7 TO 15	OCCASSIONAL RIFFLE OR BEND; CONTOURS PROVIDE SOME HABITAT; DISTANCE BETWEEN RIFFLES DIVIDED BY THE WIDTH OF THE STREAM IS BETWEEN 15 TO 20	GENERALLY ALL FLAT WATER OR SHALLOW RIFFLES; POOR HABITAT; DISTANCE BETWEEN RIFFLES DIVIDED BY THE WIDTH OF THE STREAM IS GREATER THAN 25
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. CHANNEL FLOW STATUS SCORE:	WATER REACHES THE BASE OF BOTH BANKS AND A MINIMAL AREA OF CHANNEL SUBSTRATE IS EXPOSED	WATER FILLS MORE THAN 75% OF THE AVAILABLE CHANNEL; OR LESS THAN 25% OF THE CHANNEL SUBSTRATE IS EXPOSED	WATERS FILLS 25 TO 75% OF THE AVAILABLE CHANNEL; AND/OR RIFFLE SUBSTRATES ARE MOSTLY EXPOSED	VERY LITTLE WATER IN CHANNEL AND MOSTLY PRESENT AS STANDING POOLS
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9. BANK CONDITION SCORE:	UPPER BANK STABLE, 0-10% OF BANKS WITH EROSIONAL SCARS AND LITTLE POTENTIAL FOR FUTURE PROBLEMS	MODERATELY STABLE, 10 TO 30% OF BANKS WITH EROSIONAL SCARS, MOSTLY HEALED OVER, SLIGHT POTENTIAL IN EXTREME FLOODS	MODERATELY UNSTABLE, 30 TO 60% OF BANKS WITH EROSIONAL SCARS AND HIGH EROSION POTENTION DURING EXTREME HIGH FLOW	UNSTABLE. MANY ERODED AREAS. “RAW” AREAS ARE FREQUENT ALONG STRAIGHT SECTIONS AND BENDS. SIDE SLOPES > 60° COMMON
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
10. BANK VEGETATIVE PROTECTION SCORES:	MORE THAN 90% OF THE STREAM BANK SURFACES ARE COVERED BY VEGETATION	70 TO 90% OF THE STREAM BANK SURFACES ARE COVERED BY VEGETATION	50 TO 70% OF THE STREAM BANK SURFACES ARE COVERED BY VEGETATION	LESS THAN 50% OF THE STREAM BANK SURFACES ARE COVERED BY VEGETATION
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
11. GRAZING OR OTHER DISRUPTIVE PRESSURE SCORE:	VEGETATIVE DISRUPTION THRU GRAZING OR MOWING IS MINIMAL OR NOT EVIDENT; ALMOST ALL PLANTS ARE ALLOWED TO GROW NATURALLY	DISRUPTION IS EVIDENT BUT IS NOT AFFECTING FULL PLANT GROWTH POTENTIAL TO ANY GREAT EXTENT; MORE THAN ONE HALF OF THE POTENTIAL PLANT STUBBLE HEIGHT REMAINS	DISRUPTION IS OBVIOUS; PATCHES OF BARE SOIL OR CLOSELY CROPPED VEGETATION ARE COMMON; LESS THAN ONE HALF OF THE POTENTIALPLANT STUBBLE HEIGHT REMAINS	DISRUPTION OF STREAM BANK VEGETATION IS VERY HIGH; VEGETATION HAS BEEN REMOVED TO 2 INCHES OR LESS IN AVERAGE STUBBLE HEIGHT
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
12. RIPARIAN VEG. ZONE WIDTH (LEAST BUFFERED SIDE) SCORE:	WIDTH OF RIPARIAN ZONE IS GREATER THAN 18 METERS; HUMAN ACTIVITIES (I.E., PARKING LOTS, ROADBEDS, CLEARCUTS, LAWNS OR CROPS) HAVE NOT IMPACTED THIS AREA	ZONE WIDTH IS BETWEEN 12 AND 18 METERS; HUMAN ACTIVITIES HAVE ONLY MINIMALLY IMPACTED THIS ZONE	ZONE WIDTH IS BETWEEN 6 AND 12 METERS; HUMAN ACTIVITIES HAVE IMPACTED THE ZONE A GREAT DEAL	WIDTH OF ZONE IS LESS THAN 6 METERS; LITTLE OR NO RIPARIAN VEGETATION DUE TO MAN INDUCED ACTIVITIES
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
TOTAL SCORE:				

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WVDEP WATERSHED ASSESSMENT PROGRAM

RAPID HABITAT ASSESSMENT: GLIDE POOL PREVALENCE

STREAM NAME:		A-N CODE:		STATION #:		DATE OF VISIT:	

HABITAT PARAMETER	CATEGORY			
	Optimal	Sub-optimal	Marginal	Poor
1.INSTREAM COVER (FISH)	GREATER THAN 50% MIX OF SNAGS, SUBMERGED LOGS, UNDERCUT BANKS, OR OTHER STABLE HABITATS; RUBBLE OR GRAVEL MAY BE PRESENT	30 TO 50% MIX OF STABLE HABITAT; ADEQUATE HABITAT FOR MAINTENANCE OF POPULATIONS	10 TO 30% MIX OF STABLE HABITAT; HABITAT AVAILABILITY IS LESS THAN DESIREABLE	LESS THAN 10% STABLE HABITAT; LACK OF HABITAT IS OBVIOUS
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. EPIFAUNAL SUBSTRATE	PREFERRED BENTHIC SUBSTRATE (TO BE SAMPLED) IS ABUNDANT THROUGHOUT STREAM SITE AND AT A STAGE TO ALLOW FOR FULL COLONIZATION POTENTIAL (I.E., LOGS & SNAGS THAT ARE NOT NEW FALL AND NOT TRANSIENT	SUBSTRATE IS COMMON BUT NOT PREVALENT AND NOT WELL SUITED FOR FULL COLONIZATION POTENTIAL	SUBSTRATE FREQUENTLY DISTURBED OR REMOVED	SUBSTRATE IS UNSTABLE OR LACKING
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. POOL SUBSTRATE CHARACTERIZATION	MIXTURE OF SUBSTRATE MATERIALS WITH GRAVEL & FIRM SAND PREVALENT; ROOT MATS & SUBMERGED VEGETATION COMMON	MIXTURE OF SOFT SAND, MUD OR CLAY; MUD MAY BE DOMINANT; SOME ROOT MATS AND SUBMERGED VEGETATION ARE PRESENT	ALL MUD OR CLAY OR SAND BOTTOM; LITTLE OR NO ROOT MAT; NO SUBMERGED VEGETATION	HARD-PAN CLAY OR BEDROCK; NO ROOT MAT OR VEGETATION
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. POOL VARIABILITY SHALLOW < 1 m DEEP > 1 m	EVEN MIX OF LARGE SHALLOW, LARGE DEEP, SNALL SHALLOW, SMALL DEEP POOLS ARE PRESENT	MAJORITY OF POOLS LARGE DEEP; VERY FEW SHALLOW	SHALLOW POOLS MUCH MORE PREVALENT THAN DEEP POOLS	MAJORITY OF POOLS SNALL SHALLOW OR POOLS ABSENT
SCORES:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. CHANNEL ALTERATION	NO CHANNELIZATION OR DREDGING PRESENT	SOME CHANNELIZATION PRESENT, USUALLY IN AREAS OF BRIDGE ABUTMENTS; EVIDENCE OF PAST CHANNELIZATION, I.E., DREDGING (>THAN PAST 20 YEARS) MAY BE PRESENT BUT NO EVIDENCE OF RECENT CHANNELIZATION	NEW EMBANKMENTS ARE PRESENT ON BOTH BANKS; CHANNELIZATION MAY BE EXTENSIVE, USUALLY IN URBAN AREAS OR DRAINAGE AREAS OF AGRICULTURAL LANDS; AND MORE THAN 80% OF THE STREAM REACH IS CHANNELIZED AND DISRUPTED	EXTENSIVE CHANNELIZATION; BANKS SHORED WITH GABION OR CEMENT; HEAVILY URBANIZED AREAS; INSTREAM HABITAT GREATLY ALTERED OR REMOVED ENTIRELY
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. SEDIMENT DEPOSITION	LESS THAN 205 OF THE BOTTOM IS AFFECTED; MINOR ACCUMULATION OF FINE AND COARSE MATERIAL AT SNAGS AND SUBMERGED VEGETATION; LITTLE OR NO ENLARGEMENT OF ISLANDS OR POINT BARS	20 TO 50% AFFECTED; MODERATE ACCUMULATION; SUBSTANTIAL SEDIMENT MOVEMENT ONLY DURING MAJOR STORM EVENTS; SOME NEW INCREASE IN BAR FORMATION	50 TO 80% AFFECTED; MAJOR DEPOSITION; POOLS SHALLOW AND HEAVILY SILTED; EMBANKMENTS MAY BE PRESENT ON BOTH BANNKS; FREQUENT AND SUBSTANIAL SEDIMENT MOVEMENT DURING STORM EVENTS	CHANNELIZED; MUD, SILT, AND /OR SAND IN BRAIDED OR NON-BRAIDED CHANNELS; POOLS ALMOST ABSENT DUE TO DEPOSITION
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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[1]Large if length, width, or oblique dimension is > than ½ stream width.

WVDEP WATERSHED ASSESSMENT PROGRAM

RAPID HABITAT ASSESSMENT: GLIDE/POOL PREVALENCE (continued)

		REVIEWERS INITIALS:	
STREAM NAME:		A-N CODE:	
STATION #:		DATE OF VISIT:	

HABITAT PARAMETER	CATEGORY: Optimal	Sub-optimal	Marginal	Poor
7. CHANNEL SINUOSITY	THE BENDS IN THE STREAM INCREASE THE STREAM LENGTH 3 TO4 TIMES LONGER THAN IF IT WAS A STRAIGHT LINE	THE BENDS IN THE STREAM INCREASE THE STREAM LENGTH 2 TO 3 TIMES LONGER THAN IF IT WAS IN A STRAIGHT LINE	THE BENDS IN THE STREAM INCREASE THE STREAM LENGTH BETWEEN 1 AND 2 TIMES LONGER THAN IF IT WAS IN A STRAIGHT LINE	CHANNEL IS STRAIGHT; WATERWAY HAS BEEN CHANNELIZED FOR A LONG DISTANCE
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. CHANNEL FLOW STATUS	WATER REACHES THE BASE OF BOTH LOWER BANKS AND A MINIMAL AREA OF CHANNEL SUBSTRATE IS EXPOSED	WATER FILLS MORE THAN 75% OF THE AVAILABLE CHANNEL; OR LESS THAN 25% OF THE CHANNEL SUBSTRATE IS EXPOSED	WATERS FILLS 25 TO 75% OF THE AVAILABLE CHANNEL; AND/OR RIFFLE SUBSTRATES ARE MOSTLY EXPOSED	VERY LITTLE WATER IN CHANNEL AND MOSTLY PRESENT AS STANDING POOLS
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9. BANK CONDITION	UPPER BANK STABLE, 0-10% OF BANKS WITH EROSIONAL SCARS AND LITTLE POTENTIAL FOR FUTURE PROBLEMS	MODERATELY STABLE, 10 TO 30% OF BANKS WITH EROSIONAL SCARS, MOSTLY HEALED OVER, SLIGHT POTENTIAL IN EXTREME FLOODS	MODERATELY UNSTABLE, 30 TO 60% OF BANKS WITH EROSIONAL SCARS AND HIGH EROSION POTENTION DURING EXTREME HIGH FLOW	UNSTABLE. MANY ERODED AREAS. “RAW” AREAS ARE FREQUENT ALONG STRAIGHT SECTIONS AND BENDS. SIDE SLOPES > 60° COMMON
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
10. BANK VEGETATIVE PROTECTION	MORE THAN 90% OF THE STREAM BANK SURFACES ARE COVERED BY VEGETATION	70 TO 90% OF THE STREAM BANK SURFACES ARE COVERED BY VEGETATION	50 TO 70% OF THE STREAM BANK SURFACES ARE COVERED BY VEGETATION	LESS THAN 50% OF THE STREAM BANK SURFACES ARE COVERED BY VEGETATION
SCORES:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
11. GRAZING OR OTHER DISRUPTIVE PRESSURE	VEGETATIVE DISRUPTION THRU GRAZING OR MOWING IS MINIMAL OR NOT EVIDENT; ALMOST ALL PLANTS ARE ALLOWED TO GROW NATURALLY	DISRUPTION IS EVIDENT BUT IS NOT AFFECTING FULL PLANT GROWTH POTENTIAL TO ANY GREAT EXTENT; MORE THAN ONE HALF OF THE POTENTIAL PLANT STUBBLE HEIGHT REMAINS	DISRUPTION IS OBVIOUS; PATCHES OF BARE SOIL OR CLOSELY CROPPED VEGETATION ARE COMMON; LESS THAN ONE HALF OF THE POTENTIALPLANT STUBBLE HEIGHT REMAINS	DISRUPTION OF STREAM BANK VEGETATION IS VERY HIGH; VEGETATION HAS BEEN REMOVED TO 2 INCHES OR LESS IN AVERAGE STUBBLE HEIGHT
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
12. RIPARIAN VEG. ZONE WIDTH (LEAST BUFFERED SIDE)	WIDTH OF RIPARIAN ZONE IS GREATER THAN 18 METERS; HUMAN ACTIVITIES (I.E., PARKING LOTS, ROADBEDS, CLEARCUTS, LAWNS OR CROPS) HAVE NOT IMPACTED THIS AREA	ZONE WIDTH IS BETWEEN 12 AND 18 METERS; HUMAN ACTIVITIES HAVE ONLY MINIMALLY IMPACTED THIS ZONE	ZONE WIDTH IS BETWEEN 6 AND 12 METERS; HUMAN ACTIVITIES HAVE IMPACTED THE ZONE A GREAT DEAL	WIDTH OF ZONE IS LESS THAN 6 METERS; LITTLE OR NO RIPARIAN VEGETATION DUE TO MAN INDUCED ACTIVITIES
SCORE:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
TOTAL SCORE:				

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WVDEP WATERSHED ASSESSMENT PROGRAM

AESTHETIC RATING AND REMOTENESS CHARACTERIZATION >					REVIEWER'S INITIALS:	
STREAM NAME:		A-N CODE:		STATION #:		DATE OF VISIT:

HABITAT PARAMETER	CATEGORY																				
	Optimal					Sub-optimal					Marginal					Poor					
AESTHETIC RATING	LITTLE OR NO EVIDENCE OF HUMAN REFUSE PRESENT; VEGETATION VISIBLE FROM STREAM ESSENTIALLY IN A NATURAL STATE					HUMAN REFUSE PRESENT IN MINOR AMMOUNTS					REFUSE PRESENT IN MODERATE AMMOUNTS					HUMAN REFUSE ABUNDANT AND UNSIGHTLY					
SCORE:	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
REMOTENESS RATING	STREAM ASSESSMENT SITE MORE THAN ¼ MILE FROM NEAREST ROAD; ACCESS DIFFICULTY AND LITTLE OR NO EVIDENCE OF HUMAN DISTURBANCE					STRAM ASSESSMENT SITE WITHIN ¼ MILE OF BUT NOT IMMEDIATELY ACCESSIBLE TO ROADSIDE; SITE WITH MODERATELY WILD CHARACTER					STREAM WITHIN ¼ MILE OF ROADSIDE; DEVELOPMENT ACTIVITIES EVIDENT					SEGMENT IMMEDIATELY ADJACENT TO ROADSIDE ACCESS; VISUAL OLFACTORY AND/OR AUDITORY DISPLEASURE					
SCORE:	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

STREAM DISCHARGE MEASUREMENT (Calculated to cubic feet per second (CFS))

Measurer:		Time:	

Distance	Width	Depth	Click	Seconds	Velocity	Discharges (cfs)

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APPENDIX C: GLOSSARY

303(d) list -a list of streams that are water quality limited and not expected to meet water quality criteria even after applying technology-based controls. Required by the Clean Water Act and named for the section of the Act in which it appears.

acidity -the capacity of water to donate protons. The abbreviation pH (see def.) refers to degree of acidity. Higher acidities are more corrosive and harmful to aquatic life.

acid mine drainage (AMD) -acidic water discharged from an active or abandoned mine.

alkalinity -measures water's buffering capacity, or resistance to acidification; often expressed as the concentration of carbonate and bicarbonate.

aluminum -a potentially toxic metallic element often found in mine drainage; when oxidized forms a white precipitate called "white boy".

benthic macroinvertebrates - small animals without backbones yet still visible to the naked eye, that live on the bottom (the substrate) of a water body, and are large enough to be collected with a 595 μm mesh screen. Examples include insects, worms, snails, clams, and crayfish.

benthic organisms, or benthos - organisms that live on or near the substrate (bottom) of a water body, e.g., algae, mayfly larvae, and darters.

buffer -a dissolved substance that maintains a solution's original pH by neutralizing added acid.

canopy -The layer of vegetation that is more than five meters from the ground; see understory and ground cover.

citizens monitoring team -a group of people that periodically check the ecological health of their local streams.

conductivity (conductance) -the capacity of water to conduct an electrical current, higher conductivities indicate higher concentrations of ions.

designated uses -the uses specified in the state water quality standards for each water body or segment (e.g., "fish propagation" or "industrial water supply").

discharge -liquid flowing from a point source; or the volume of water flowing down a stream per unit of time, typically recorded as cfs (cubic feet /second).

discharge permit -a legal document issued by a government regulatory agency specifying the kinds and amounts of pollutants a person or group may discharge into a water body; often called NPDES permit.

dissolved oxygen - the amount of molecular oxygen dissolved in water.

Division of Environmental Protection (DEP) -a unit in the executive branch of West Virginia's state government charged with enforcing environmental laws and monitoring environmental quality.

ecoregion -a land area with relative homogeneity in ecosystems that, under nonimpaired conditions, contain habitats which should support similar communities of animals.

ecosystem -the complex of a community and its environment functioning as an ecological unit in nature. A not easily defined aggregation of biotic and abiotic components that are interconnected through various trophic pathways, and that interact systematically in the transfer of nutrients and energy.

effluent -liquid flowing from a point source (e.g., pipe or collection pond).

Environmental Quality Board (EQB) -a standing group, whose members are appointed by the governor, that promulgates water quality criteria and judges appeals for relief from water quality regulations.

Environmental Protection Agency (EPA) -a unit in the executive branch of the federal government charged with enforcing environmental laws.

ephemeral -a stream that carries surface water during only part of the year; a stream that occasionally dries up.

eutrophic -a condition of a lake or stream which has higher than normal levels of nutrients, contributing to excessive plant growth. Usually etropic waters are seasonally deficient in oxygen. Consequently more food and cover is provided to some macrobenthos than would be provided otherwise.

fecal coliform bacteria -a group of single-celled organisms common in the alimentary tracts of some birds and all mammals, including man; indicates fecal pollution and the *potential* presence of human pathogens.

ground cover -vegetation that forms the lowest layer in a plant community defined as less than 0.5 meters high for this assessment) .

impaired -(1) according to the water quality standards, a stream that does not fully support one or more of its designated uses; (2) as used in this assessment report, a benthic macroinvertebrate community with metric scores substantially worse than those of an appropriate reference site; or having a bioscore below 50.

iron -a metallic element often found in mine drainage that is potentially harmful to aquatic life. When oxidized, it forms an orange precipitate called “yellow boy” that can clog fish and macroinvertebrate gills.

lacustrine - of or having to do with a lake or lakes.

MACS -Mid-Atlantic Coastal Streams -macrobenthic sampling methodology used in streams with very low gradient that lack riffle habitat suitable for The Program’s preferred procedure (see Appendix B).

manganese -a metallic element often found in mine drainage that is potentially harmful to aquatic life.

metrics -statistical tools used by ecologists to evaluate biological communities.

National Pollutant Discharge Elimination System (NPDES) -a government permitting activity created by section 402 of the federal Clean Water Act of 1972 to control all discharges of pollutants from point sources. In West Virginia, this activity is conducted by the Office of Water Resources.

nonimpaired -(1) according to the water quality standard, a stream that fully supports all of its designated uses: (2) as used in this assessment report, a benthic community with metric scores comparable to those of an appropriate reference site.

nonpoint source (NPS) pollution -contaminants that run off a broad landscape area (e.g., plowed field, parking lot, dirt road) and enter a receiving water body.

Office of Water Resources (OWR) -a unit within the DEP that manages a variety of regulatory and voluntary activities to enhance and protect West Virginia's surface and ground waters.

oligotrophic - a stream, lake or pond which is poor in nutrients.

palustrine - of or having to do with a marsh, swamp or bog.

pH -indicates the concentration of hydrogen ions; a measure of the intensity of acidity of a liquid. Represented on a scale of 0-14, a pH of one describes the strongest acid, fourteen represents the strongest base, and seven is neutral. Aquatic life cannot tolerate either extreme.

point source -a specific, discernible site (e.g., pipe, ditch, container) locatable on a map as a point, from which pollution discharges into a water body.

Program, (the) – The Watershed Assessment Program, a program within the Office of Water Resources, Division of Environmental Protection.

reference site -a stream reach that represents an area's (watershed or ecoregion) least impacted condition; used for comparison with other sites within that area. Site must meet the agency's minimum degradation criteria.

SCA -Soil Conservation Agency

stakeholder -a person or group with a vested interest in a watershed, e.g., landowner, businessperson, angler.

STORET -STOrage and RETrieval of U.S. waterways parametric data -a system maintained by EPA and used by OWR to store and analyze water quality data.

total maximum daily load (TMDL) -the total amount of a particular pollutant that can enter a water body and not cause a water quality standards violation.

turbidity -the extent to which light passes through water, indicating its clarity; indirect measure of suspended sediment.

understory -the layer of vegetation that forms a forest's middle layer (defined as 0.5 to 5 meters high for this assessment).

USGS -United States Geological Survey.

water-contact recreation -the type of designated use in which a person (e.g., angler, swimmer, or boater) comes in contact with the stream's water.

watershed -a geographic area from which water drains to a particular point.

Watershed Approach Steering Committee -a task force of federal (e.g., U.S. EPA, USGS) and state (e.g., DEP, SCA) officers that recommends streams for intense, detailed study.

Watershed Assessment Program (the Program) -a group of scientists within the OWR charged with evaluating and reporting on the ecological health of West Virginia's watersheds.

watershed association -a group of diverse stakeholders working via a consensus process to improve water quality in their local streams.

Watershed Network -an informal coalition of federal, state, multi-state, and non-governmental groups cooperating to support local watershed associations.

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WV Division of Environmental Protection
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Nitro, WV 25143-2506

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