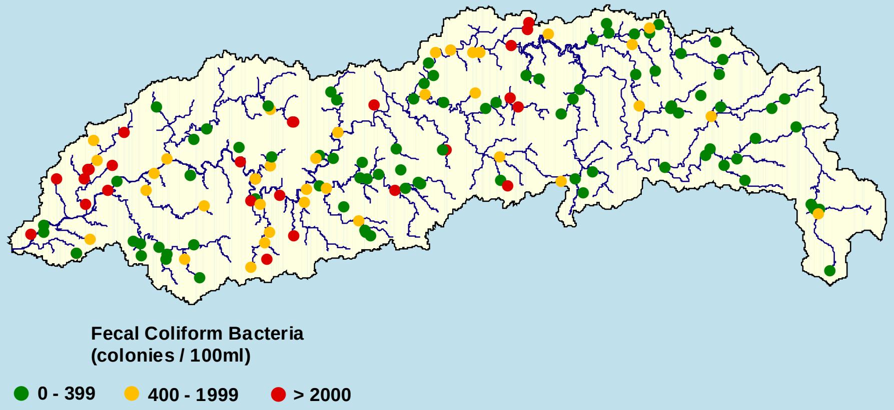
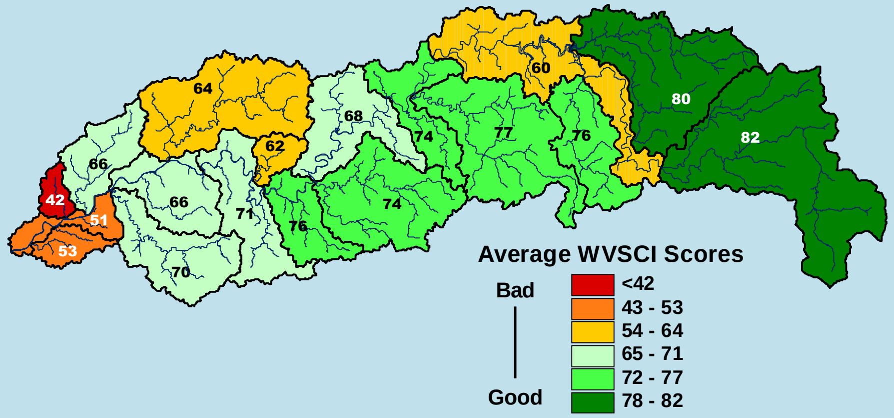
West Virginia
Department of Environmental Protection
Division of Water Resources

This report summarizes the data collected in the Elk River Watershed by the Watershed Assessment Program in 1997. It includes:

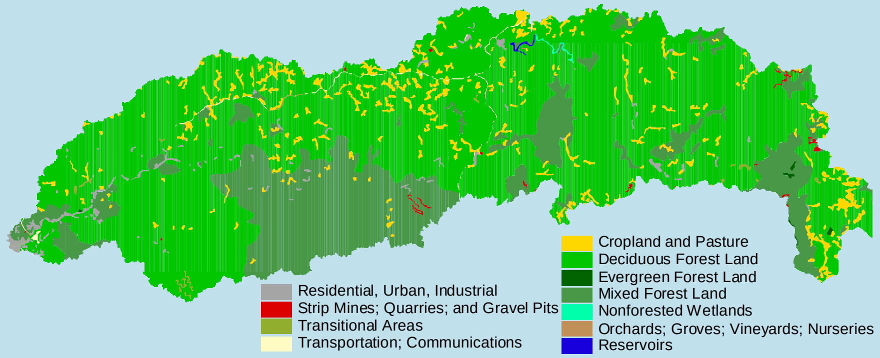
Water Quality Information from 151 sites;



Biological Health Information (Macrobenthic invertebrates) from 135 sites;



And physical habitat and landuse pattern information that help us identify and understand the impairments that are affecting the streams of West Virginia.



Watershed Assessment Program

WV Division of Water Resources

An Ecological Assessment of the Elk River Watershed

DEP **WEST VIRGINIA**
Department of Environmental Protection

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Elk River Watershed

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Report number - 05050007 - 1997

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Summary

Assessment teams visited 165 sites in the Elk River watershed from June 25th to August 7th 1997. Assessments at each site included measurements of physical attributes of the stream and riparian zone, observations of activities and disturbances in the surrounding area, water quality analysis, and a benthic macroinvertebrate collection. One hundred and forty-five of the sites were sampled for macrobenthos. Stream Condition Index scores were determined for these sites by summarizing the results of six benthic community metrics. Of the 145 sites sampled, 26 were impaired, 14 were potentially impaired, 95 were unimpaired, and 10 were collected by uncomparable methods and could not be scored. The potentially impaired sites had WVSCI (West Virginia Stream Condition Index) scores between 60.6 and 68. These scores correspond to the confidence interval below the established threshold of impairment of 68. This threshold was derived from the 5th percentile of scores of a set of minimally disturbed reference sites.

Five streams were listed in the 1998 303(d) list. Morris Creek, Left Fork of Morris Creek, Buffalo Creek and Pheasant Run were listed as being impaired by mine drainage. Fall Run of the Left Fork of Holly River was listed as being impaired by acid rain. The data collected for this assessment support retaining the Left Fork of Morris Creek on the list. The main stem of Morris Creek appears to be impaired only downstream of the Left Fork and this section should remain listed.

The Buffalo Creek drainage has several tributaries that are affected by mine drainage. Hickory Fork, Taylor Creek and Dille Run all had pH and metals violations. These should be considered for addition to the 303(d) list as impaired by mine drainage. Pheasant Run did not have a pH problem at the time of sampling, but the benthic community was impaired. The only sample from the main stem of Buffalo Creek did not reveal any mine drainage problems, however there is currently not enough data to support delisting. Four additional streams had water quality problems and should be considered candidates for future 303(d) lists:

STREAM NAME	ANCODE	IMPAIRMENT	WVSCI
Schoolhouse Fork	KE-14-G-2-A	pH/metals	62.65
Mudlick Branch	KE-14-M-2	pH/metals	57.06
White Oak Fork	KE-14-G-2	pH	59.86
Jacks Run	KE-76-W	metals (Mn)	38.69

Several streams had benthic impairment and should be considered for addition to the list of waterbodies with biological impairment:

STREAM NAME	ANCODE	WVSCI
NEWHOUSE BRANCH	WVKE-3	25.51
GREEN BOTTOM	WVKE-2-E	36.25
OLD WOMAN RUN	WVKE-88	36.89
BIG FORK	WVKE-9-B-1	38.19
KAUFMAN BRANCH	WVKE-7-E	41.87
U.T./GRANNY CREEK	WVKE-87-C	45.59
BEAR RUN	WVKE-84.5	48.57
COONSKIN BRANCH	WVKE-4	50.55
TURKEY RUN	WVKE-59	50.56
SUMMERS FORK	WVKE-37-D	52.91
BIG SANDY CREEK	WVKE-23-{12.6}	55.69
UT OF BROOKS CREEK	WVKE-102-C-1-{0.4}	57.57
GRASSY FORK	WVKE-41-C-1	57.72
CAMP CREEK	WVKE-34	57.79
LEATHERWOOD CREEK	WVKE-21	58.85
LAUREL FORK	WVKE-37-B	59.06
UPPER MILL RUN	WVKE-78	60.40

The upper part of the Elk River watershed has several streams that sustain year-round trout populations. These trout waters include the Elk River and Back Fork above Webster Springs, the Left Fork Holly River, Desert Fork, Fall Run, Laurel Fork, and Sugar Creek – all in Webster County. Sutton Lake and its tailwaters in Braxton County are also considered trout waters.

The Elk River is important also in that it serves as a public water supply for many people. There are at least ten public water operators using the Elk River as their source and one using the Holly River.

The Elk River watershed has many beautiful streams that have no obvious impairments and should be protected to ensure that they remain healthy. The following streams had healthy benthic communities (WVSCI > 75) and optimal stream habitat (RBP total >180):

STREAM NAME	ANCODE	WVSCI	TOTAL
MIDDLE FORK	WVKE-14-O-{5.2}	77.45	186
TWO MILE FORK	WVKE-19-B	81.35	188
ELK RIVER	WVK-43-{156.2}	79.27	189
MCBRIDE HOLLOW	WVKE-14-O-0.5	82.25	188
SYCAMORE RUN	WVKE-50-B-9	76.50	196
PISGAH RUN	WVKE-49	88.39	186
RICH FORK	WVKE-76-N-8	91.28	193
FALL RUN	WVKE-98-B-3-{0.6}	86.87	190
CHUFFY RUN	WVKE-76-S.8	88.50	182
JOHNSON BRANCH	WVKE-76-U-{0.8}	78.58	191
SINNETT BRANCH	WVKE-50-B-1-{2.0}	83.43	196
IKE FORK	WVKE-50-B-10	86.45	206
LILLY FORK	WVKE-50-B-{0.1}	85.36	186
LAUREL CREEK	WVKE-102-{14.6}	90.27	194
WILSON FORK	WVKE-98-C-1-0.5A	77.61	192
LEFT FORK/HOLLY RIVER	WVKE-98-C-{13.8}	86.18	183
ELK RIVER	WVK-43-{87.4}	82.26	195
BEECH FORK	WVKE-50-B-8	80.94	185
RIGHT FORK/LEATHERWOOD	WVKE-117-B	84.49	197
CAMP CREEK	WVKE-102-A	89.32	189
LONG RUN	WVKE-98-C-5	77.58	182

Acknowledgments

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

Jeffrey Bailey, John Wirts, Doug Wood, Perry Casto, Christina Moore, Janice Smithson, Mike Puckett, Alvan Gale, Charles Surbaugh, and Karen Maes 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. Christina Moore, Karen Maes and Charles Surbaugh entered the raw data into the database. John Wirts summarized the data, created the tables and figures and is the primary author of this report. Patrick Campbell and Michael Arcuri provided help in reviewing the various drafts of this report and bringing it to completion. James Hudson and John Wirts applied finishing touches to the report.

Watersheds and their Assessment

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's waters.

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. The Act's National Pollutant Discharge Elimination System (NPDES) has resulted in reductions in 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 many 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. When West Virginia assumed primacy over NPDES permits in 1982, the state's Water Resources Board [renamed the Environmental Quality Board (EQB) in 1994] began developing water quality criteria for each kind of use designated for the state's waters (see box). In addition the WV Department 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

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
- water contact recreation.

Other types of designated uses include:

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

uses, whether or not the uses are specifically designated by the EQB.

After 25 years of significant improvements, many streams were still not supporting their designated uses. Consequently, environmental managers began examining pollutants flushing off the landscape from a broad array of sources. Recognizing the negative impacts of these Non-Point 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.

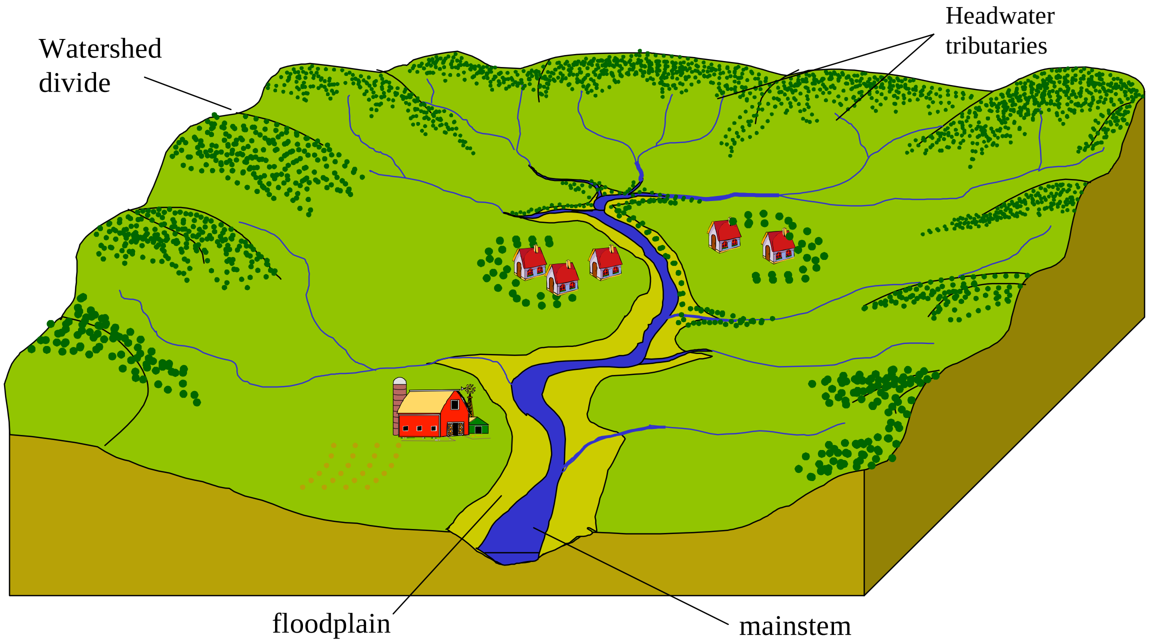
Several DEP units, including the Watershed Assessment Program (the Program) are currently implementing a variety of watershed projects. Located within the OWR, the Program's scientists are charged with evaluating the health of West Virginia's watersheds. The Program is guided, in part, by the Interagency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

The Program uses the U.S. Geological Survey's (USGS) scheme of hydrologic units to divide the state into 32 watersheds. 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) divisions of large watersheds (e.g., Upper and Lower Kanawha River Watersheds).

THE INTERAGENCY WATERSHED MANAGEMENT STEERING COMMITTEE 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.

Figure 1. A Generalized Watershed



In this report, watershed refers to all of the land that drains to a certain point on a river. In the case of the Elk River Watershed, it includes all of the land (about 980,775 acres) that drains to the mouth of the Elk River at Charleston.

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.

General Watershed Assessment Strategy

A watershed can be envisioned as an aquatic tree, a system of upwardly branching, successively smaller streams. An ideal watershed 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 exit point of the watershed. Land uses throughout the watershed would also be quantified. Obviously this approach requires more time and resources than are available. The Program, therefore, assesses the health of a watershed by evaluating the health of as many streams as possible, as close to their mouths as possible. The number of streams sampled in any watershed is dependant on the number of named streams in the watershed. In 1997, the Program started sampling an additional 30 - 35 sites from each watershed that are randomly selected. This strategy is detailed in the section titled "Probabalistic or Random Sampling." The general sampling strategy (non-random) can be broken into several steps:

- The names of streams within the watershed are retrieved from the U. S. EPA's Water Body System database.
- A list of streams is developed that consists of several sub-lists, including:
    1. Severely impaired streams,
    2. Slightly or moderately impaired streams,
    3. Unimpaired streams,
    4. Unassessed streams, and
    5. Streams of particular concern to citizens.
    6. Candidate reference sites
- Assessment teams visit as many streams listed as possible and sample as close to the streams' mouths as allowed by access and sample sitesuitability.
- If inaccessible or unsuitable sites are dropped from the list, they are replaced with previously determined alternate sites.

Longer streams may also be sampled at additional sites further upstream. In general if a stream is: 15 to 30 miles (25 to 50 km) long, two sites are sampled; 30 to 50 miles (50 to 89 km) long, three sites are sampled; 50 to 100 miles (80 to 160 km) long, four sites are sampled; longer than 100 miles (160 km), five sites are sampled.

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

In broad terms, OWR evaluates the streams and the Interagency Watershed Management Steering Committee sets priorities 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 outside teams (e.g., USGS or consultants) intensively study the priority streams.

Phase 5 - The Office of Water Resources issues recommendations for improvement; develops TMDL's (see next 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 wide variety of users, including elected officials, environmental consultants, educators and natural resources managers.

Probabalistic or Random Sampling

Beginning in 1997, the Program has included random sampling as part of the assessment process. The non-random component of the watershed assessments has potential bias because of the way that sites are selected. The non-random sites are generally sampled at locations that are most easily accessed, generally near the mouth of streams and at road crossings. An assessment of just these sites does not provide a valid evaluation of the entire watershed.

The random sites are computer chosen and assessments may occur at any point along the length of the stream. This should allow for statistically valid statements to be made about the conditions of streams within each watershed. This also allows for comparisons between watersheds, which the non-random assessments do not.

U.S. EPA personnel provide locations for about 40 random sites within each watershed. Because there are many more miles of first and second order headwater streams than there are of higher ordered streams, sites are weighted so that an adequate number of larger streams are selected.

Program field crews visit the sites and verify their location with GPS units. If the site meets the criteria of being a wadeable stream with riffle / run habitat, it is assessed according to protocols which are the same as for the non-random sites with some additional water quality parameters.

TOTAL MAXIMUM DAILY LOAD AND THE 303(d) LIST

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 and acid deposition (rain).

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 Elk River Watershed

The Elk River watershed extends from Snowshoe Resort above the town of Linwood (now called Snowshoe by some people) in Pocahontas County west to its confluence with the Kanawha River at Charleston. The elevation in this watershed ranges from over 4300 feet near the headwaters to 566 feet at Charleston. The Elk River itself flows about 186 miles from Slaty Fork and drops about 2070 feet in this distance.

The Elk is formed by the junction of Big Spring Fork and Old Field Fork at the town of SlatyFork. The Elk River originates in the western edge of the limestone deposits in Pocahontas County and flows north to Elk River Springs (sometimes called Cowger Mill or Cougar Mill Springs) where it turns to the west and flows to Charleston.

During the summer, the water of Big Spring Fork flows through and out of the six springs and over 60 caves found in this vicinity. This scenario of surface water flowing underground via a network of limestone solution cavities or faults and then resurging at a down gradient spring is common in the upper Elk River watershed. Black Hole Cave, located some four miles below the junction of Big Spring Fork and Old Field Fork, is an insurgence for My Cave. On dry summer days the entire Elk River can sink into this hole (Dasher).

The underground flow of the Elk River appears in the downstream sections of the Simmons Mingo/My Cave system and resurges at Elk River Springs at the lowermost outcrop of Greenbrier Limestone. Part of this flow is water diverted from Mingo Run in the Tygart Valley River watershed through the Simmons Mingo/My Cave system into the Elk River Springs (Jones). Thus water from Mingo Run can flow into the Tygart Valley River or into the Elk River.

Down river from Elk River Springs, the river predominantly flows through sandstone, shales and siltstones on its way to Charleston except for a small outcrop of Greenbrier Limestone near Webster Springs (Town of Addision). This outcrop is in the middle of the Elk River and is less than one mile long and a few hundred yards wide. No caves have been found in this outcrop, but there is one resurgence, Fork Lick Spring. This spring is reportedly one of the original Webster Springs (Dasher).

According to geologists, the Elk River is older than the Gauley River immediately to the south (Byrne). Near Webster Springs these two rivers are within two miles of each other. Yet the Elk River is about 800 feet lower in elevation than the Gauley River.

The Elk River was renowned for its excellent fishery during the early 1800s. In 1837 the West Virginia Iron Mining and Manufacturing Company reported pike between 4 and 5 feet in length and weighing 30 to 40 pounds. Catfish up to 5 feet in length and weighing 120 pounds were reported in the same document. However, modern records list the largest Northern Pike caught in West Virginia at 22.06 pounds and the largest Flathead catfish at 70 pounds (Stauffer, et. al.). One endangered species, the crystal darter (Crystallaria asperella) is found only in the Elk River between Clendenin and Charleston in West Virginia. This fish is also found in other tributaries of the Mississippi in other states. The U. S. Fish and Wildlife Service collected two specimens in the vicinity of Clendenin during September 1995 (http://www.fws.gov/r9endspp/esb/96/jannews.html).

The Elk River watershed includes coal, oil, gas, timbering and sandstone quarries among its important industries. Agriculture is dominated by livestock and related products. The distribution of landuses within the watershed are shown in Figure 3.

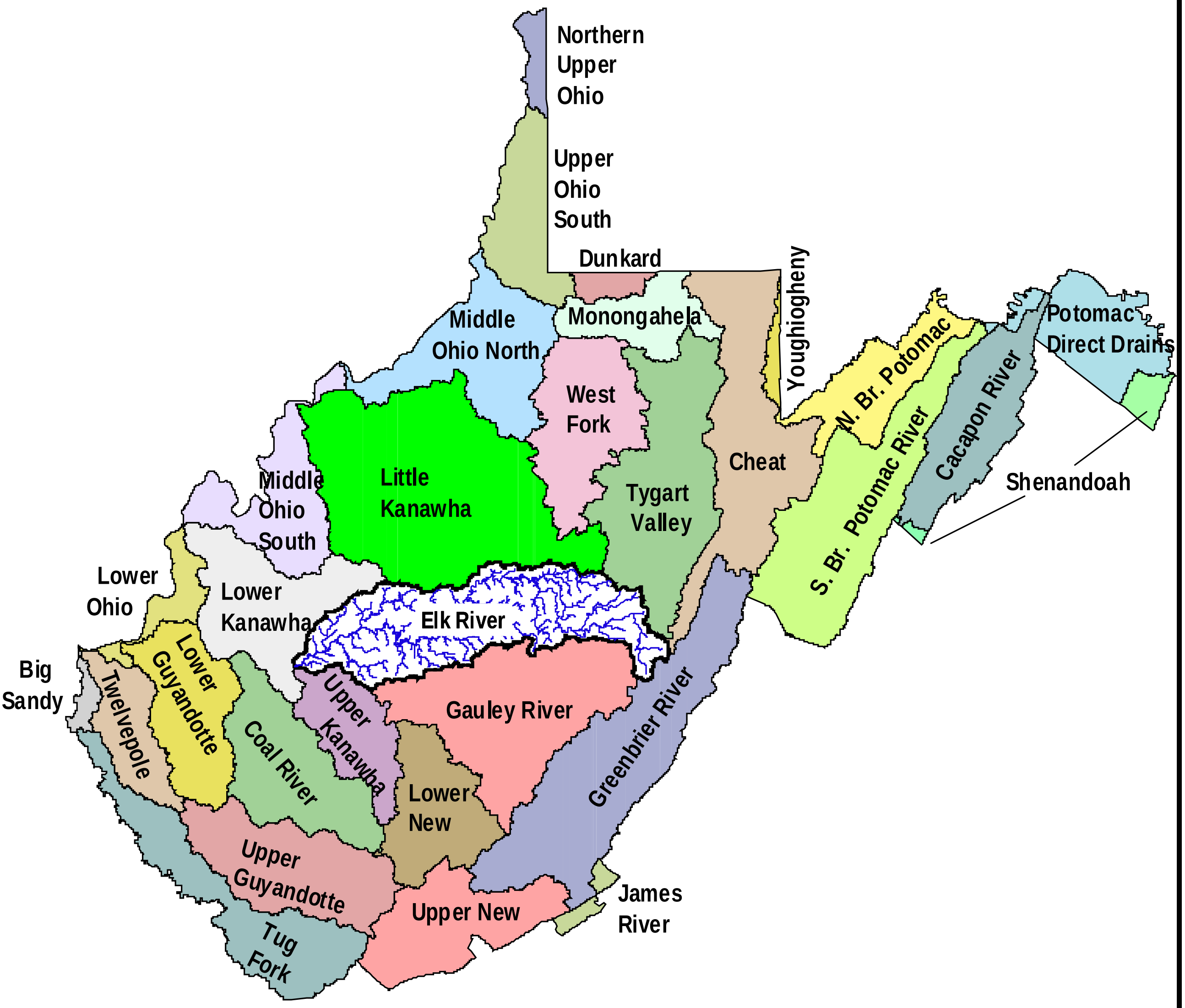
Sutton Lake, an important flood control/recreational impoundment, is located on the Elk River at Sutton in Braxton County. This lake, which drains 537 square miles, was completed in 1961 and has a maximum capacity of 265,300-acre feet.

Coal mining was limited at first, used primarily for local needs. Mining increased as better transportation became available to get the coal to market. While some locks and dams had been constructed to improve navigation on the Coal and Kanawha Rivers to aid in transporting coal, the Elk had to wait until after the Civil War and the construction of railroads. Residents of the area were also aware of the presence of oil and natural gas, but it was not used except incidentally until after the Civil War (Harris).

The timber industry has been important in the Elk River watershed for over 140 years. There were steam powered sawmills in the lower Elk as early as 1860. Figure 3 shows that the watershed is mostly forested. The future health of the watershed depends in large part on the way these forests are managed.

The EPA has developed an ecoregional framework based on geology, physiography, vegetation, climate, soils, landuse, wildlife, and hydrology. This framework provides a useful spatial structure for research and monitoring activities. The Elk River watershed is within two

Figure 2. West Virginia's Watersheds



Level III Ecoregions. The northern half of the lower portion of the watershed (below Sutton Lake) is within the Western Allegheny Plateau Ecoregion (70). The upper portion and southern half of the lower portion are within the Central Appalachian Ecoregion (69). (See Figure 4.)

The Level III ecoregions are further divided into subecoregions or Level IV ecoregions. The Western Allegheny Plateau portion of the Elk Watershed is entirely within the Monongahela Transition Zone subecoregion (70b). The Central Appalachian portion is in two subecoregions: the upper portions of the watershed are in the Forested Hills and Mountains

Figure 3. Landuse in the Elk River Watershed

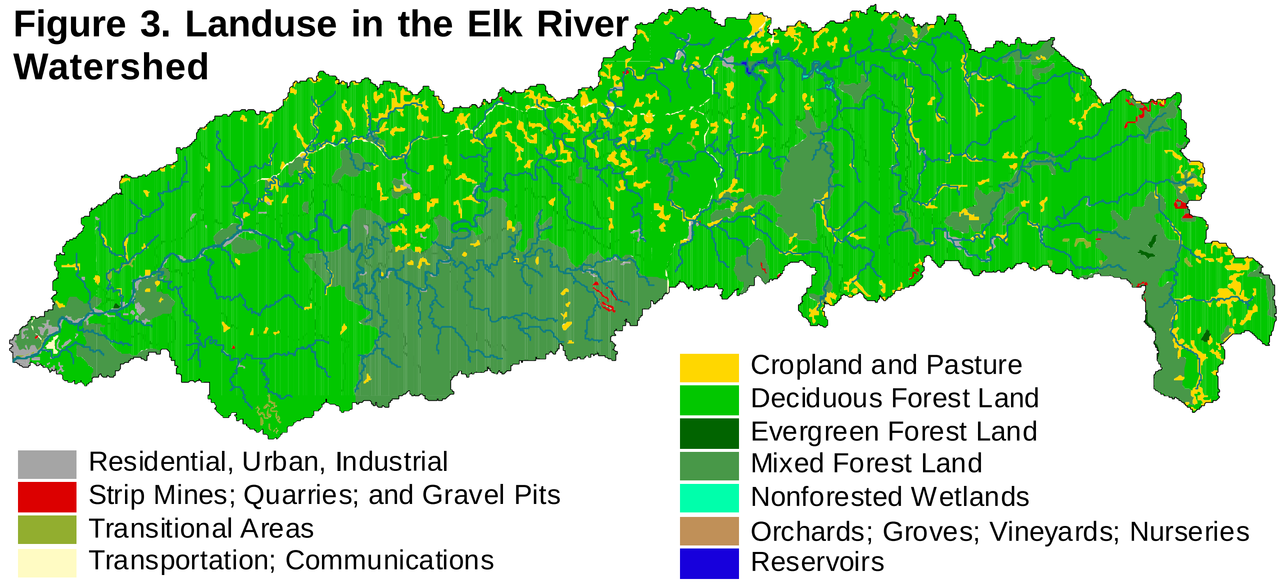
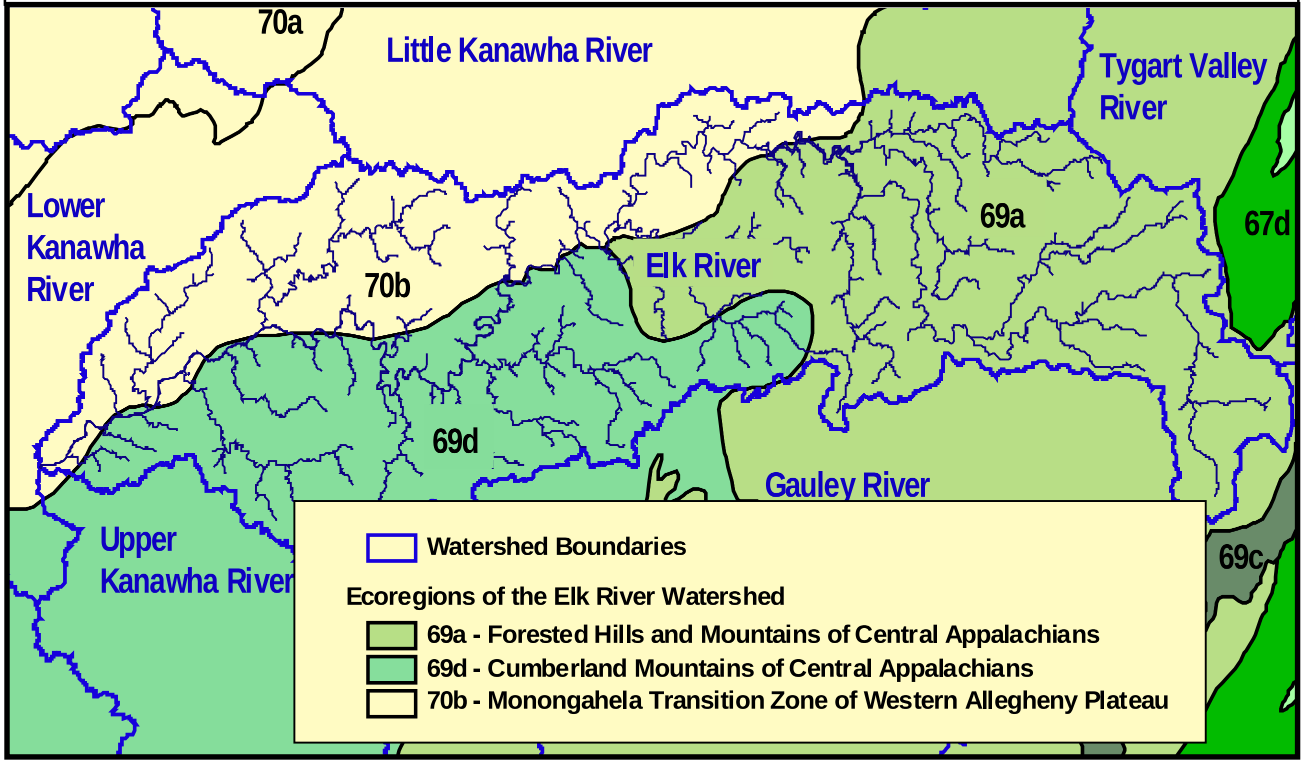


Figure 4. Ecoregions within the Elk River Watershed.



(69a); and the southern part of the lower portion are in the Cumberland Mountains (69d).

The Monongahela Transition Zone, in general, is lower, warmer, less steep, and less densely forested than the Central Appalachians. This region is underlain by less resistant horizontal sedimentary rock. The potential vegetation in this area is mapped as mostly Mixed

Mesophytic Forest. Acid mine drainage, siltation, and industrial pollution have degraded stream habitat in this subecoregion and have affected fish and invertebrates.

The Forested Hills and Mountains subecoregion occupies the highest and most rugged parts of the Ecoregion. It is characterized by dissected hills, mountains and ridges with steep sides and narrow valleys. Erosion resistant sandstone and conglomerate of the Pennsylvanian Pottsville group, sandstone of the Missisippian Pocono Formation and sedimentary rocks of the Mississippian Mauch Chunk Formations are commonly exposed at the surface. Characteristically the streams of this sub-ecoregion do not have much buffering capacity and many reaches, including some not affected by mine drainage, are too acidic to support fish.

The Cumberland Mountain sub-ecoregion has steep slopes and very narrow ridgetops. The boundary between this sub-ecoregion and the Forested Hills and Mountains sub-ecoregion divides different fish assemblages. It generally follows a topographic and elevation break. The Cumberland Mountain sub-ecoregion is slightly lower and more highly dissected than the Forested Hills and Mountains sub-ecoregion.

Watershed Associations

There are at least two local citizen groups that have formed to help improve sections of the Elk River watershed. The Blue Creek Watershed Association was formed in 1999 to discuss concerns with flooding, solid waste, and sludge dumping. This group has organized stream clean ups and established an outdoor classroom at the Community Center. The Webster County Horizon Line Rivers Club was established from a partnership between local paddlers, the local science club, and West Virginia University. This group has done a lot to promote the well being of the upper Elk River and nearby streams.

Watershed Assessment Methods

In 1989, the U.S. EPA published a document entitled Rapid Bioassessment Protocols for Use in Streams and Rivers - Benthic Macroinvertebrates and Fish (Plafkin et al. 1989). This document was intended to provide water quality monitoring programs such as WVDEP-WAP with a practical technical reference for conducting cost-effective biological assessments of flowing waters.

Originally, the Rapid Bioassessment Protocols (RBP) were intended to be inexpensive screening tools to determine if 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 to 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 one 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 to assess the streams in this watershed. A more detailed description of the assessment procedures is in the Watershed Assessment Program's Standard Operating Procedures, available by contacting the Program.

Biological Monitoring — Benthic Macroinvertebrates

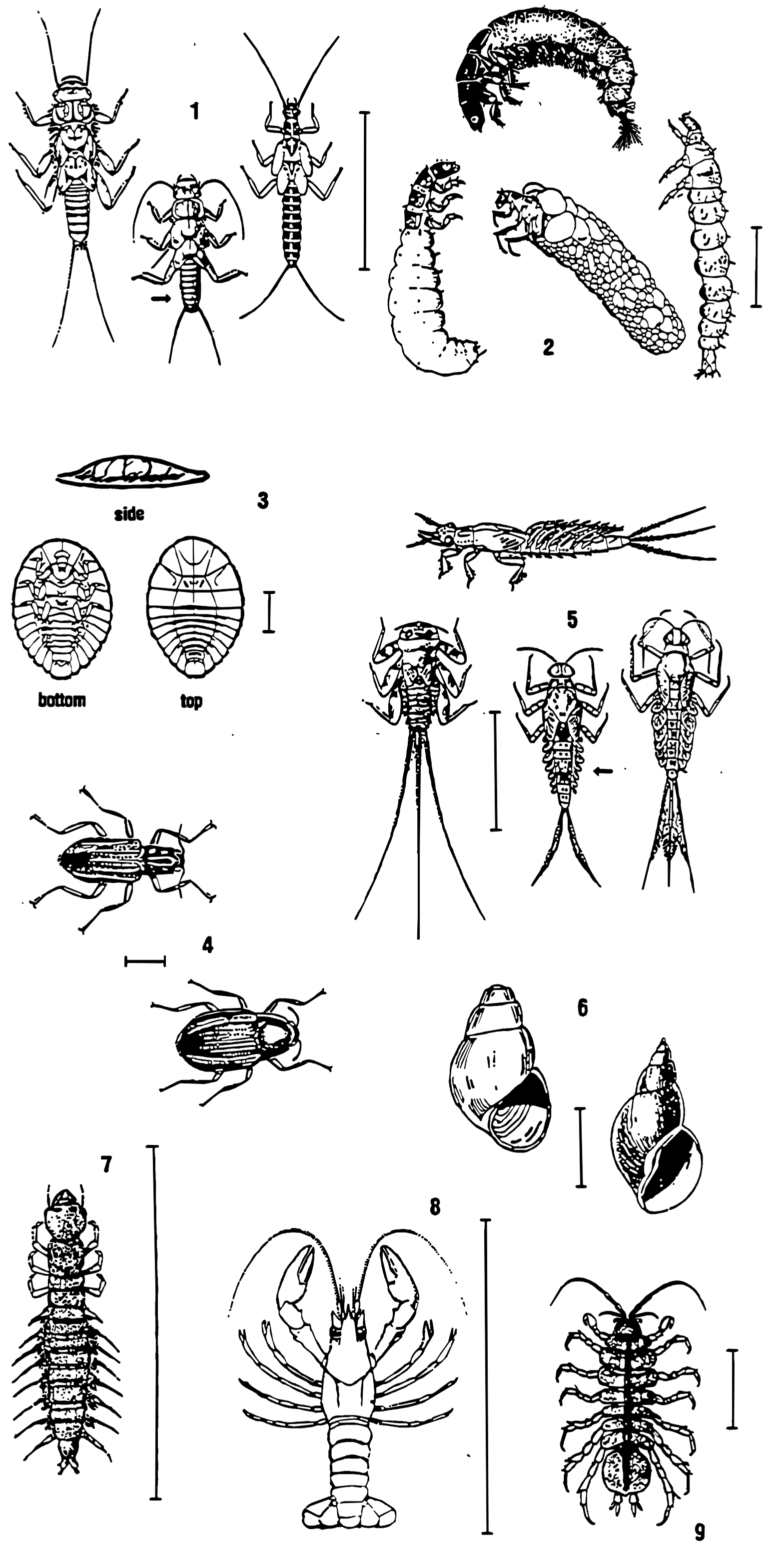
Benthic macroinvertebrates are small animals living on the bottom of streams, rivers, and lakes. Insects comprise the largest diversity of these animals and include mayflies, stoneflies, caddisflies, beetles, midges, crane flies, dragonflies, and others. Snails, mussels, aquatic worms and crayfish are also members of the benthic macroinvertebrate community. Benthic macroinvertebrates are important 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 pollution sensitive species.

Benthic macroinvertebrate data has been used for several decades as a tool for conducting ecological assessments of streams. Many federal, state and private organizations use this group of animals as part of their biological monitoring programs. The advantages are myriad. The most recognized benefit is that benthic macroinvertebrate communities reflect overall ecological integrity (i.e., chemical, physical, and biological integrity). They provide a holistic measure of environmental condition by integrating responses to stresses over time, and the public better understands them (as opposed to chemical conditions) as measures of environmental health (Plafkin et al. 1989).

The West Virginia Save Our Streams Program (WVSOS) is an example of how benthic macroinvertebrates are used to monitor the biological health of streams. This program was established by the Izaak Walton League of America and adapted by the Office of Water Resources. WVSOS utilizes benthic sampling of streams for biological monitoring and instructs the public on collection methods and data interpretation. Figure 5 was adopted from the WVSOS program and provides illustrations of the organisms commonly collected during benthic macroinvertebrate sampling.

Benthic macro-invertebrates can be collected using several techniques. The program used EPA's RBP II with some modifications. The two-man kick net 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 employed the modified kick net (rectangular framed dip net) to capture organisms dislodged by kicking the stream bottom substrate and rubbing large rocks and sticks. In streams too small to accommodate the rectangular framed dip net, a smaller net called a D-frame was used to collect dislodged organisms (See Figure 6). 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 (an area equal to 8 kicks with a rectangular

Figure 5. Benthic Macroinvertebrates (SOS Card - page 1)



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.

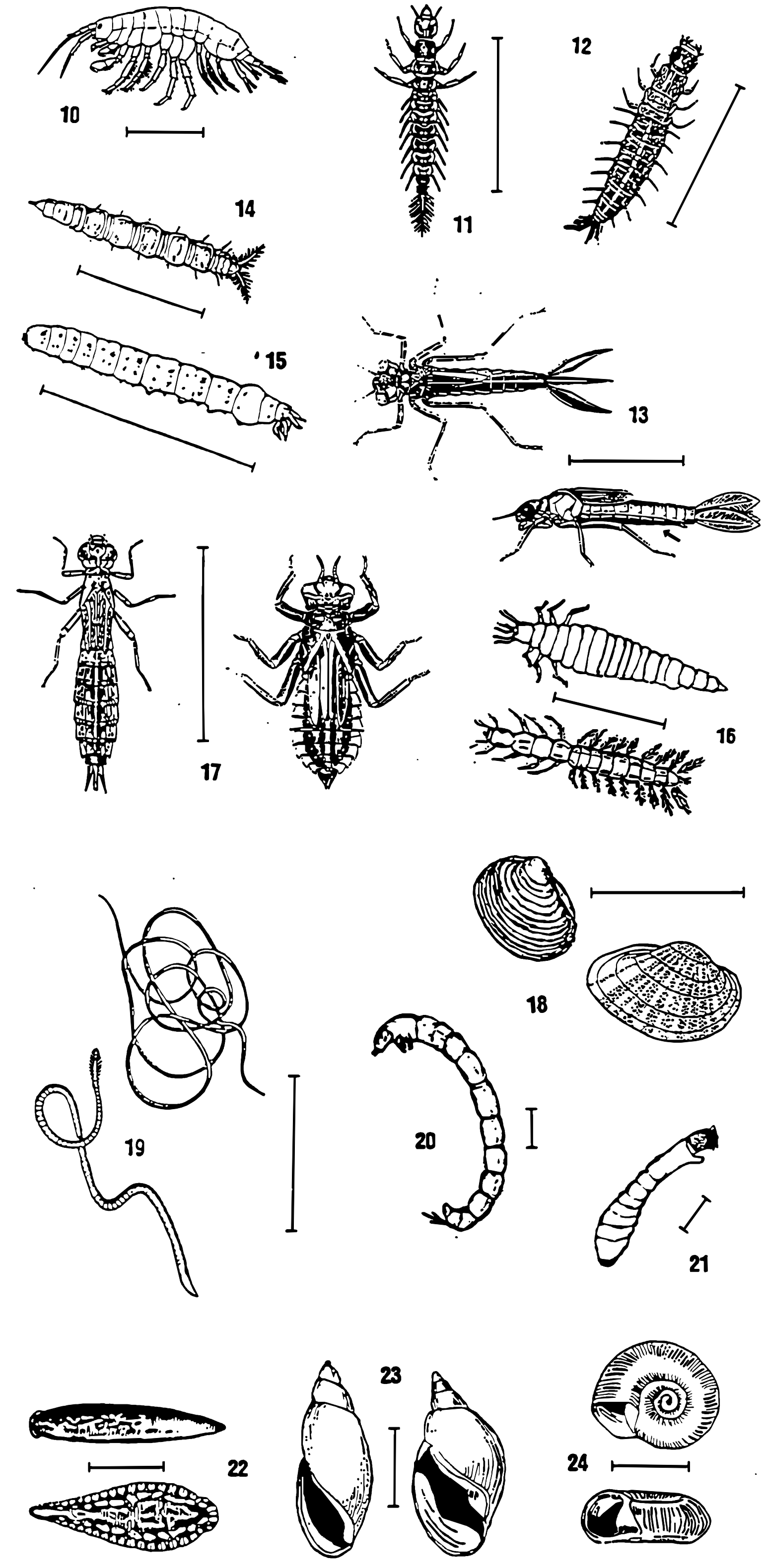
8 *Crayfish: Order Decapoda.* Up to 6", 2 large claws, 8 legs, resembles small lobster.

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

Figure 5. Benthic Macroinvertebrates (SOS Card - page 2)



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.

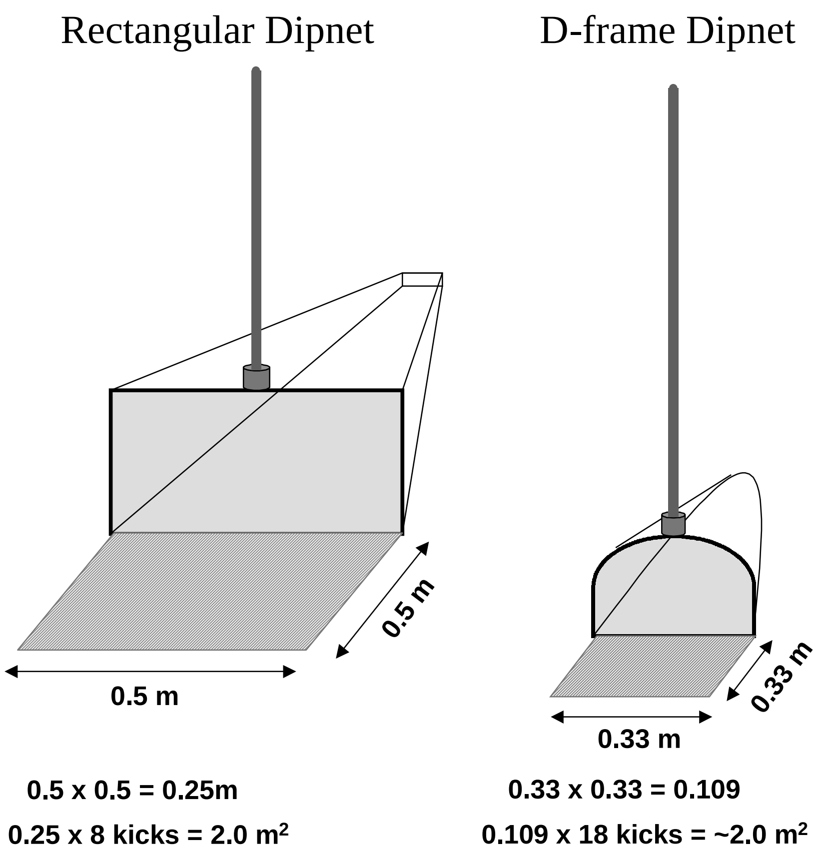
22 *Leech: Order Hirudinea.* 1/4" - 2", brown, slimy body, ends with suction pads.

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.

framed dip net) regardless of the device or technique employed.

Figure 6. Benthic collection Nets



The D-frame net was also used to collect macroinvertebrates in slow flowing (glide/pool dominated) streams that did not have riffle/run habitat. Sampling of macroinvertebrates in glide/pool streams was accomplished using a procedure developed for use in sluggish coastal streams. The sampling procedure is called the Mid-Atlantic Coastal Streams technique (MACS) 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 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 was returned to Program biologists who counted and identified the specimens to the family or the lowest level of classification possible. The samples were kept for future reference and for identification to lower taxonomic levels if necessary.

Fish specimens inadvertently collected during macroinvertebrate sampling were transferred to the DNR Office in Elkins, West Virginia where they became part of the permanent fish collection. Salamanders inadvertently collected were donated to the Marshall University Biological Museum in care of Dr. Tom Pauley.

The Program's primary goal in collecting macroinvertebrate data was to determine the biological condition of the selected stream assessment sites. Determining the biological condition of each site involved calculating and summarizing six-community metrics using the benthic macroinvertebrate data. The following benthic community metrics were used for each assessment site:

Richness Metrics

1. Total taxa - measures the total number of different macroinvertebrate taxa collected in the sample. In general, the total number of taxa increases with improving water quality. It is not uncommon for healthy streams to have 17 or more taxa at the family level of identification.

2. EPT Index - measures the total number of distinct taxa within the generally pollution sensitive groups Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). In general, this index increases with improving water quality. This index is widely used because it is very sensitive to changes in water quality. Healthy streams commonly have 9 to 12 EPT taxa at the family level of identification.

Benthic Community Metrics

Metrics are calculations that numerically describe the benthic community of streams. Some metrics are simple summations such as Taxa Richness; a measure of the total number of different kinds of organisms in a sample.

Other metrics are more complex such as Hilsenhoff's Biotic Index, which incorporates pollution tolerance values of collected organisms to provide a number that assesses organic pollution in streams.

The Program currently uses six metrics to determine the health of benthic macroinvertebrate communities. The use of several metrics provides a greater assurance that a valid assesssment of health has been reached because several components of community structure are measured.

Community Composition Metrics

3. Percent Contribution of 2 Dominant Taxa - measures the relative abundance of the 2 numerically dominant taxa to the total number of organisms in the sample. Generally this index decreases with improving water quality. It is not uncommon for healthy streams to have as few as 40-60% of the total individuals in a sample in the 2 dominant taxa.

4. Percent EPT – measures the relative abundance of mayfly, stonefly, and caddisfly individuals to the total number of organisms in the sample. In general, this index increases with improving water quality. It is common in healthy streams that at least 70 to 90% of the total organisms are in these sensitive orders.

5. Percent Chironomidae – measures the relative abundance of chironomid (midges) individuals to the total number of individuals in the sample. Chironomids are considered to be tolerant to many pollutant sources. This metric generally decreases in value with improving water quality. In healthy streams, it is not uncommon that less than 10% of the organisms in a sample belong to the family Chironomidae.

Tolerance/Intolerance Metric

6. HBI (Hilsenhoff's Biotic Index - modified) - summarizes tolerances of the benthic community to organic pollution. Tolerance values are assigned to each taxon on a scale of 0 to 10, with 0 identifying the organisms that are least tolerant (most sensitive), and 10 identifying the most tolerant (least sensitive) organisms. The HBI metric score can be thought of as an average organic pollution tolerance value for a sample, weighted by the abundance of organisms. As water quality of a stream decreases, the HBI increases. This is especially true where organic enrichment is present. Since many of the organic pollution tolerant organisms are also tolerant to other stressors, the HBI is often used as a general indicator of stress.

These metrics were used because: 1) they provide the best discrimination between impaired and non-impaired or reference sites; 2) they represent different community attributes; and 3) they minimize redundancy.

Stream Condition Index

The six benthic community metrics were combined into a single index, The West Virginia Stream Condition Index (WVSCI). The WVSCI was developed by Tetra Tech Inc. (Gerritsen et al, 2000) using WVDEP-WAP data collected from riffle habitats in wadeable streams. This document is available on WV Division of Environmental Protection's web page at http://www.dep.state.wv.us/wr/OWR_Website/index.htm.

The WVSCI score is determined by averaging the standardized score of each metric. The standardized score for metrics is determined by comparing an individual metric value to the "best standard value". This value is the 95th or 5th percentile (depending on whether the metric scores high or low for healthy streams) of all sites sampled with comparable methods. In general terms, all metrics values were converted to a standard 0 to 100 (worst to best) scale. The six standardized metric scores were then averaged for each benthic sample site to come up with a final index score that ranges from 0 to 100.

In order to interpret the WVSCI score, the Program needed to establish a reference condition. In previous assessments, the Program used either a *single least impaired site* or a *set of sites* based on both stream width and ecoregion as the reference condition. As the Program has progressed, it has become clear that it is difficult to identify a single reference site that has both (1) minimal impairment and (2) the type of biological community that would provide defensible conclusions about the impairment of assessed sites.

As a result, the Program began using a collection of streams that met predetermined minimum impairment criteria to define the reference condition. Reference conditions were established by comparing 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 Program developed the degradation criteria with the assumption that sites meeting these criteria would provide a reasonable approximation of the least disturbed conditions.

Reference Condition

Reference conditions describe the characteristics of waterbody 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, Non-Point Sources (NPS) of pollution, benthic substrate, channel alteration, sediment deposition, streambank vegetation, riparian vegetation, overall habitat condition, human disturbances, point sources of pollution, and land use.

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

Originally, the program was using a set of sites limited to the watershed being studied. Subsequent research showed that a single reference set for wadeable streams is sufficient for statewide assessments (Tetra Tech, 2000). They found that partitioning streams into ecoregions does not significantly improve the accuracy of assessments. The Program currently has 107 reference sites it uses to describe the reference condition. The reference condition is then used to establish a threshold for biological impairment. This reference condition can be used statewide, in all wadeable streams, and throughout the established sampling period of April through October.

The reference sites are used to determine the score that represents the threshold between impaired and non-impaired sites. The25th percentile of the WVSCI scores for all of the reference sites was selected for determining this impairment threshold. The 25th percentile for the 107 reference sites was 68. The 5th percentile of the reference sites was selected as a threshold to indentify the the least impacted streams.

Initially, a site that received a WVSCI score equal to or less than 68 was considered impaired. However because the final WVSCI score can be affected by a number of factors (collector, micro-habitat variables, subsampling, etc.) the Program sampled 26 sites in duplicate to determine the precision of the scoring. Following an analysis of the duplicate data, the Program determined the precision estimate to be 7.4 WVSCI points. The Program then subtracted 7.4 points from the impaired threshold of 68 and generated what is termed the gray zone that ranges from 60.6 to 68.0. If a site had a WVSCI score within the gray zone, a single kick sample was considered insufficient for classifying it as impaired. If a site received a WVSCI score equal to or less than 60.6, the Program was confident that the site was truly biologically impaired based on a single benthic macroinvertebrate sample. Accordingly, sites receiving the lowest WVSCI scores are the most impaired.

The impairment threshold and impairment categories developed within the WVSCI are important tools the Program uses in making important management decisions and steering limited resources to the streams that need them most. For the purposes of this report, the Program considered all impaired sites and sites with WVSCI scores in the gray zone to be in need of further investigation and/or corrective action.

Fecal Coliform Bacteria

Numerous disease-causing organisms may accompany fecal coliform bacteria, which is released to the environment in feces. Thus, the presence of such 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 utilized during this sampling effort. All bacteria samples were packed in wet ice until delivered to the laboratory for analysis.

Physico-Chemical Sampling

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

Field analyses for pH (standard units), temperature (°C), dissolved oxygen (mg/l) and conductivity (µmhos/cm) were performed. 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 many sites for analysis of specific water quality parameters. A list of these parameters, preservation procedures, and analytical methods is included in Table 1.

In areas where mine drainage was present, assessment teams collected water samples for the analyses of aluminum (Al), iron (Fe), and manganese (Mn). In a few cases, samples were analyzed for hot acidity (mg/l), alkalinity (mg/l), and sulfate (mg/l). Water samples were collected in conjunction with the habitat assessment and benthic macroinvertebrate sampling.

Assessment teams measured stream flow in cubic feet per second (cfs) 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 either <u>EPA: Methods for Chemical Analysis of Water and Wastes; March 1983</u> 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 mg/l	200.7	6 months
Aluminum	100 mg/l	200.7	6 months
Manganese	10 mg/l	200.7	6 months
Fecal Coliform Bacteria	Not Applicable	9222 D[1]	24 hours[2]
Conductivity	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 accuracy's 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 completed 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 non-point source pollution, and any anthropogenic activities and disturbances. They also recorded observational data about the stream substrate, water, and riparian zone.

An important part of each 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 information provided insight into what macroinvertebrate taxa may be present or 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.

A Rapid Habitat Assessment data set is a valuable tool because it provides a means of comparing sites to one another. Each parameter was given a score ranging from 0 to 20. Table 2 describes the categories that are used to rate each parameter:

The 12 individual scores for each parameter were summed (maximum possible = 240) and this number provided the final habitat condition score for each assessment site. The habitat condition score and WVSCI score for each site were plotted on an XY graph.

Table 2. Scoring for Rapid Habitat Assessment parameters

Optimal (score 16-20)	Habitat quality meets natural expectations.
Sub-optimal (score 11-15)	Habitat quality is less than desirable but satisfies expectations in most areas.
Marginal (score 6-10)	Habitat quality has a moderate level of degradation; severe degradation at frequent intervals.
Poor (score 0-5)	Habitat is substantially altered; severe degradation

Assessment Results

General Overview

One hundred and sixty six Elk River Watershed sites were visited by field assessment teams between June 25th and August 7th 1997 (Figure 7 and Table 3). Twelve of these sites were not sampled due to lack of permission, lack of physical access to site (4 sites), or because the stream was too dry at the time of the visit. Several other streams had just enough water to allow some water quality parameters to be measured but not enough to collect a comparable benthic sample or habitat data.

Five streams in the Elk River Watershed are included in the 1998 303(d) list of impaired streams. All five of these were sampled in 1997. Fall Run (KE-98-C-14) was listed as being impaired by acid rain. Our data suggests that acid rain is not adversely affecting this stream. The other four streams are listed as being impaired by mine drainage.

The field teams collected benthic macroinvertebrate samples at 145 of the sites. Lack of adequate stream flows prevented assessment teams from using comparable methods at 10 sites. These ten were either sampled using methodology developed for sampling low-gradient coastal streams (MACS) or by simply picking up loose substrate and rinsing them off into a bucket, the “hand-picked” method. While these samples cannot be directly compared to the others, the data does provide useful information about the health of those streams.

TABLE 3: SAMPLING SUMMARY

Named streams	**736**
Sites visited	**166**
Habitat assessed	**145**
Water quality sampled	**151**
Benthic macroinvertebrates collected	**135**

Figure 7. Sample Site Locations

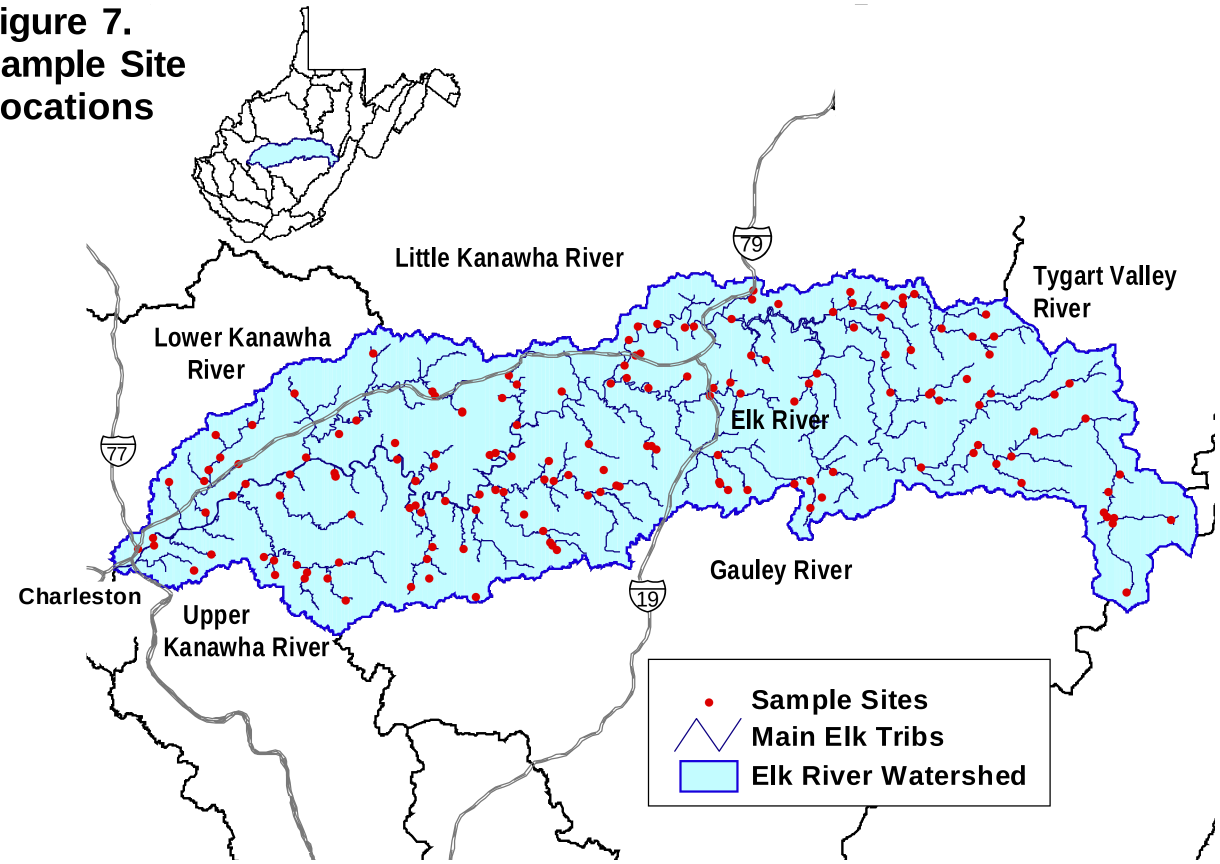
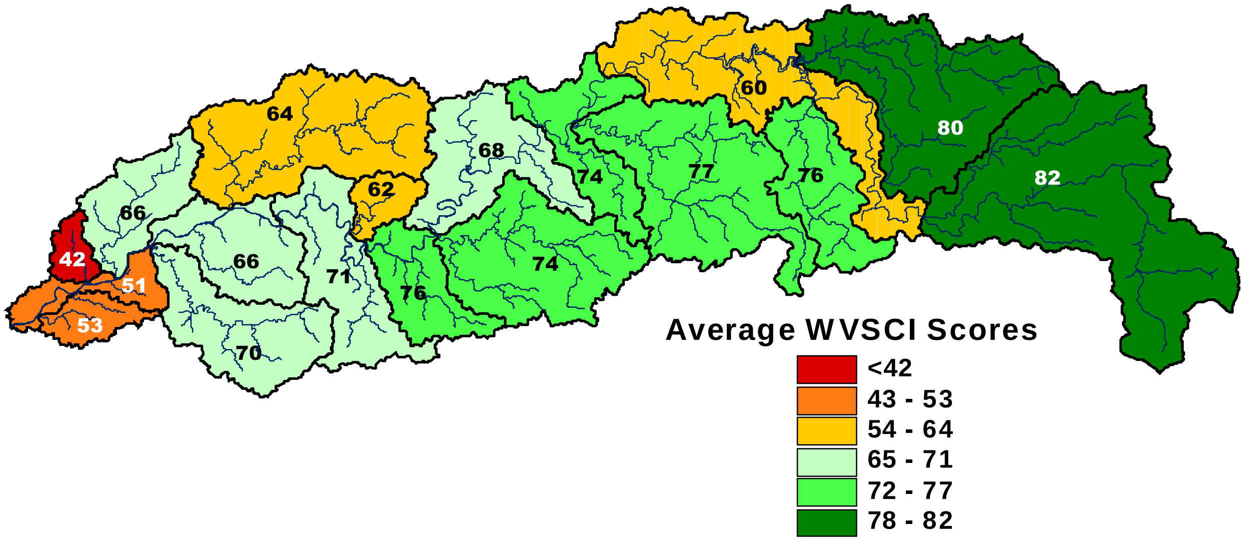


Figure 8. Average WVSCI scores by sub-watershed



Benthic Macroinvertebrates

Of the 135 sites that had comparable benthic samples collected, 25 were impaired with WVSCI scores below 60.6. Table 8 shows the benthic macroinvertebrate community metric scores and the final WVSCI scores for these sites. One site, Newhouse Branch (KE-3), was severely impaired with a score of 25.5. The impaired sites were mostly from tributaries draining from the Western Allegheny Plateau Ecoregion and the area nearest Charleston. There were also five impaired sites in the Buffalo Creek sub-watershed. Figure 8 shows the average WVSCI scores in each of the eighteen subwatersheds of the Elk River. The Upper Elk River and Holly River Subwatersheds had the highest average scores, 82.0 and 79.8 respectively. The Charleston area subwatersheds had the lowest average score of 50.2.

Figure 9 shows the relationship between the WVSCI score and the total score from the RBP Habitat Assessment. In general, as the habitat score increases, the WVSCI score increases as well. Sites that have a good habitat score but score poorly for biology freequently have an observable water quality problem. Sites with poor biology and no obvious problems with habitat or water quality may be affected by episodic events such as a spill or discharge that are not detected at the time of sampling.

There were eighty-one distinct family level taxa identified from the benthic samples. Twenty-one of these taxa were identified from just one location. The most frequently encountered taxa were Chironomidae (middges), Hydropsychidae (caddisfly), Heptageniidae (mayfly), and Baetidae (mayfly). The top thirty-three taxa and their respective frequency of occurrence are shown in Figure 10.

Fecal Coliform Bacteria

Water was collected from 152 sites to measure fecal coliform bacteria concentrations. The majority of streams had levels below 400/100ml (58.3%), which is the state’s water quality standard for contact recreation (can not exceed this level in more than 10 percent of all samples taken during the month). Because our data is from single samples, results which are higher than 400/100ml are not necessarily in violation of the standard. Twenty-three percent of the samples had levels between 400 and 2000, and

Figure 9. Stream Condition Index versus Habitat Condition

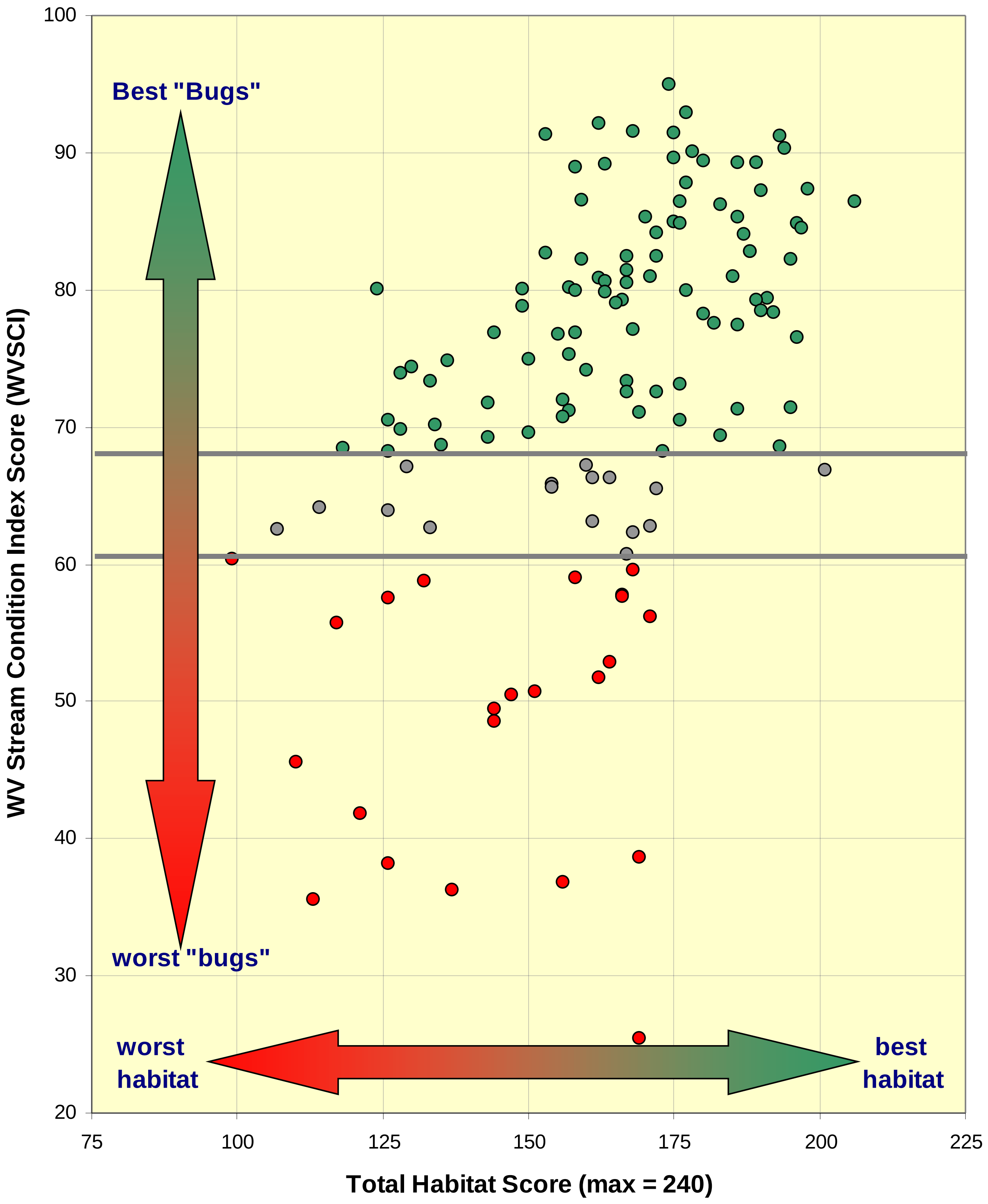


Figure 10. Frequency of Occurrence of Macrobenthic Taxa in 135 Collections. Top 33 of 81 total family level taxa

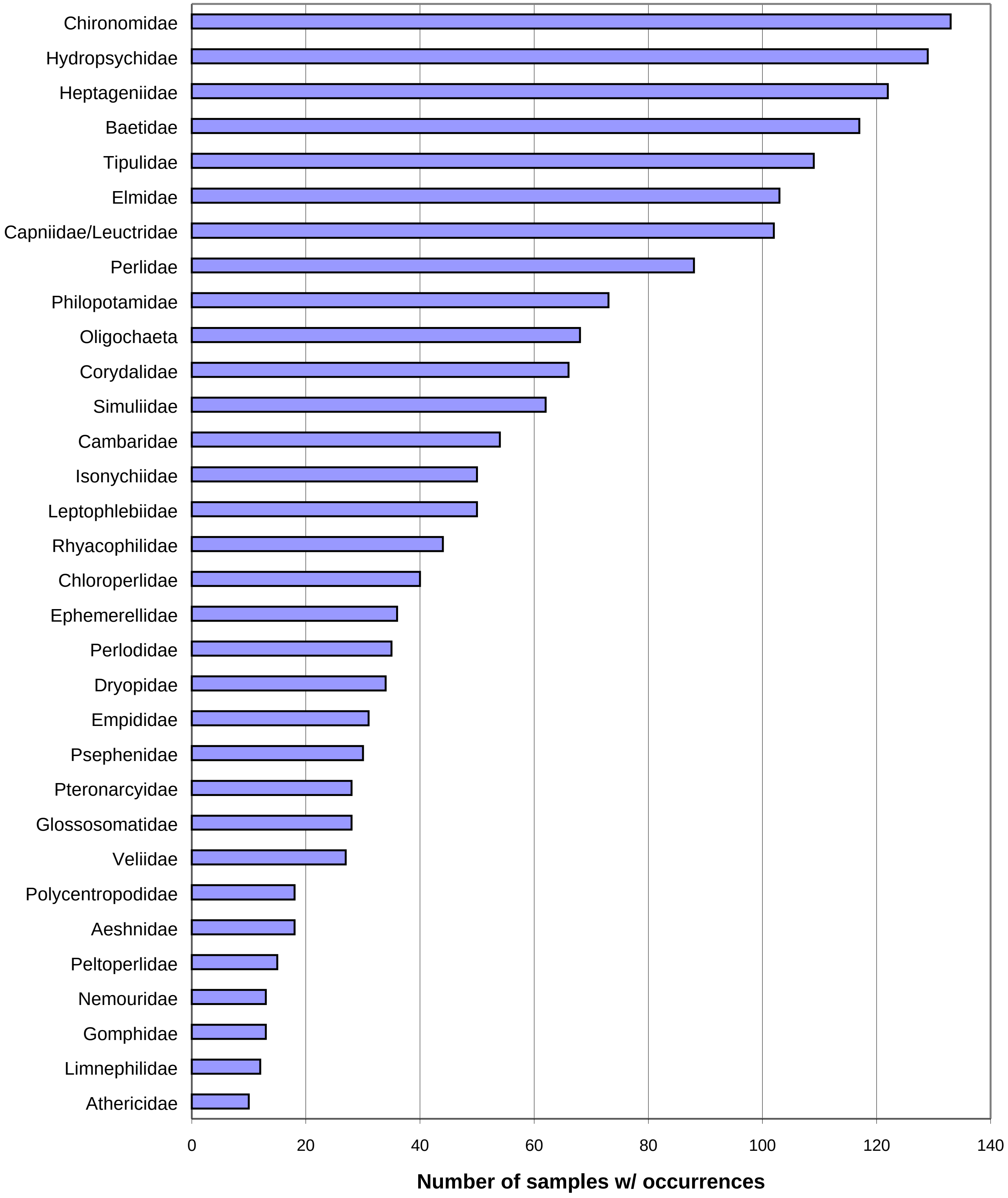
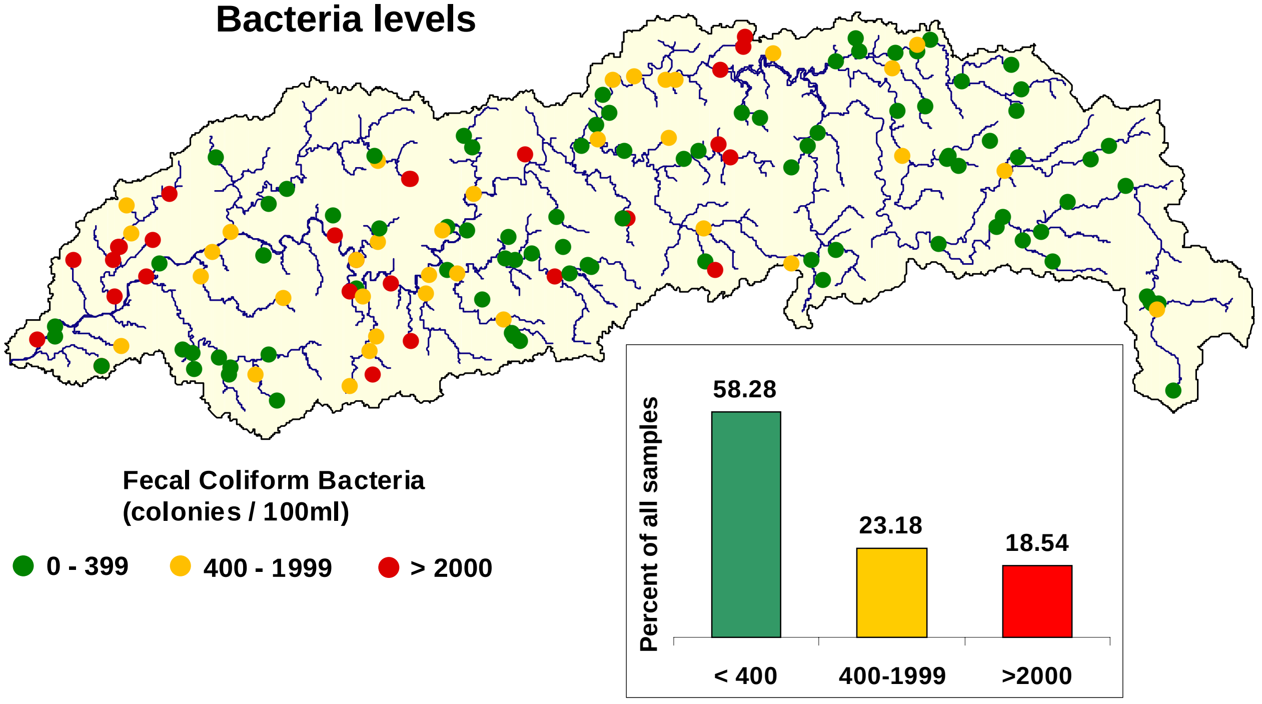


Figure 11. Fecal Coliform Bacteria levels



18.5 percent had levels equal to or higher than 2000. See Figure 11.

The high bacteria levels are, as expected, concentrated around population centers. There are noticeable increases in bacteria levels in the Charleston/Elkview, Clay, and Frametown/Gassaway/Sutton areas. High bacteria levels are nearly absent from the streams above Sutton Lake.

Physico-chemical Water Quality

Temperature, pH, conductivity, and dissolved oxygen were also measured at these 152 sites. This data is summarized in Table 10 in Appendix A. Nine sites had pH violations with readings below 6.0. Six sites had D.O. levels below the warmwater standard of 5.0 mg/l, another two were below 6.0 mg/l. Temperature varied from 14.1 to 30.2 degrees C. Eight sites had conductivities greater than 500 umhos, with most (58 %) below 150 umhos.

In addition to these “field parameters”, field crews collected water for other parameters at 67 sites. Water quality data from these “lab parameters” are presented in Table 11.

Physical Habitat

The habitat in and around the stream was assessed at 145 sites. The physical properties of the stream (width; and riffle, run, and pools depths) were measured and recorded (Table 5). The streams sampled varied in width from 0.5 to 80 meters, with an average width of 5.7 meters and most (over 87 %) had widths of less than ten meters. The depth of the water in the riffle areas varied from one to forty centimeters, with an average of 8 cm.

Field crews looked for and noted the presence of activities and disturbances that could have an affect on the stream water quality. Power lines were observed the most often, followed by residences, lawns, roads, foot trails, and ATV/horse/bike trails. Logging was observed at ten sites. Several streams were physically altered by channelization (14 sites) and by the addition of rip-rap (16 sites). It should be noted that these results are biased towards more development because of the way the Program chooses sample sites, generally at the road crossing nearest the mouth – upstream of the bridge or culvert. This practice puts us in locations where there is often the most development.

The average scores for most RBP Habitat parameters were in the sub-optimal range. One parameter, “riparian vegetation zone width – least buffered side” was in the marginal range. Results of the RBP Habitat Assessment can be found in Table 12. Twenty-nine sites had very good total habitat scores (>180). Nine sites had total habitat scores in the marginal range (below 120), and the rest (107 sites) had totals in the sub-optimal range.

While all of the parameters measure important aspects of stream habitat, some affect the benthic community more than others. Embeddedness is the measurement of the amount of fine materials surrounding (or embedding) the larger substrate types – cobble and boulders. This embedding limits the interstitial space, (areas between and below rocks), which benthic organisms depend on for feeding and shelter. Figure 12 illustrates stream substrate embeddedness.

Another important habitat parameter is the riparian buffer zone width. The condition of the land next to a stream has a direct and important affect on the instream conditions. An intact riparian zone, (i.e.; one with a combination of mature trees, saplings, and ground cover), serves as a buffer to pollutants entering a stream from runoff, controls erosion, and provides habitat and nutrient input into the stream. (Figure 13)

Figure 12. Illustration of embeddedness

The view on the left is heavily embedded with sand and silt. Notice the different amounts of interstitial space (the space between the rocks and gravel).

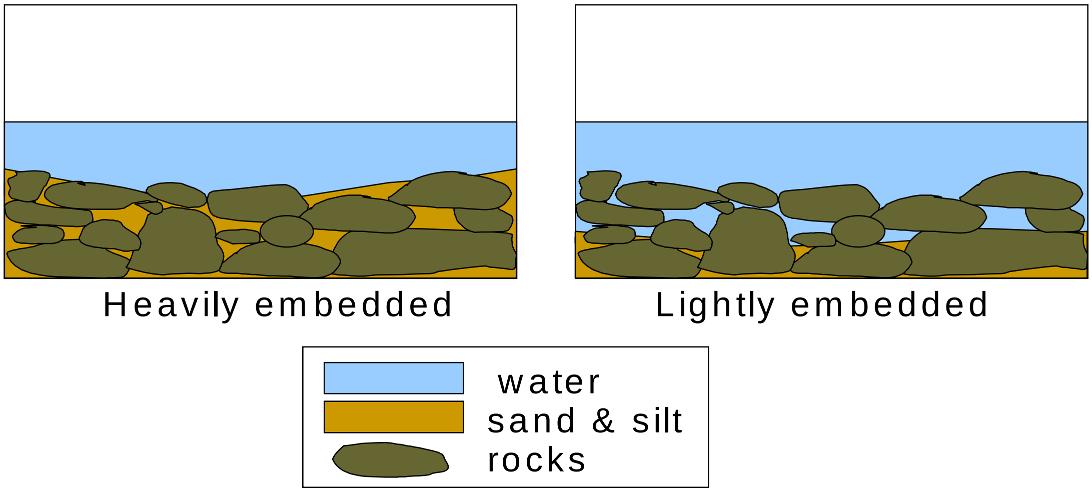
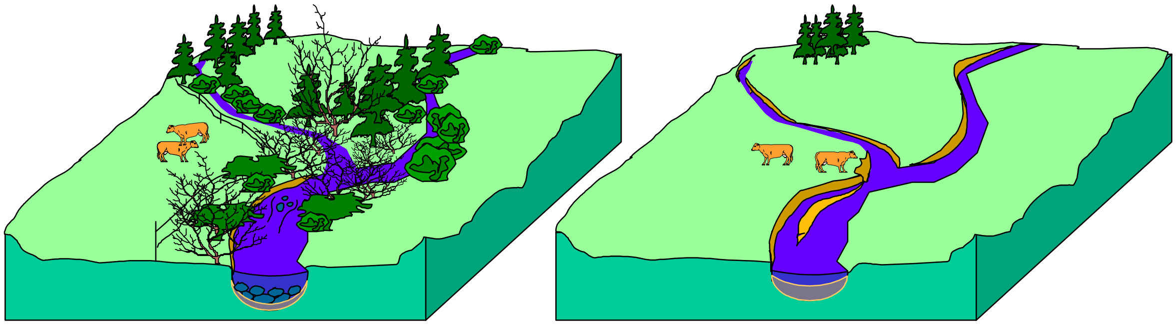


Figure 13. Stream segment with and without riparian buffer zone



Results by sub-watershed

The following discussion will focus on the biologically impaired streams that received WVSCI scores below 60.6 and those that are potentially impaired with scores between 60.6 and 68. An attempt will be made to determine the probable cause or causes of the impairment. Often there is not enough information to make a determination. Streams that are either impaired or potentially impaired should be revisited during the next sampling cycle.

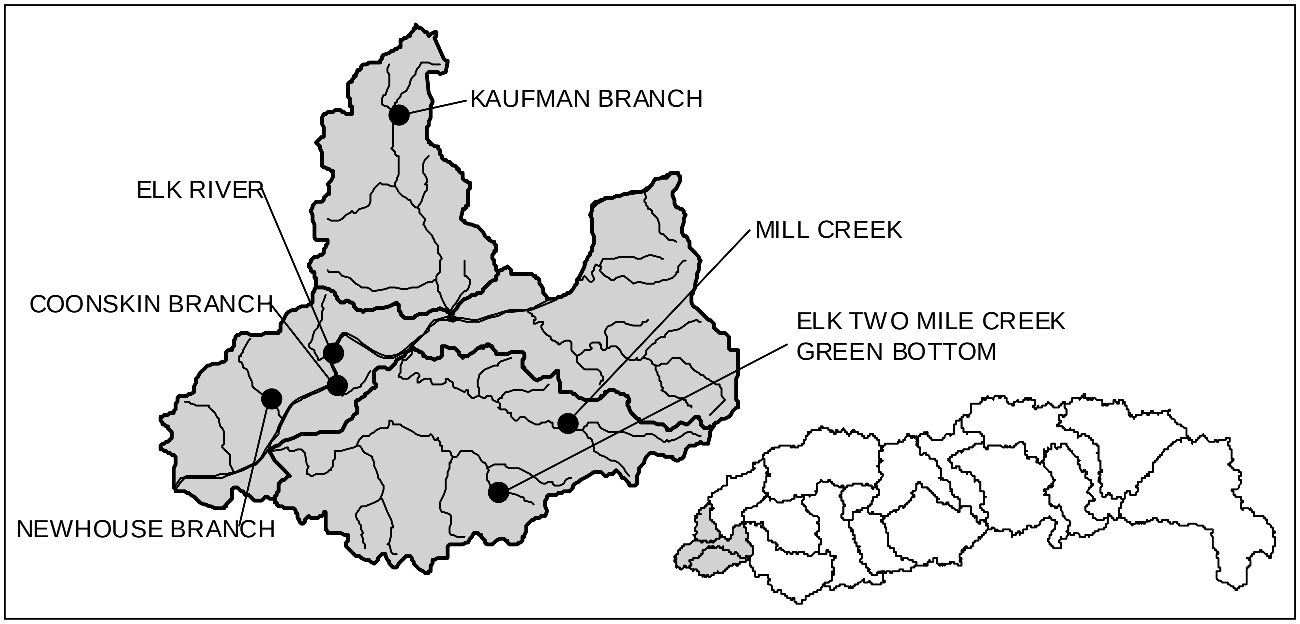
Discussions of streams will be grouped into the sub-watersheds as shown in Figure 8. Some of the smaller watersheds that had few sites (i.e. Cooper Creek, Elk Twomile and Lower Elk) are combined for this discussion.

The maps in the following section show the location of the sample sites within each sub-watershed. The color of the marker indicates the level of biological impairment. Green markers indicate no impairment, red markers are for impaired sites, and gray markers are for those with WVSCI scores between 60.6 and 68 (potentially impaired or in the 'gray zone').

Elk River mainstem sites

The mainstem of the Elk River was sampled at eight sites that ranged in location from 1.2 miles from the mouth to a site in Webster County that was 156.2 miles from the mouth. Four of these sites were sampled for macrobenthics and all scored well, with WVSCI scores of 77 or higher. The lower section of the Elk River is listed on the 303(d) list as being impaired by metals and is scheduled to have a TMDL developed. The fact that our site near the mouth had a healthy macrobenthic community suggests that the high metal values that are routinely found in water samples collected from the lower Elk River are associated with suspended solids, not dissolved in water. A recent study performed by Program staff verified the high correlation between total suspended solids and metals. However, the high WVSCI scores for the lower Elk River mainstem sites may not reflect their true health. The index was developed based on mostly first through third order streams. Large rivers typically offer a wider variety of microhabitats , potentially masking some degradation in water quality.

Charleston area sites



Charleston area sites

ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-6-{5.6}	MILL CREEK	69.56	150	500
WVKE-2-E	GREEN BOTTOM	36.25	137	360
WVKE-2	ELK TWOMILE CREEK	n/a	n/a	5200
WVKE-7-E	KAUFMAN BRANCH	41.87	121	4200
WVK-43-{1.2}	ELK RIVER	77.28	n/a	200
WVKE-4	COONSKIN BRANCH	50.55	147	260
WVKE-3	NEWHOUSE BRANCH	25.51	169	10000

Sites with benthic impairment in gray box

Fecal coliform bacteria violations in BOLD

This group of subwatersheds includes several of the most impaired sites sampled in this assessment. These watersheds include the highly developed area around Charleston. The site with the lowest WVSCI score (25.5) was *Newhouse Branch (KE-3)*. This sample site was on a portion of stream that parallels Interstate 77. The only water quality parameter that might indicate a problem was the fecal coliform bacteria level. At

10,000 col./100ml, this site had the fourth highest level measured in the watershed. Worms and midges, organisms tolerant of organic pollution, comprised 85 % of all macrobenthos identified. The benthic substrate was poor, consisting mostly of sand and gravel, and only 5 % cobble. The conductivity was also fairly high, (431 mmhos).

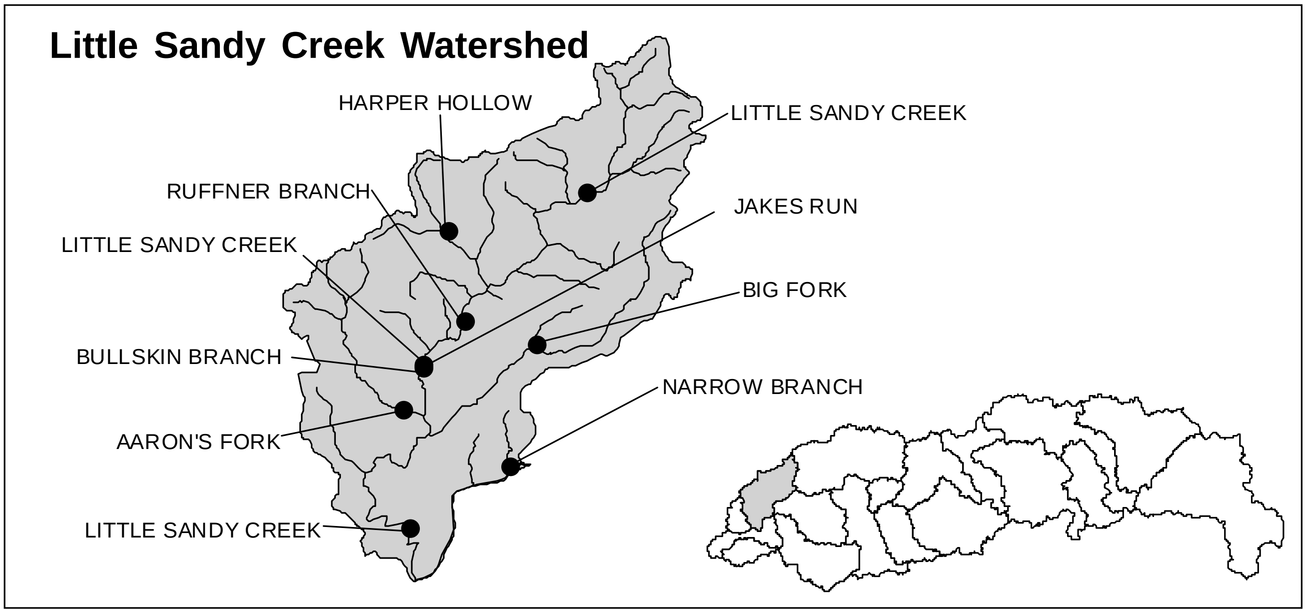
Green Bottom (KE-2-E) also had a low WVSCI score (36.2). The sample was dominated by chironomids (>65%), and had less than 7.5 % EPT's. There are many residences along this hollow and many stream-side disturbances.

Coonskin Branch (KE-4) is another site near Charleston that had a low WVSCI score (50.5). The area draining this stream includes many residences and businesses including the Air National Guard. There have been problems in the past with inadequate sewage treatment in the stream as well. Instream cover and epifaunal substrate were marginal according to the RBP habitat scores (Table 12).

Kaufman Branch (KE-7-E) was the only tributary of Coopers Creek sampled as part of this assessment. Its WVSCI score of 41.9 indicated at least partial impairment. The stretch of stream sampled had a lawn on one side and a single lane asphalt road on the other. The instream habitat was poor. The substrate was embedded (score of 9) and sediment deposition was high (score of 7 – See Table 12). Fecal Coliform Bacteria levels were high (4200 colonies/100ml). It appears that the lack of an adequate riparian buffer zone and incomplete or possibly nonexistent sewage treatment were the main problems at this site.

Little Sandy Creek Watershed sites

The mainstem of Little Sandy Creek was sampled at three locations, one of which was sampled for fecal coliform bacteria only. Both sites with benthic collections indicated potential impairment. The upstream site on *Little Sandy Creek (KE-9-{15.0})* had only three EPT taxa and eight taxa overall. The substrate at this site was favorable for macrobenthos, 60 % cobble. The overall habitat was not very good however. The RBP total score was 133, which is at the low end of sub-optimal. The fecal coliform bacteria levels were somewhat high and could indicate failing septic systems or straight sewage discharges. These "straight pipes" can often introduce toxins other than the sewage itself, such as solvents used to clear clogged pipes.



Little Sandy Watershed sites				
ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-9-B-1	BIG FORK	38.19	126	3000
WVKE-9-C-{0.6}	AARON'S FORK	70.75	156	4800
WVKE-9-E	BULLSKIN BRANCH	74.43	130	160000
WVKE-9-G	RUFFNER BRANCH	65.85	154	1200
WVKE-9-I-1-A	HARPER HOLLOW	80.57	167	900
WVKE-9-J	JAKES RUN	62.56	107	57000
WVKE-9-{1.5}	LITTLE SANDY CREEK	67.25	160	5000
WVKE-9-{15.0}	LITTLE SANDY CREEK	62.70	133	2200
WVKE-9-{8.2}	LITTLE SANDY CREEK	n/a	n/a	13000
WVKE-13	NARROW BRANCH	71.96	156	4200
Sites with potential benthic impairment in light gray box				
Sites with benthic impairment in dark gray box				
Fecal coliform bacteria violations in BOLD				

The downstream site (1.5 miles from the mouth) had six EPT taxa and 12 taxa overall. The substrate was mostly sand at this site, but the overall habitat was better than that of the upstream site (RBP total =160). The sand and silt embedding the substrate were probably the cause of impairment at this site.

The Little Sandy Creek was also sampled 8.2 miles from the mouth at a site that was suspected to have sewage contamination. This site had the highest bacteria level of the mainstem sites (13,000 col/100ml).

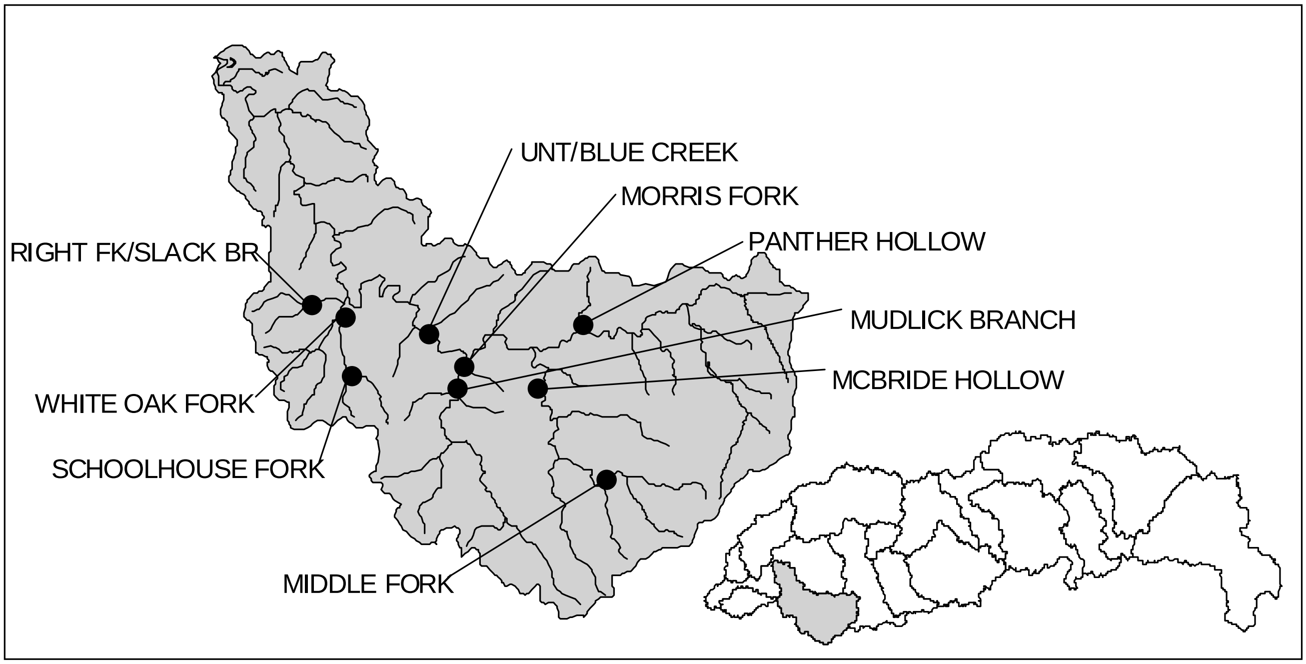
Jakes Run (KE-9-J) had been dredged and channelized shortly before sampling. The stream habitat was 107, which is the fourth worst assessed in the entire watershed. The sediment deposition value was poor, indicating heavy deposits of fine material. This site also had the second highest fecal coliform bacteria level at 57,000 colonies/100ml.

Ruffner Branch (KE-9-G) had nine EPT taxa and 15 overall. The WVSCI score was depressed due mainly to the number of midges present.

In general, the sites with low or intermediate scores have impairment caused by landuse activities in the watershed. There is some level of agriculture or residential activity in most of the valley areas. There is considerable oil and gas activity in the area. The roads associated with these wells can contribute large quaantities of sediment to streams, especially in areas where the soils are prone to erosion and the roads are poorly maintained.

All ten of the sites in this area exceeded the standard for fecal coliform bacteria of 400-colonies/100 ml. The three highest values in the Elk watershed were from the Little Sandy watershed. There are several small landfills in the watershed, but these don’t appear to be the main problem. The highest values are from streams that do not drain any of the landfills. The high values are most likely due to inadequate or non-existent sewage treatment. All nine of the Little Sandy sites had residences or lawns that could potentially affect the stream reach sampled. Bullskin Branch, the site with the highest fecal levels, does have some cattle near the site that could contribute to the high levels.

Blue Creek Watershed



Blue Creek Watershed sites				
ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-14-G-1-{0.8}	RIGHT FK OF SLACK BR	73.37	167	110
WVKE-14-G-2	WHITE OAK FORK	63.18	161	68
WVKE-14-G-2-A	SCHOOLHOUSE FORK	65.58	154	84
WVKE-14-K.1	UNT OF BLUE CREEK	60.74	167	120
WVKE-14-M	MORRIS FORK	65.49	172	160
WVKE-14-M-2	MUDLICK BRANCH	59.62	168	300
WVKE-14-O-{5.2}	MIDDLE FORK	77.45	186	28
WVKE-14-O-0.5	MCBRIDE HOLLOW	82.79	188	700
WVKE-14-P	PANTHER HOLLOW	79.92	177	68
Sites with potential benthic impairment in light gray box				
Sites with benthic impairment in dark gray box				
Reference sites in bold italics				
Fecal coliform bacteria violations in BOLD				

The Blue Creek Watershed was sampled at nine locations. Four were not impaired, four were in the intermediate zone and one was impaired. The watershed has a fair amount of contour mining and several streams are affected by acid mine drainage. Three of the sites had a pH of 4.2 or less (Table 10). The suprisingly high scores of these low pH streams are largely due to the presence of acid-tolerant stoneflies (the Capniidae/ Leuctridae group) which result in high scores for at least three metrics. The percent EPT is generally high, the HBI is high because this group has a low tolerance value of 1 (these values are based on sensitivity to organic pollution not to acidity), and generally percent chironomids is low in these streams as well. This group of stoneflies was the dominant taxon collected in six of the seven sites in the Elk River Watershed that had a pH of 5.0 or less. *Mudlick Branch (KE-14-M-2)* had a WVSCI score of 59.62 and is an example of an acid impaired site that is dominated by Capniidae/Leuctridae (82.4%). The habitat at this site was good and the only disturbance noted was the presence of strip mining further up the hollow. This site had the highest conductivity (Table 10) of any site sampled in the Elk River Watershed.

Four of the five sites that had WVSCI scores in the impaired or potentially impaired range had similar benthic assemblages. Capniid/Leuctrid stoneflies were dominant in all four. The metrics were all similar as well. The score for HBI was over 100 and was high for *% EPT* and *% chironomidae*. The scores were low for the other three metrics. These sites appear to be impaired by mining activity.

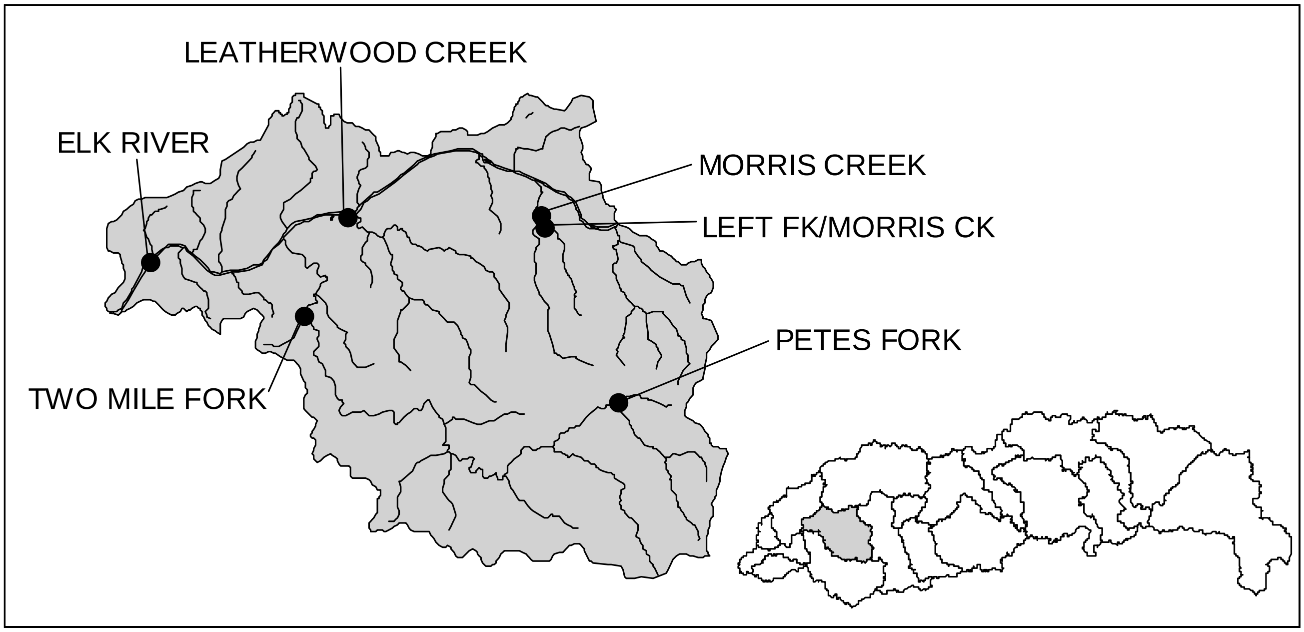
An *unnamed tributary of Blue Creek (KE-14-K.1)* also appears to be impaired by mining. Its benthic sample was not dominated by stoneflies, but the metrics looked similar to those of the four sites discussed above.

Falling Rock Creek and other streams near Clendenin

This area includes Falling Rock Creek, Leatherwood Creek, Morris Creek, and several smaller Elk River tributaries. Six sites were visited and four sites were sampled for macrobenthos in this area. Two were impaired and two were not impaired. The Elk River was visited and water quality data collected. The Left Fork of Morris Creek was visited on two occasions to obtain a complete sample

Leatherwood Creek (KE-21) empties into the Elk River just downstream of Clendenin. This site had a WVSCI score of 58.9. Blackfly larvae and midges dominated the benthic

Falling Rock Creek and other sites near Clendenin



Falling Rock Creek and other sites near Clendenin				
ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-19-B	TWO MILE FORK	82.87	188	560
WVKE-19-H	PETES FORK	71.07	169	1000
WVK-43-{16.0}	ELK RIVER	n/a	n/a	200
WVKE-21	LEATHERWOOD CREEK	58.85	132	1600
WVKE-26-A-{0.16}	LEFT FK OF MORRIS CK	50.04	178	2
WVKE-26	MORRIS CREEK	n/a	n/a	n/a
Sites with benthic impairment in dark gray box				
Fecal coliform bacteria violations in BOLD				

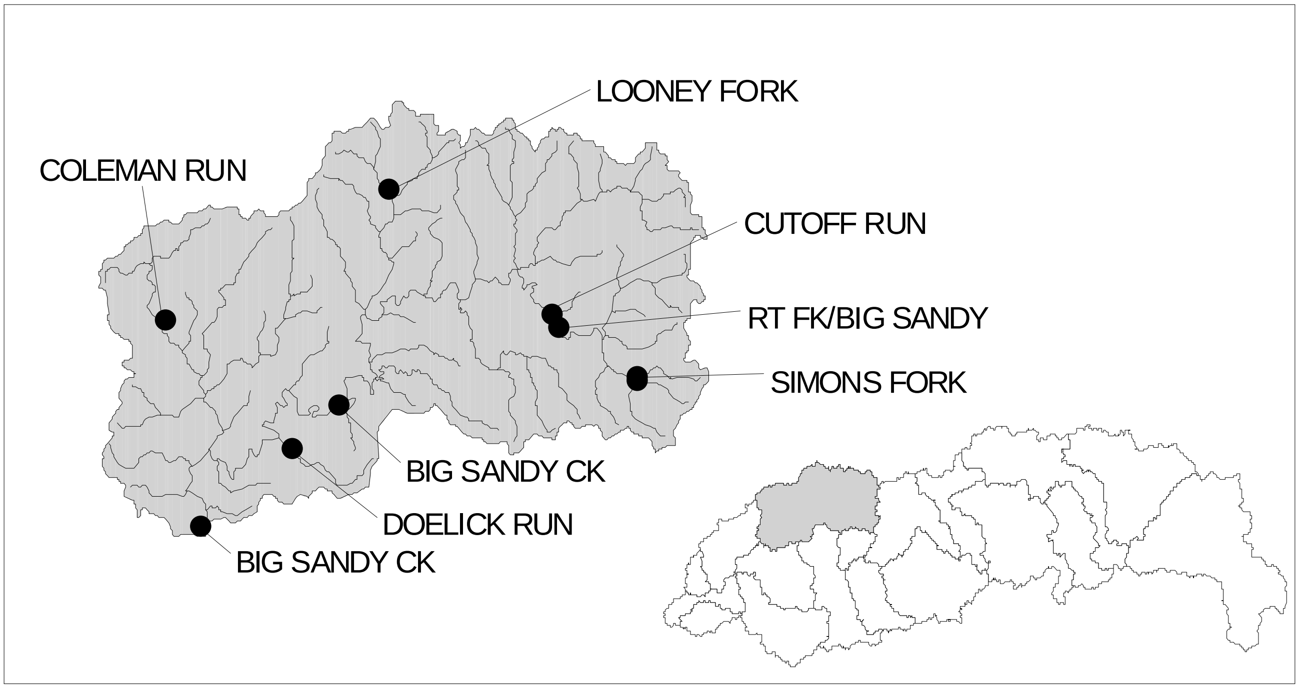
sampled. The dominance of a benthic community by these taxa indicates the probability of organic enrichment. The fecal coliform bacteria level was moderately high at 1600 colonies/100ml. No residences were noted near the stream reach, but there are several homes upstream from the sample point. Mining does not appear to be a problem as there were four mayfly taxa collected (which are generally sensitive to mining activity).

Morris Creek (KE-26) is affected by acid mine drainage coming from the Left Fork of

Morris Creek. Morris Creek above this tributary does not appear to have AMD problems. The sampling crew took water samples from above and below the confluence of the Left Fork and determined that the AMD is only affecting the receiving stream downstream of this tributary. The pH just above Left Fork was 6.88 and just below the confluence it was 4.35. The site on *Left Fork (KE-26-A-{0.16})* had pHs of 3.53 and 3.42 on different sampling days. The field crew found caddisflies and mayflies on Morris Creek upstream of left Fork and only one stonefly downstream in an incomplete check of the benthic life. The WVSCI score for the Left Fork was 50.0, not too bad considering there were only 13 organisms in 5 taxa collected. This stream is considered severely impaired. This site is another example of an AMD stream scoring higher than expected due to the presence of acid tolerant stoneflies (Capniidae/Leuctridae). Left Fork had the highest levels of acidity, aluminum, iron, and manganese (see Table 11) of any site sampled in the Elk River watershed.

Both Morris Creek and the Left Fork are listed in the 1998 303(d) list of streams impaired by mine drainage. The listing of Left Fork appears warranted. Based on the information collected during this study, Morris Creek is only impaired downstream of Left Fork.

Big Sandy Creek Watershed



Big Sandy watershed sites

ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-23-F-1	DOELICK RUN	73.32*	133	320
WVKE-23-P-3-B	SIMONS FORK	68.43	118	5800
WVKE-23-P-3-A	HORSE RUN	78.83	149	3000
WVKE-23-P-1	CUTOFF RUN	54.17*	162	220
WVKE-23-P-{3.0}	RIGHT FK OF BIG SANDY	46.32*	150	1200
WVKE-23-D-6	COLEMAN RUN	64.11	114	240
WVKE-23-{0.43}	BIG SANDY CREEK	71.22	157	1800
WVKE-23-{12.6}	BIG SANDY CREEK	55.69	117	28

* Non-comparable benthic collection

Sites with potential benthic impairment in light gray box

Sites with benthic impairment in dark gray box

Fecal coliform bacteria violations in BOLD

The Big Sandy Creek Watershed was sampled at eight locations. The average WVSCI score for these eight was 63.95 (Figure 8), with four of eight sites receiving scores indicating either impairment or potential impairment. However, the two lowest scoring sites were sampled with incomparable methodology. The site on *Right Fork (KE-23-P-{3.0})* had no riffle/run habitat to sample, so the crew used the MACS method, which was developed for slow moving coastal streams. The fact that there was no riffle/run habitat could be due to the stream being severely impaired by sediment or it could be the natural condition of a sluggish low-gradient stream.

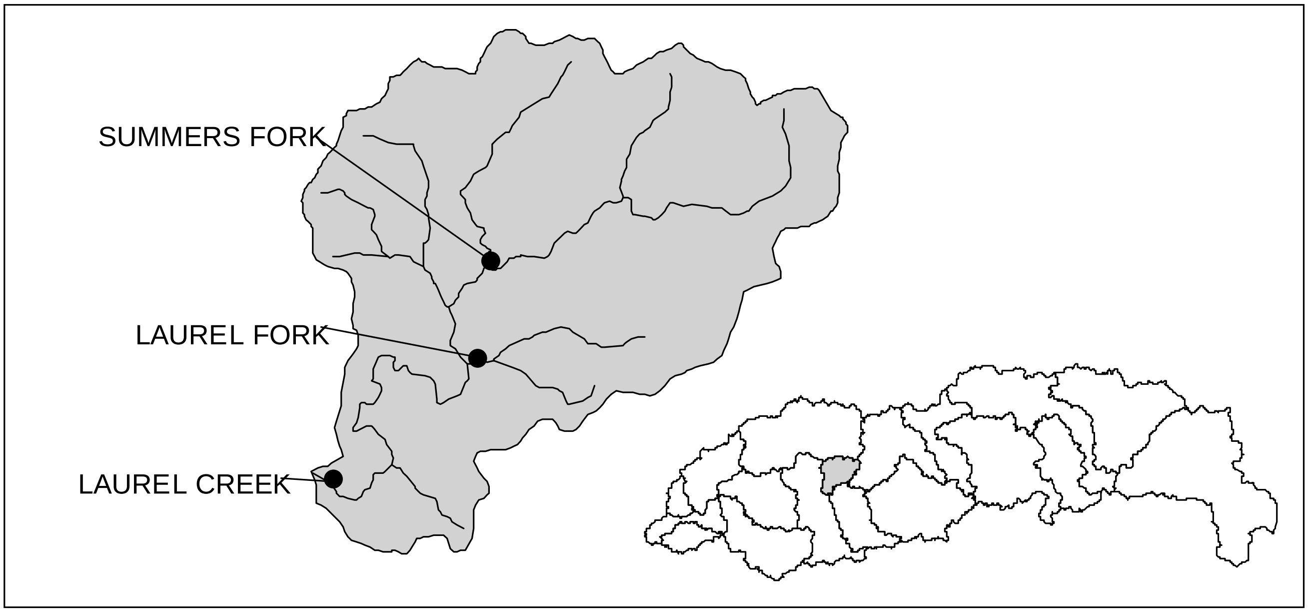
Cutoff Run (KE-23-P-1) was sampled by handpicking rocks and washing organisms into a bucket. While both of these methods provide useful information, the results should not be compared to the others directly. Cutoff Run had only five taxa collected, but the most common were Heptageniid mayflies and Psephenid beetles, which are moderately sensitive. Another site, *Doelick Run (KE-23-F-1)* did not have enough flow to use mormal methodology. The crew used a combination of handpicking and using the d-net when possible. The WVSCI score was fairly high considering the lack of flow (73.2) and the stream does not appear to be impaired.

One of the sites on the mainstem *Big Sandy (KE-23-{12.6})* received a WVSCI score of 55.69. This site had no obvious local disturbances. The instream habitat was marginal, the majority of the riffle areas consisting of gravel. The RBP habitat scores for epifaunal substrate and sediment deposition were also marginal. There is a considerable amount of agriculture in the relatively wide valleys upstream of this site. Despite this possible source of eutrofication, the density of organisms was low at this sight. The entire sample was identified (not subsampled) and had only 79 organisms. Forty-seven of these were either black fly larvae or midges. Because the substrate was mostly gravel, it is susceptible to frequent disturbance caused by rapid runoff from open areas associated with agricultural and interstate I-79, and is probably the primary reason for the impaired benthic community.

The site on *Big Sandy (KE-23-{0.4})* nearest the mouth had a better benthic community. Each metric scored slightly higher resulting in a WVSCI score of 71.2. The sample was dominated by caddisflies instead of midges and black flies. The substrate may be the largest factor here, this site having cobble as the dominant class size.

One small tributary of Left Hand Fork was sampled. The benthic sample from *Coleman Run (KE-23-D-6)* had only 4 EPT taxa and 8 total taxa. The majority of the watershed is forested with only the lower third disturbed by residences. The narrow channel and low flow made the collection of the benthic sample difficult. The riparian habitat was very poor, offering almost no buffer from the roads, lawns, and residences.

Laurel Creek Watershed



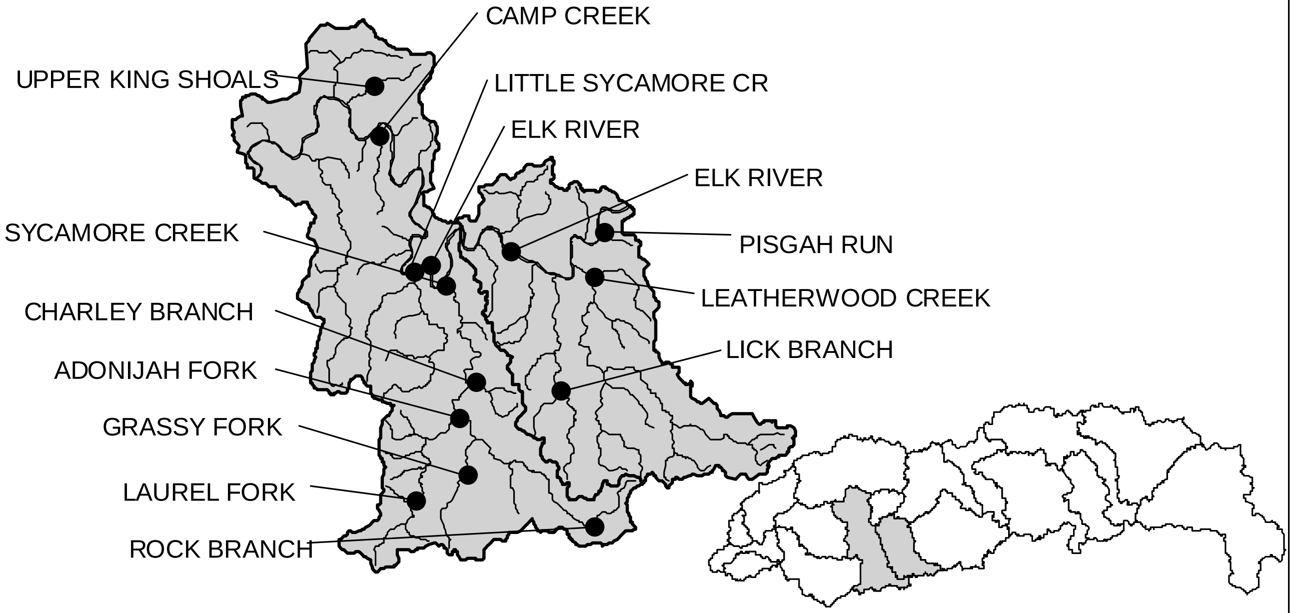
Laurel Creek (of Clay Co.) watershed sites				
ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-37	LAUREL CREEK	66.32	161	4000
WVKE-37	LAUREL CREEK	68.63	193	900
WVKE-37-B	LAUREL FORK	59.06	158	1000
WVKE-37-D	SUMMERS FORK	52.91	164	76
Sites with potential benthic impairment in light gray box				
Sites with benthic impairment in dark gray box				
Fecal coliform bacteria violations in BOLD				

There were four assessments made in the Laurel Creek (Clay Co.) watershed. Different crews sampled the mainstem twice in approximately the same location. The benthic collections resulted in WVSCI scores of 66.3 and 68.6. These scores are near the impairment threshold. Possible stressors are runoff from residential and agricultural areas (almost nine percent of the watershed) and the many oil and gas wells.

The site on *Summers Fork (KE-37-D)* had a WVSCI of 52.9. There is a high density of oil and gas wells and associated roads in this watershed. The chloride level was a relatively high 120 mg/l; the conductivity was also much higher than the surrounding sites. Hydropsychid caddisflies and midges were the dominant organisms collected and stoneflies were absent. The field crew noted “good benthic substrate” and the total habitat score was sub-optimal.

The site on *Laurel Fork (KE-37-B)* had a WVSCI score of 59.1. There are fewer oil and gas wells in this part of the watershed. Agriculture is more common in this area, almost 13 percent of the land area. The benthic community was similar to the site on Summers Fork, hydropsychid caddisflies and midges were dominant, and there were very few stoneflies present. Habitat does not appear to have been impaired (RBP total of 158).

Lower Mid Elk River Sites



Lower Mid Elk River sites				
ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-32-{1.0}	UPPER KING SHOALS RUN	69.18*	127	200
WVKE-34	CAMP CREEK	57.79	166	2200
WVKE-40	LITTLE SYCAMORE CREEK	70.49	176	3000
WVK-43-{46.6}	ELK RIVER	n/a	n/a	280
WVKE-41	SYCAMORE CREEK	77.14	168	480
WVKE-41-A	CHARLEY BRANCH	90.11	178	1600
WVKE-41-B-{0.2}	ADONIJAH FORK	73.18	176	1600
WVKE-41-B-1.5	LAUREL FORK	72.52	172	700
WVKE-41-C-1	GRASSY FORK	57.72	166	5200
WVK-43-{49.8}	ELK RIVER	n/a	n/a	2800
WVKE-45-B	LICK BRANCH	69.38	183	4400
WVKE-46-{1.2}	LEATHERWOOD CREEK	71.48	195	700
WVKE-49	PISGAH RUN	89.29	186	1500
* Non-comparable benthic collection				
Sites with benthic impairment in gray box				
Fecal coliform bacteria violations in BOLD				

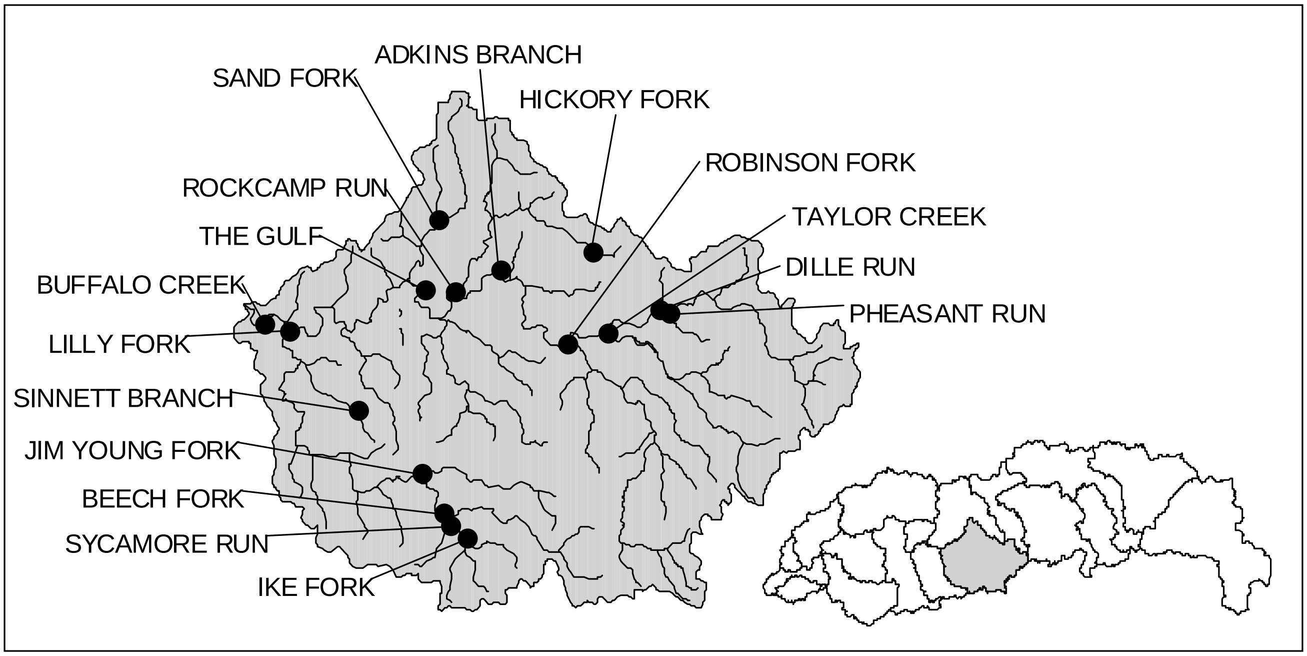
There were thirteen sample sites in the two subwatersheds that make up the Lower Mid Elk River Sites section , eleven of these were sampled for macrobenthos. Two of them were impaired, the other nine were unimpaired.

Upper Kings Shoals Run (KE-32-{1.0}) was a small stream and had almost no surface flow. The benthic sample was collected by the "hand picking" method. The field crew collected very few individuals, but these included several sensitive taxa. This site does not appear to be impaired

Camp Creek (KE-34) had a WVSCI score of 57.8. There were seven taxa, three EPT and no stoneflies in the collection. The stream habitat and limited water quality did not reveal any major problems. The fecal coliform bacteria level was high, 2200 colonies/ 100ml. Sewage treatment may be insufficient in this narrow hollow. Gray water discharges are often found in these small narrow valley communities because the extra water would overburden septic systems that, because of the lack of available space, are too small. There are many household cleaning and disinfectant products that could be in this gray water that could harm the stream. A benthic sample taken upstream of the residences would determine if gray water was degrading this stream. Another possible source of degradation is the presence of many oil wells in the headwater area. These wells can cause elevated levels of chlorides. Also, erosion of the roads associated with these wells can contribute large amounts of sediment to streams.

There were five sites assessed in the Sycamore Creek Watershed. *Grassy Fork (KE-41-C-1)* received a WVSCI score of 57.72. There is mining in the upper parts of this stream. The pH (8.28) and conductivity (552) were higher than in the other Sycamore sites, suggesting that the water from this area is being treated for mine drainage. A resident near the site said that the stream was getting worse since a nearby coal tipple was constructed. The fecal coliform bacteria level was high at 5200 colonies/100ml. The habitat does not appear to be a limiting factor, although the lack of a good riparian zone could contribute to future degradation. It appears that mining and residential pressures are causes of impairment in this stream.

Buffalo Creek Watershed



Buffalo Creek enters the Elk River just upstream of Clay. The streams entering Buffalo Creek vary from being nearly pristine to being heavily impacted by mining. This watershed had sixteen sites assessed, five of which had WVSCI scores below 60.6. Eleven of the sites were in good condition with scores above 75.4 There is mining activity at each of the five impaired sites. Two of the sites that scored above 75.4 were sampled with non-comparable methods, however the benthic community collected from these streams support labeling these as unimpaired.

Jim Young Fork (KE-50-B-7) had only seven total taxa and just two EPT taxa identified and received a WVSCI score of 56.15. There is a large surface mining operation in the headwater area of this stream, an oil well compressor next to the site with pipes running along the stream, and the entire 100-meter sampling reach was previously channelized. Despite the channelization, the stream habitat does not appear to be limiting (RBP total score of 171).

Hickory Fork (KE-50-I-3), a small headwater tributary of Rockcamp Run, appears to be impaired by acid mine drainage. The pH was 4.73 and the total aluminum was 1.7 mg/l. There were only twenty-two organisms collected in three taxa, 20 of these were Hydropsychid caddisflies. This taxon is generally considered fairly tolerant, but there are some sensitive genera within the family, therefore we use a tolerance value of 5. Because

Buffalo Creek watershed sites

ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-50-{0.2}	BUFFALO CREEK	75.31	157	44
WVKE-50-B-{0.1}	LILLY FORK	85.36	186	800
WVKE-50-B-1-{2.0}	SINNETT BRANCH	84.85	196	110
WVKE-50-B-7-{0.1}	JIM YOUNG FORK	56.15	171	1200
WVKE-50-B-8	BEECH FORK	80.94	185	80
WVKE-50-B-9	SYCAMORE RUN	76.50	196	300
WVKE-50-B-10	IKE FORK	86.45	206	180
WVKE-50-F-{2.2}	SAND FORK	80.17	157	100
WVKE-50-G	THE GULF	90.42*	164	16
WVKE-50-I	ROCKCAMP RUN	84.21	172	300
WVKE-50-I-3	HICKORY FORK	51.80	162	4
WVKE-50-K	ADKINS BRANCH	83.85*	165	32
WVKE-50-O	ROBINSON FORK	79.93	158	2000
WVKE-50-P	TAYLOR CREEK	35.61	113	2
WVKE-50-S	DILLE RUN	58.98	168	20
WVKE-50-T	PHEASANT RUN	49.47	144	130

* Non-comparable benthic collection

Sites with benthic impairment in gray box

Fecal coliform bacteria violations in BOLD

Reference sites in italics

the majority of organisms were in this family, the HBI metric was fairly high for this stream. It also scored very high for “% chironomid” and “% EPT”. This is another scenario where the WVSCI does not respond as expected to an AMD stream, and does not indicate the severity of the impairment adequately.

The site on *Taylor Creek (KE-50-P)* was below a large reclamation site. The aluminum and manganese levels were in violation of the acute WQ standard. The habitat was poor (total RBP score of 113). The substrate was heavily embedded with coal fines and clay. Only two organisms were identified from the entire collection indicating severe impairment. This site should be sampled again when the reclamation is complete to see if the stream biota improves.

Dille Run (KE-50-S) received a WVSCI score of 58.98. The site had a pH of 4.07 and had an aluminum value of 1.7 mg/l. A white precipitate was seen where Dille Run enters Buffalo Creek. The dominance of the benthic community by acid tolerant stoneflies (Capniidae/Leuctridae) provides further evidence that the stream is in fact impaired by AMD. The topo map showed extensive surface mining in the area.

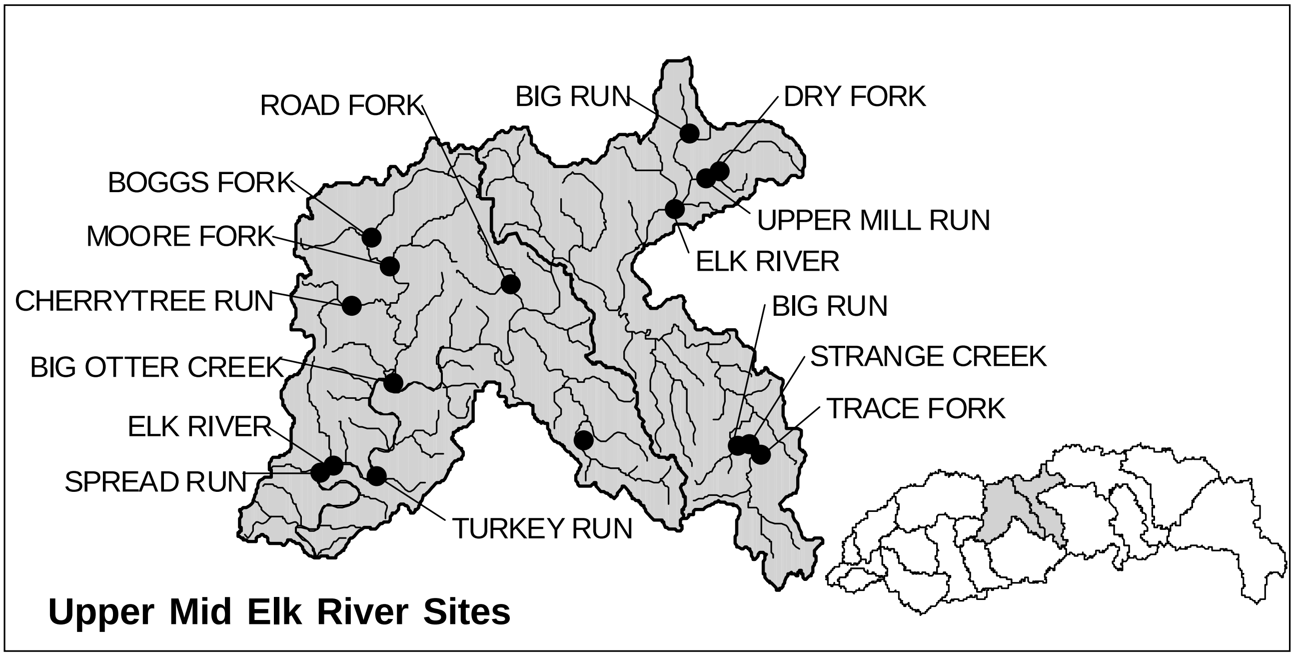
Pheasant Run (KE-50-T) was also impaired (WVSCI score of 49.47). The pH (7.5) and conductivity (99 mmhos/cm) were better than the other AMD impaired streams. The topo map shows contour strip mining in this hollow. There was a series of ponds upstream of the sampling site, presumably to treat runoff from the mining areas. Despite the ponds, coal fines were present in high amounts. The instream habitat was poor. The embeddedness and sediment deposition scores were both marginal. Over 90 % of the organisms collected were either hydropsychid caddisflies or tipulid (cranefly) larvae. There were three EPT taxa and the Total Taxa score was six.

Buffalo Creek was listed in the 1998 303(d) list of impaired streams because of metals. Our sample near the mouth did not show any problems with aluminum, iron, or manganese. Violations of standards for these metals probably only occur in association with rainfall events. The sample was dominated by mayflies and does not appear to be greatly impacted by the upstream mining.

Upper Mid Elk River sites

This area includes the Elk River and its tributaries between Clay and Frametown. There were thirteen sites sampled in these two subwatersheds. Five had benthic communities that showed impairment, however, three of these were non-comparable.

Turkey Run (KE-59) is a small stream that enters directly into the Elk River between



Clay and Ivydale. There was very little flowing water the day of the assessment and the field crew suspected that it was dry prior to heavy rains two days before sampling. There were no roads in the watershed and the only disturbance noted was an ATV trail running parallel to the stream. The low WVSCI score of 50.56 is probably attributable to the lack of flowing water preceding the sample event.

Three sites were sampled in the Big Otter Watershed, although only one of them had adequate riffle/run habitat to allow the collection of a comparable benthic sample*. Big Otter Creek (KE-64)* was sampled near the mouth. Its WVSCI score (69.80) indicated it was in good condition.

The site on *Boggs Fork (KE-64-E)* had no riffle / run habitat to enable the use of our normal benthic collection methodology. The field crew utilized the method developed for coastal streams (MACS). Because riffle /run habitats are generally considered to have the most diverse benthic communities, a non-riffle sample can not be directly compared to them. The substrate at this site was mostly sand and silt, which reflects the high percentage of agriculture and other disturbances upstream.

Moore Fork (KE-64-D) was nearly dry at the time of sampling. The water was restricted to a few small pools. The substrate was mostly sand. An abbreviated MACS sample was taken; there simply wasn't enough habitat to get a complete sample. The benthos from this stream can't be compared to others with adequate riffle/run habitat.

Upper Mid Elk River sites

ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-56	SPREAD RUN	80.09	149	420
WVK-43-{63.0}	ELK RIVER	92.99	177	260
WVKE-59	TURKEY RUN	50.73	151	200
WVKE-64	BIG OTTER CREEK	69.80	128	600
WVKE-64-D	MOORE FORK	54.50*	79	80
WVKE-64-E	BOGGS FORK	36.84*	106	120
WVKE-69-{5.6}	GROVES CREEK	91.58	168	200
WVKE-70-A	ROAD FORK	68.68	135	2000
WVKE-74-{10.4}	STRANGE CREEK	81.41	167	3600
WVKE-74-F	BIG RUN	92.16	162	76
WVKE-76-S.8	CHUFFY RUN	88.50*	110	110
WVKE-43-{87.4}	ELK RIVER	82.28	195	220
WVKE-78	UPPER MILL RUN	60.40	99	320
WVKE-79	BIG RUN	57.16*	144	12

* Non-comparable benthic collection

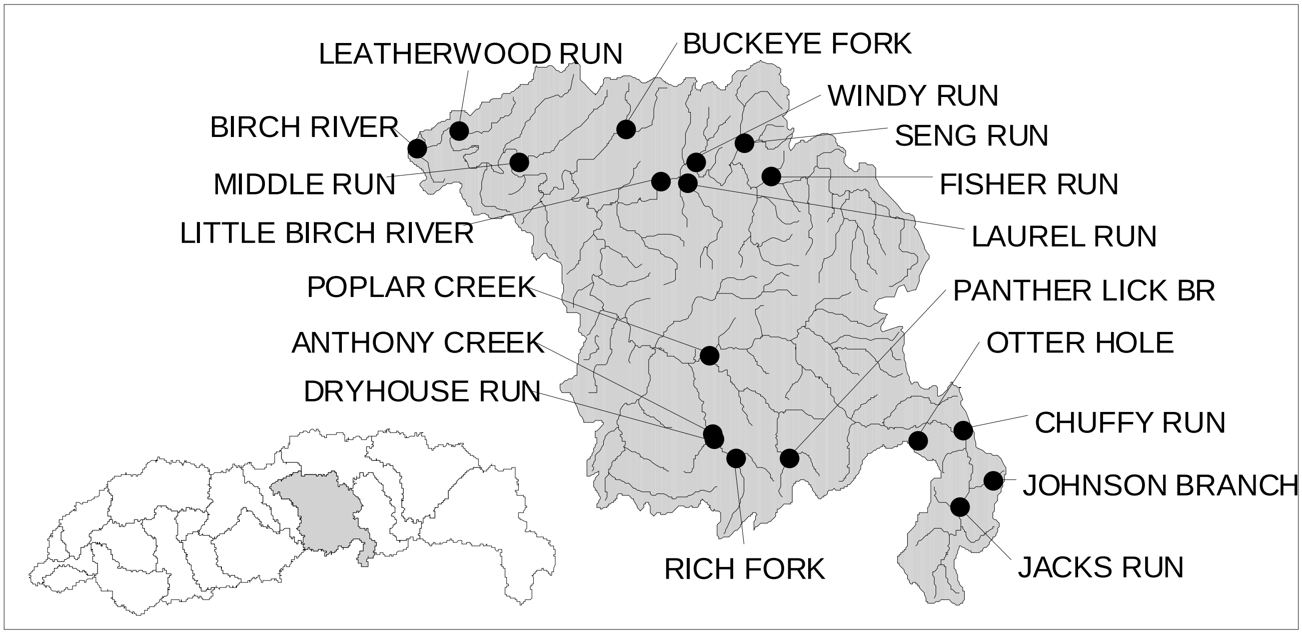
Sites with benthic impairment in dark gray box

Fecal coliform bacteria violations in BOLD

The site on *Upper Mill Run (KE-78)* was heavily channelized and dredged. Its instream habitat was reduced to fairly uniform gravel substrate that is susceptible to scouring at high flows. This site received the second lowest overall habitat score in the entire watershed. Unfortunately, once a stream is dredged and channelized to this degree, it takes a long time for the habitat to improve to the point where it can sustain a healthy benthic community.

Big Run (KE-79) was too dry to obtain a comparable benthic sample. This site runs along Braxton CR 9 for its entire length. This area has many residences and much of the drainage area is hay field and pasture. This site needs to be resampled to determine if the disturbances are impairing the benthic life.

Birch River Watershed sites



The Birch River Watershed was sampled at fifteen sites. Three other locations were visited and not sampled because they were dry. The average WVSCI score for this major subwatershed of the Elk was 77.18. Twelve of the fifteen sites had unimpaired benthic communities, two were potentially impaired (WVSCI scores between 60.6 and 68), and only one site was impaired.

Jacks Run (KE-76-W) drains a large surface mine site. Nearly a third of the land in its drainage is, or has recently been, cleared for mining activities (WCMS). This stream was sampled in the area between the spillway for the settling pond and the confluence with Birch River. The substrate at this site was mostly cobble, however it was embedded with dark silt (manganese precipitate or coal fines). The manganese level was in violation of state water quality standards at 1.8 mg/l. Black fly larvae and midges, eighty percent of all organisms identified, dominated the benthic sample. There were no mayflies or stoneflies present. The WVSCI score of 38.7 indicates severe impairment.

Birch River (KE-76-{0.9}) and Little Birch River (KE-76-E-{02.6}) had benthic collections that indicated potential problems. The sites on Birch River and Little Birch River had just five and six EPT taxa identified, respectively, and individuals from these families were present in small numbers. Therefore the “EPT Taxa” and “% EPT” benthic metrics scored fairly low. Sedimentation deposition (RBP parameter) levels were

Birch River subwatershed sample sites

ANCODE	Stream Name	WVSCI	Habitat Total	Fecal
WVKE-76-E-{2.6}	LITTLE BIRCH RIVER	62.74	171	200
WVKE-76-N-{2.4}	ANTHONY CREEK	91.52	175	110
WVKE-76-E-7.5	FISHER RUN	76.85	144	3000
WVKE-76-E-6-A	SENG RUN	71.74	143	2800
WVKE-76-N-8	RICH FORK	91.28	193	2800
WVKE-76-E-5	WINDY RUN	80.13	124	10
WVKE-76-S.3	OTTER HOLE	87.87	177	1400
WVKE-76-{0.9}	BIRCH RIVER	66.91	201	52
WVKE-76-A	LEATHERWOOD RUN	76.91	158	1500
WVKE-76-C	MIDDLE RUN	80.92	162	44
WVKE-76-W	JACKS RUN	38.69	169	n/a
WVKE-76-D-1	BUCKEYE FORK	79.88	163	1600
WVKE-76-S.8	CHUFFY RUN	88.50*	182	110
WVKE-76-U-{0.8}	JOHNSON BRANCH	79.46	191	56
WVKE-76-O	POPLAR CREEK	85.37	170	420

* Non-comparable benthic collection

Sites with potential benthic impairment in light gray box

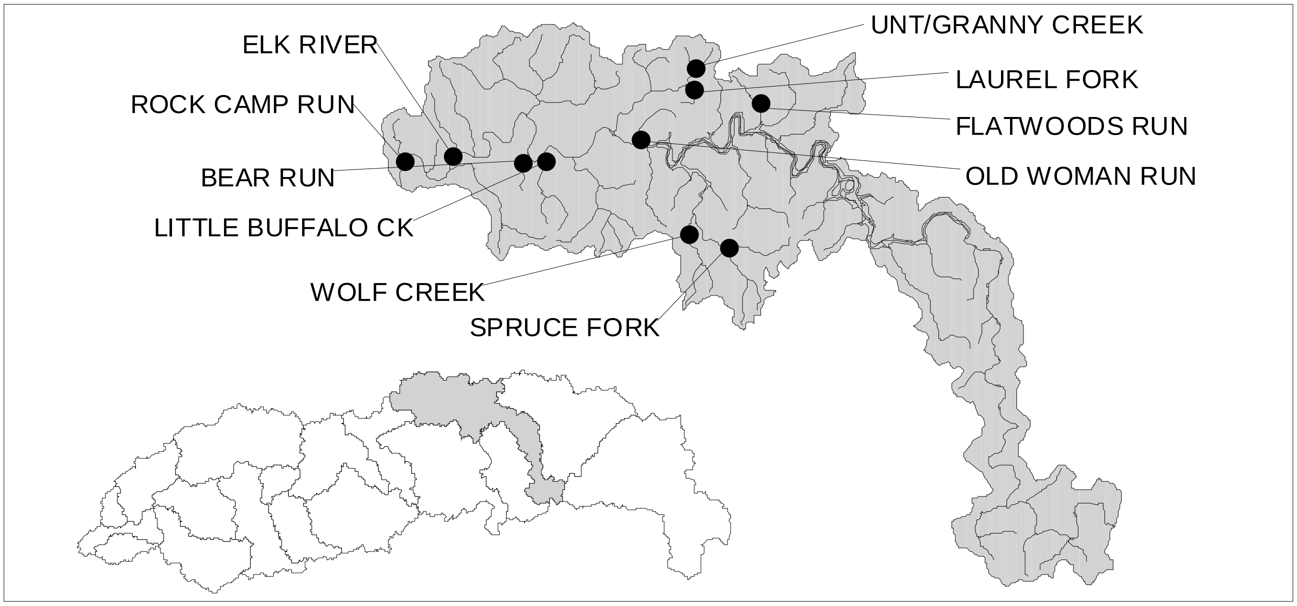
Sites with benthic impairment in dark gray box

Fecal coliform bacteria violation in BOLD

Reference sites in italics

marginal (sand, silt, and clay were present) and could be the reason for these deficiencies.

Sites from Frametown to Webster Springs



This section includes the fairly developed Sutton and Flatwoods areas. Six out of nine sites with benthic samples had WVSCI scores indicating impairment or potential impairment, one of these was sampled with non-comparable methods. The site on the Elk River was sampled for water quality only.

Rock Camp Run (KE-82) did not have enough flowing water to sample with the kicknet. A handpicked sample contained only four EPT taxa and no stoneflies. As the name and local appearance suggest, this area was previously a rock quarry. Approximately half of the stream's substrate was affected by sediment deposition (Table 6) and sand was the dominant substrate class (Table 7).

Bear Run (KE-84.5) is a small stream that empties into the Elk River just upstream of Gassaway. It had a WVSCI score of 48.6. There were only 10 total taxa and 4 EPT taxa. There was active logging upstream that was resulting in heavy siltation.

The site on Little Buffalo Creek (KE-85) had been dredged and channelized. The stream was directly adjacent to the county road 13/2. The benthic sample included four sensitive taxa with tolerance values of 1 or 2. The disturbed habitat is most likely the reason for the depressed WVSCI score (67.2).

An unnamed tributary of Granny Creek (KE-87-C) was sampled in the middle of a hay

Sites from Frametown to Webster Springs

ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVK-43-{105.2}	ELK RIVER	n/a	n/a	420
WVKE-82	ROCK CAMP RUN	65.12*	138	1800
WVKE-84.5	BEAR RUN	48.57	144	1200
WVKE-85	LITTLE BUFFALO CREEK	67.16	129	700
WVKE-87-B	LAUREL FORK	66.30	164	2400
WVKE-87-C	U.T./GRANNY CREEK	45.59	110	7800
WVKE-88	OLD WOMAN RUN	36.89	156	3000
WVKE-91	WOLF CREEK	76.79	155	160
WVKE-91-A-1	SPRUCE FORK	68.29	126	30
WVKE-94	FLATWOODS RUN	73.91	128	1200

* Non-comparable benthic collection

Sites with potential benthic impairment in light gray box

Sites with benthic impairment in dark gray box

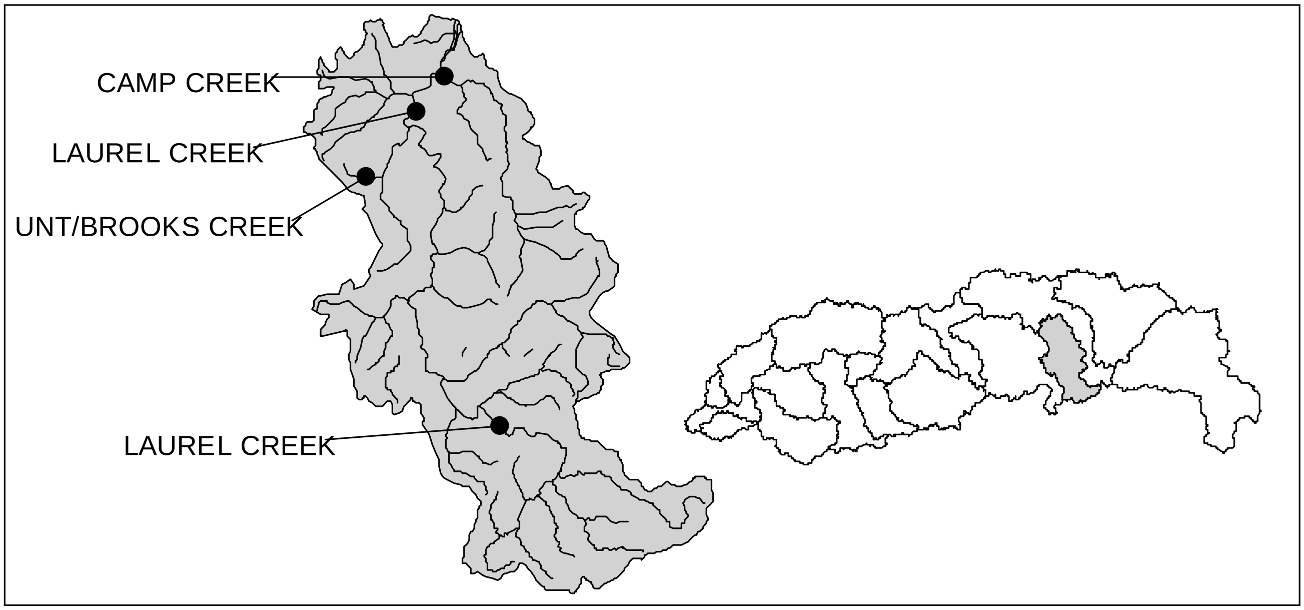
Fecal coliform bacteria violations in BOLD

field. Over 70 percent of this watershed is developed for agriculture. The substrate was 70 percent sand, very poor for benthic colonization. There were only 10 organisms collected resulting in a WVSCI score of 45.6. The fecal coliform bacteria was high (7800 col/100ml) and is probably associated with livestock.

Another tributary of Granny Creek, Laurel Fork (KE-87-B), received a WVSCI score indicating potential impairment (66.3). This watershed is also largely agricultural. There were no stoneflies identified from the benthic sample, which was dominated by hydropsychid caddisflies and midges. The instream habitat was good at the site, which suggests that there is a water quality problem in this stream.

Old Woman Run (KE-88) drains the eastern edge of downtown Sutton. There was evidence of raw sewage in the stream. The site had the highest HBI score of any in the watershed (7.98). The WVSCI score of 36.9 was one of the lowest in the watershed, indicating obvious impairment

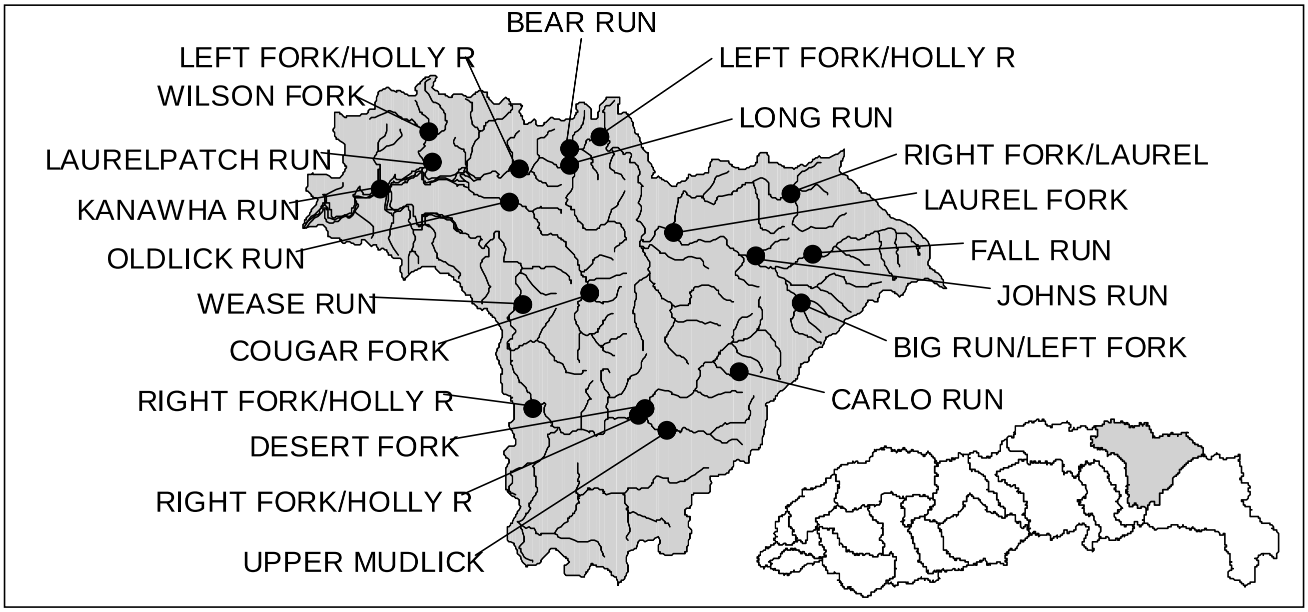
Laurel Creek Watershed



Laurel Creek watershed sites				
ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-102-C-1-{0.4}	UT OF BROOKS CREEK	57.57	126	220
WVKE-102-A	CAMP CREEK	89.32	189	120
WVKE-102-{2.8}	LAUREL CREEK	68.20	173	64
WVKE-102-{14.6}	LAUREL CREEK	90.27	194	140
Sites with benthic impairment in dark gray box				
Reference sites in italics				

The Laurel Creek (Webster Co.) Watershed was sampled at four sites. Based on the WVSCI scores, three were unimpaired and one was impaired. This watershed primarily drains the western part of Webster County and includes several coal-mining operations. The site with impairment, an *un-named tributary of Brooks Creek (KE-102-C-1),* lacked stable habitat. The substrate in the area of the benthic collection was entirely sand and silt!

Holly River Watershed



There were twenty sites sampled in the Holly River Watershed. None of these received WVSCI scores below 60.6, and only one was in the “gray zone” with potential impairment. The average WVSCI score was 79.83. The two main forks, Right Fork and Left Fork, were both sampled twice and all four samples indicated no impairment. The one potentially impaired stream was a small tributary that drains into the lower part of Holly River.

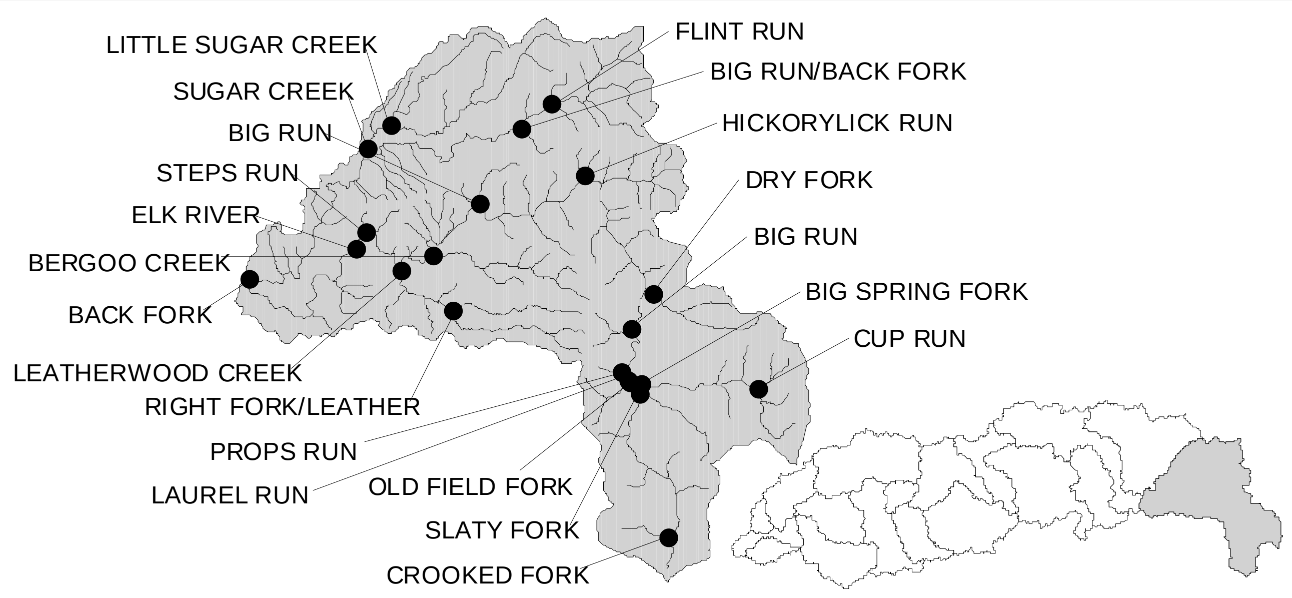
Kanawha Run (KE-98-A) had thelowest WVSCI score at 64.0. Route 15 runs along much of this stream and there are several large farms in the watershed. The pH was 8.2 on the sampling date. There were eight EPT taxa and twelve taxa in total. This stream appears to be slightly impaired by the development in the watershed.

One site, *Right Fork/Laurel Fork/Left Fk Holly (KE-98-C-11-C),* appears to be slightly impaired by acid precipitation. The pH was 5.0 and the conductivity was only 16 ìmhos. Another Holly River tributary, *Fall Run (KE-98-C-14-{1.4})* had a low conductivity, but its pH was higher (6.1) and had a much more diverse macrobenthic fauna.

Upper Mudlick (KE-98-B-16.4) and *Carlo Run (KE-98-B-16-B-{1.0})* were very small streams that were difficult to sample because of low flow. Upper Mudlick had some disturbances at its mouth, but otherwise these two streams drain pristine areas.

Holly River watershed sites				
ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVKE-98-A	KANAWHA RUN	63.98	126	40
WVKE-98-B	RIGHT FK HOLLY RIVER	91.39	153	47
WVKE-98-B-{13.6}	RIGHT FK HOLLY RIVER	80.94	171	1300
WVKE-98-B-16	DESERT FORK	88.99	158	107
WVKE-98-B-16.4	UPPER MUDLICK	74.81	136	51
WVKE-98-B-16-B-{1.0}	CARLO RUN	74.95	150	263
WVKE-98-B-3-{0.6}	FALL RUN	87.21	190	80
WVKE-98-B-8	WEASE RUN	74.16	160	120
WVKE-98-C-{10.0}	LEFT FK HOLLY RIVER	78.28	180	151
WVKE-98-C-{13.8}	LEFT FK HOLLY RIVER	86.18	183	35
WVKE-98-C-1	LAURELPATCH RUN	79.31	166	143
WVKE-98-C-1-0.5A	WILSON FORK	78.35	192	97
WVKE-98-C-11	LAUREL FORK	82.26	159	149
WVKE-98-C-11-C	RIGHT FORK/LAUREL FK	72.56	167	133
WVKE-98-C-14-{1.4}	FALL RUN	84.03	187	84
WVKE-98-C-15-{1.0}	BIG RUN/LEFT FK HOLLY	89.22	163	21
WVKE-98-C-2	OLDLICK RUN	70.49	126	610
WVKE-98-C-2-D	COUGAR FORK	84.97	175	80
WVKE-98-C-5	LONG RUN	77.58	182	87
WVKE-98-C-6	BEAR RUN	82.49	167	1500
Sites with potential benthic impairment in light gray box				
Fecal coliform bacteria violations in BOLD				
Reference sites in italics				

Upper Elk River Watershed



The Upper Elk River Watershed was sampled at 17 locations and had the highest average WVSCI score for the major sub-watersheds. This sub-watershed extends from Webster Springs to the headwaters and includes the highest elevations in the Elk Watershed, draining mountainous areas of Webster, Randolph, and Pocahontas Counties. There were no obviously or potentially impaired sites in this section of the Elk.

The Big Spring Fork (KE-138) watershed includes the area around the intersection of Rt. 219 and Rt. 66. This area drains several open areas including the golf course at Snowshoe Resort. The substrate at this site was mostly bedrock. The benthic sample was collected at the only areas of exception. The periphyton was heavy, indicating a possibility of excess nutrients in the stream. The somewhat low WVSCI score (69.29) is likely attributable to both the lack of good substrate and the impacts from the upstream disturbances.

Upper Elk River watershed sites

ANCODE	Stream Name	WVSCI	Total Habitat	Fecal
WVK-43-{156.2}	ELK RIVER	79.27	189	193
WVKE-111-{0.2}	BACK FORK	70.24	134	360
WVKE-111-K	SUGAR CREEK	82.75	153	500
WVKE-111-K-2	LITTLE SUGAR CREEK	86.48	176	28
WVKE-111-Q	BIG RUN/BACK FORK ELK	82.46	172	8
WVKE-111-S	FLINT RUN	78.45	190	12
WVKE-115	STEPS RUN	71.36	186	40
WVKE-117	LEATHERWOOD CREEK	86.59	159	87
WVKE-117-B	RIGHT FORK/LEATHERWOOD	84.49	197	8
WVKE-118	BERGOO CREEK	84.85	176	77
WVKE-124	BIG RUN	89.70	175	33
WVKE-128	HICKORYLICK RUN	94.94	174	77
WVKE-136-{0.5}	PROPS RUN	87.36	198	0
WVKE-137	LAUREL RUN	89.45	180	60
WVKE-138	BIG SPRING FORK	69.29	143	53
WVKE-139	OLD FIELD FORK	79.03	165	23
WVKE-139-0.5A	SLATY FORK		150	633
WVKE-139-B	CROOKED FORK	80.67	163	83

Fecal coliform bacteria violations in BOLD

Reference sites in italics

Implications

In the Elk River watershed, there were five streams listed in the 1998 303(d) list. Morris Creek, Left Fork of Morris Creek, Buffalo Creek, and Pheasant Run were listed as being impaired by mine drainage. Fall Run of the Left Fork of Holly River was listed as being impaired by acid rain.

The data collected for this assessment support retaining the Left Fork of Morris Creek on the list. Mainstem Morris appears to be impaired only downstream of the Left Fork and this section should remain listed.

The section of the Elk River downstream of Big Sandy Creek is scheduled for TMDL development because of high total metal concentrations. The macroinvertebrate sample collected near the mouth of the Elk indicates a healthy benthic community. This suggest that the high metal values often measured in this section of river are associated with suspended solids and are not dissolved in the water where they would cause harm to the biota. TheTMDL that will be developed will address this and hopefully suggest ways to minimize the amounts of sand, silt, and clay entering the river.

The Buffalo Creek drainage does have several tributaries that are affected by mine drainage. Hickory Fork, Taylor Creek, and Dille Run all had pH and metals violations. These should be considered for addition to the 303(d) list as impaired by mine drainage. Pheasant Run did not have a pH problem at the time of sampling, but the benthic community was impaired. The only sample from Buffalo Creek did not reveal any mine drainage problems, although metals (listed as the pollutant) may be associated with rainfall events only. There is currently not enough data to support delisting.

The following streams had water quality problems and should be considered candidates for future 303(d) lists:

Stream Name	Stream Code	Impairment
Schoolhouse Fork	KE-14-G-2-A	pH/metals
Mudlick Branch	KE-14-M-2	pH/metals
White Oak Fork	KE-14-G-2	pH
Jacks Run	KE-76-W	metals (Mn)

Several streams had benthic impairment and should be considered for addition to the list of waterbodies with biological impairment:

STREAM NAME	STREAM CODE	WVSCI
NEWHOUSE BRANCH	WVKE-3	25.51
GREEN BOTTOM	WVKE-2-E	36.25
OLD WOMAN RUN	WVKE-88	36.89
BIG FORK	WVKE-9-B-1	38.19
KAUFMAN BRANCH	WVKE-7-E	41.87
U.T./GRANNY CREEK	WVKE-87-C	45.59
BEAR RUN	WVKE-84.5	48.57
COONSKIN BRANCH	WVKE-4	50.55
TURKEY RUN	WVKE-59	50.56
SUMMERS FORK	WVKE-37-D	52.91
BIG SANDY CREEK	WVKE-23-{12.6}	55.69
UT OF BROOKS CREEK	WVKE-102-C-1-{0.4}	57.57
GRASSY FORK	WVKE-41-C-1	57.72
CAMP CREEK	WVKE-34	57.79
LEATHERWOOD CREEK	WVKE-21	58.85
LAUREL FORK	WVKE-37-B	59.06
UPPER MILL RUN	WVKE-78	60.40

The upper part of the Elk River watershed has several streams that sustain year-round trout populations. These trout waters include the Elk River and Back Fork above Webster Springs, the Left Fork Holly River, Desert Fork, Fall Run, Laurel Fork, and Sugar Creek – all in Webster County. Sutton Lake and its tailwaters in Braxton County are also considered trout waters.

The Elk River is important also in that it serves as a public water supply for many people. There are at least ten public water operators using the Elk River as their source and one using the Holly River.

The Elk River watershed has many beautiful streams that have no obvious impairments and should be protected to ensure that they remain healthy. The following streams had healthy benthic communities (WVSCI > 75) and optimal stream habitat (RBP total >180):

STREAM NAME	ANCODE	WVSCI	TOTAL
MIDDLE FORK	WVKE-14-O-{5.2}	77.45	186
TWO MILE FORK	WVKE-19-B	81.35	188
ELK RIVER	WVK-43-{156.2}	79.27	189
MCBRIDE HOLLOW	WVKE-14-O-0.5	82.25	188
SYCAMORE RUN	WVKE-50-B-9	76.50	196
PISGAH RUN	WVKE-49	88.39	186
RICH FORK	WVKE-76-N-8	91.28	193
FALL RUN	WVKE-98-B-3-{0.6}	86.87	190
CHUFFY RUN	WVKE-76-S.8	88.50	182
JOHNSON BRANCH	WVKE-76-U-{0.8}	78.58	191
SINNETT BRANCH	WVKE-50-B-1-{2.0}	83.43	196
IKE FORK	WVKE-50-B-10	86.45	206
LILLY FORK	WVKE-50-B-{0.1}	85.36	186
LAUREL CREEK	WVKE-102-{14.6}	90.27	194
WILSON FORK	WVKE-98-C-1-0.5A	77.61	192
LEFT FORK/HOLLY RIVER	WVKE-98-C-{13.8}	86.18	183
ELK RIVER	WVK-43-{87.4}	82.26	195
BEECH FORK	WVKE-50-B-8	80.94	185
RIGHT FORK/LEATHERWOOD	WVKE-117-B	84.49	197
CAMP CREEK	WVKE-102-A	89.32	189
LONG RUN	WVKE-98-C-5	77.58	182
FALL RUN	WVKE-98-C-14-{1.4}	84.03	187
PROPS RUN	WVKE-136-{0.5}	87.36	198
FLINT RUN	WVKE-111-S	78.45	190

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 1-304-558-2108. In addition, the DEP's Stream Partners Program coordinator, available at 1-800-556-8181, serves as a clearinghouse for these and other resources.

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APPENDIX A. DATA TABLES

Table 4: Sites sampled

Stream Name	Stream Code	Date	Latitude			Longitude			County
ELK RIVER	K-43-{1.2}	8/7/97	38	23	38.16	81	35	11.34	KANAWHA
ELK RIVER	K-43-{105.2}	7/28/97	38	39	23.97	80	48	58.49	BRAXTON
ELK RIVER	K-43-{156.2}	7/8/97	38	29	51.65	80	20	4.1	WEBSTER
ELK RIVER	K-43-{16.0}	8/7/97	38	27	39.86	81	26	48.37	KANAWHA
ELK RIVER	K-43-{46.6}	8/5/97	38	26	6.73	81	11	9.83	CLAY
ELK RIVER	K-43-{49.8}	8/5/97	38	26	27.09	81	8	27.29	CLAY
ELK RIVER	K-43-{63.0}	8/5/97	38	29	58	81	3	52	CLAY
ELK RIVER	K-43-{87.4}	8/5/97	38	36	24	80	52	5	BRAXTON
ELK TWOMILE CREEK	KE-2	6/25/97	38	21	14.6	81	31	24.7	KANAWHA
GREEN BOTTOM	KE-2-E	6/25/97	38	21	14.6	81	31	24.7	KANAWHA
NEWHOUSE BRANCH	KE-3	7/1/97	38	22	50	81	36	34	KANAWHA
COONSKIN BRANCH	KE-4	6/25/97	38	23	5	81	35	5	KANAWHA
MILL CREEK	KE-6-{5.6}	7/3/97	38	22	25.22	81	29	52.22	KANAWHA
KAUFMAN BRANCH	KE-7-E	6/25/97	38	27	48.3	81	33	44	KANAWHA
LITTLE SANDY CREEK	KE-9	7/1/97	38	28	43	81	30	6	KANAWHA
LITTLE SANDY CREEK	KE-9-{1.5}	7/8/97	38	25	35.56	81	30	22.25	KANAWHA
LITTLE SANDY CREEK	KE-9-{15.0}	7/8/97	38	31	59.83	81	26	7.79	KANAWHA
BIG FORK	KE-9-B-1	6/26/97	38	29	7.3	81	27	21.2	KANAWHA
AARON’S FORK	KE-9-C-{0.6}	7/8/97	38	27	51.89	81	30	34.24	KANAWHA
BULLSKIN BRANCH	KE-9-E	7/1/97	38	28	38.96	81	30	5.16	KANAWHA
RUFFNER BRANCH	KE-9-G	6/26/97	38	29	33.6	81	29	4.2	KANAWHA
HARPER HOLLOW	KE-9-I-1-A	7/1/97	38	31	15.7	81	29	29.62	KANAWHA
JAKES RUN	KE-9-J	7/1/97	38	28	41.16	81	30	5.97	KANAWHA
NARROW BRANCH	KE-13	6/26/97	38	26	47	81	27	57	KANAWHA
RT FK OF SLACK BR	KE-14-G-1-{0.8}	7/3/97	38	22	18.27	81	25	1.19	KANAWHA
WHITE OAK FORK	KE-14-G-2	6/25/97	38	22	4	81	24	10	KANAWHA
SCHOOLHOUSE FORK	KE-14-G-2-A	6/26/97	38	20	59.77	81	23	59.44	KANAWHA
UNT OF BLUE CREEK	KE-14-K.1	6/25/97	38	21	46.2	81	22	1.64	KANAWHA
MORRIS FORK	KE-14-M	6/25/97	38	21	11.31	81	21	6.6	KANAWHA
MUDLICK BRANCH	KE-14-M-2	6/25/97	38	20	46.47	81	21	18.02	KANAWHA
MIDDLE FORK	KE-14-O-{5.2}	7/15/97	38	19	5.84	81	17	29.55	KANAWHA
MCBRIDE HOLLOW	KE-14-O-0.5	6/26/97	38	20	47.1	81	19	14.49	KANAWHA
PANTHER HOLLOW	KE-14-P	6/26/97	38	21	56	81	18	8	KANAWHA
TWO MILE FORK	KE-19-B	7/1/97	38	26	49	81	23	36	KANAWHA
PETES FORK	KE-19-H	7/9/97	38	25	28.15	81	17	1.03	KANAWHA
LEATHERWOOD CREEK	KE-21	6/26/97	38	28	23	81	22	41	KANAWHA
BIG SANDY CREEK	KE-23-{0.43}	7/14/97	38	29	37	81	21	12	KANAWHA
BIG SANDY CREEK	KE-23-{12.6}	7/21/97	38	32	22.51	81	16	39.89	ROANE
COLEMAN RUN	KE-23-D-6	7/21/97	38	34	16.86	81	22	20.93	ROANE
DOELICK RUN	KE-23-F-1	7/21/97	38	31	22	81	18	12	KANAWHA
LOONEY FORK	KE-23-L-5	7/22/97	38	37	15	81	15	2	ROANE
RT FK OF BIG SANDY	KE-23-P-{3.0}	7/16/97	38	34	9.63	81	9	28.19	ROANE
CUTOFF RUN	KE-23-P-1	7/16/97	38	34	27.73	81	9	40.77	ROANE
HORSE RUN	KE-23-P-3-A	7/23/97	38	33	2.6	81	6	54.34	CLAY
SIMONS FORK	KE-23-P-3-B	7/23/97	38	32	58.2	81	6	53.01	CLAY
MORRIS CREEK	KE-26	7/14/97	38	28	26.54	81	18	38.82	KANAWHA
LT FK OF MORRIS CK	KE-26-A-{0.16}	7/9/97	38	28	15.11	81	18	33.06	KANAWHA
LT FK OF MORRIS CK	KE-26-A-{0.16}	7/14/97	38	28	15.11	81	18	33.06	KANAWHA
UP. KING SHOALS RUN	KE-32-{1.0}	7/22/97	38	30	43	81	13	5	CLAY
CAMP CREEK	KE-34	7/16/97	38	29	26.53	81	12	54.44	CLAY
LAUREL CREEK	KE-37	6/26/97	38	27	53.86	81	11	8.87	CLAY

Table 4. Sites sampled (continued)

Stream Name	Stream Code	Date	Latitude			Longitude			County
LAUREL CREEK	KE-37	7/16/97	38	27	53.86	81	11	8.87	CLAY
LAUREL FORK	KE-37-B	6/26/97	38	29	0.41	81	9	27.89	CLAY
SUMMERS FORK	KE-37-D	6/26/97	38	29	54.03	81	9	18.63	CLAY
LITTLE SYCAMORE CK	KE-40	7/23/97	38	25	56.41	81	11	43.22	CLAY
SYCAMORE CREEK	KE-41	7/24/97	38	25	36	81	10	38	CLAY
CHARLEY BRANCH	KE-41-A	7/15/97	38	23	6.15	81	9	37.75	CLAY
ADONIJAH FORK	KE-41-B-{0.2}	7/17/97	38	22	10.32	81	10	9.98	CLAY
LAUREL FORK	KE-41-B-1.5	7/17/97	38	20	4.31	81	11	37.93	CLAY
GRASSY FORK	KE-41-C-1	7/17/97	38	20	45.11	81	9	52.48	CLAY
ROCK BRANCH	KE-41-H	7/23/97	38	19	24	81	5	39	NICHOLAS
LICK BRANCH	KE-45-B	7/28/97	38	22	52.8	81	6	45.02	CLAY
LEATHERWOOD CK	KE-46-{1.2}	7/31/97	38	25	48.81	81	5	38.17	CLAY
PISGAH RUN	KE-49	7/28/97	38	26	58.72	81	5	20.31	CLAY
BUFFALO CREEK	KE-50-{0.2}	7/31/97	38	27	16.94	81	3	51.73	CLAY
LILLY FORK	KE-50-B-{0.1}	7/30/97	38	27	8	81	3	9	CLAY
SINNETT BRANCH	KE-50-B-1-{2.0}	7/30/97	38	25	28.56	81	1	12.8	CLAY
IKE FORK	KE-50-B-10	7/29/97	38	22	52	80	58	11	NICHOLAS
JIM YOUNG FORK	KE-50-B-7-{0.1}	7/29/97	38	24	11.63	80	59	26.52	CLAY
BEECH FORK	KE-50-B-8	7/29/97	38	23	24	80	58	49	CLAY
SYCAMORE RUN	KE-50-B-9	7/29/97	38	23	8	80	58	39	CLAY
SAND FORK	KE-50-F-{2.2}	7/30/97	38	29	24.46	80	58	58.78	CLAY
THE GULF	KE-50-G	7/30/97	38	27	58.81	80	59	19.58	CLAY
ROCKCAMP RUN	KE-50-I	7/30/97	38	27	55.63	80	58	30.24	CLAY
HICKORY FORK	KE-50-I-3	7/29/97	38	28	45	80	54	38	CLAY
ADKINS BRANCH	KE-50-K	7/30/97	38	28	22	80	57	12	CLAY
ROBINSON FORK	KE-50-O	7/29/97	38	26	51	80	55	21	CLAY
TAYLOR CREEK	KE-50-P	7/29/97	38	27	4.58	80	54	12.07	CLAY
DILLE RUN	KE-50-S	7/29/97	38	27	34	80	52	45	CLAY
PHEASANT RUN	KE-50-T	7/28/97	38	40	51	80	37	51	CLAY
SPREAD RUN	KE-56	7/24/97	38	29	48	81	4	21	CLAY
TURKEY RUN	KE-59	7/24/97	38	29	44	81	2	22	CLAY
BIG OTTER CREEK	KE-64	7/21/97	38	32	1.75	81	1	50.56	CLAY
CHERRYTREE RUN	KE-64-C-2	7/21/97	38	33	59.01	81	3	13.83	CLAY
MOORE FORK	KE-64-D	7/21/97	38	34	57.66	81	1	54.33	CLAY
BOGGS FORK	KE-64-E	7/21/97	38	35	41.74	81	2	34.2	CLAY
GROVES CREEK	KE-69-{5.6}	7/17/97	38	30	36.2	80	55	14.66	CLAY
ROAD FORK	KE-70-A	7/16/97	38	34	31	80	57	45	CLAY
STRANGE CREEK	KE-74-{10.4}	7/22/97	38	30	29.71	80	49	34.38	NICHOLAS
TRACE FORK	KE-74-E	7/22/97	38	30	14	80	49	10	NICHOLAS
BIG RUN	KE-74-F	7/22/97	38	30	28.95	80	49	58.56	NICHOLAS
BIRCH RIVER	KE-76-{0.9}	7/17/97	38	35	4.49	80	53	16	BRAXTON
LEATHERWOOD RUN	KE-76-A	7/23/97	38	35	30.47	80	51	51.58	BRAXTON
MIDDLE RUN	KE-76-C	7/21/97	38	34	43	80	49	49	BRAXTON
BUCKEYE FORK	KE-76-D-1	7/16/97	38	35	31.6	80	46	15.25	BRAXTON
LITTLE BIRCH RIVER	KE-76-E-{2.6}	7/16/97	38	34	14	80	45	4	BRAXTON
LAUREL RUN	KE-76-E-3	7/15/97	38	34	10	80	44	8	BRAXTON
WINDY RUN	KE-76-E-5	7/15/97	38	34	43	80	43	54	BRAXTON
SENG RUN	KE-76-E-6-A	7/15/97	38	35	10	80	42	15	BRAXTON
FISHER RUN	KE-76-E-7.5	7/15/97	38	34	19	80	41	22	BRAXTON
ANTHONY CREEK	KE-76-N-{2.4}	7/23/97	38	27	50	80	43	21	NICHOLAS
DRYHOUSE RUN	KE-76-N-6	7/24/97	38	27	41.58	80	43	18.73	NICHOLAS
RICH FORK	KE-76-N-8	7/24/97	38	27	13.58	80	42	34.88	NICHOLAS
POPLAR CREEK	KE-76-O	7/23/97	38	29	49.59	80	43	27.53	NICHOLAS
PANTHER LICK BR	KE-76-O-5	7/24/97	38	27	13	80	40	46	NICHOLAS
OTTER HOLE	KE-76-S.3	7/23/97	38	27	38	80	36	28	WEBSTER

Table 4. Sites sampled (continued)

Stream Name	Stream Code	Date	Latitude			Longitude			County
CHUFFY RUN	KE-76-S.8	7/23/97	38	27	54.17	80	34	57.43	WEBSTER
JOHNSON BRANCH	KE-76-U-{0.8}	7/23/97	38	26	37	80	33	57	WEBSTER
JACKS RUN	KE-76-W	7/15/97	38	25	56.76	80	35	3.05	WEBSTER
UPPER MILL RUN	KE-78	7/16/97	38	37	7.77	80	51	1.56	BRAXTON
DRY FORK	KE-78-A	7/16/97	38	37	20	80	50	35	BRAXTON
BIG RUN	KE-79	7/21/97	38	38	16	80	51	34	BRAXTON
ROCK CAMP RUN	KE-82	7/21/97	38	39	15.23	80	50	43.31	BRAXTON
BEAR RUN	KE-84.5	7/21/97	38	39	11	80	46	26	BRAXTON
LITTLE BUFFALO CK	KE-85	7/21/97	38	39	14	80	45	38	BRAXTON
LAUREL FORK	KE-87-B	7/28/97	38	41	15.4	80	40	15.14	BRAXTON
U.T./GRANNY CREEK	KE-87-C	7/24/97	38	41	52.28	80	40	10.54	BRAXTON
OLD WOMAN RUN	KE-88	7/28/97	38	39	49.79	80	42	10.4	BRAXTON
WOLF CREEK	KE-91	7/15/97	38	37	8	80	40	26	BRAXTON
SPRUCE FORK	KE-91-A-1	7/15/97	38	36	46	80	39	0.4	BRAXTON
FLATWOODS RUN	KE-94	7/28/97	38	40	51	80	37	51	BRAXTON
KANAWHA RUN	KE-98-A	7/7/97	38	40	15.5	80	32	52.64	BRAXTON
RT FK HOLLY RIVER	KE-98-B	7/14/97	38	34	7.76	80	24	3.61	WEBSTER
RT FK/HOLLY RIVER	KE-98-B-{13.6}	7/15/97	38	34	20.11	80	27	40.84	WEBSTER
DESERT FORK	KE-98-B-16	7/14/97	38	34	19	80	23	53	WEBSTER
UPPER MUDLICK	KE-98-B-16.4	7/14/97	38	33	44.73	80	23	7.25	WEBSTER
CARLO RUN	KE-98-B-16-B-{1.0}	7/8/97	38	35	16.56	80	20	38.14	WEBSTER
FALL RUN	KE-98-B-3-{0.6}	7/7/97	39	39	10.21	80	30	59.56	BRAXTON
WEASE RUN	KE-98-B-8	7/7/97	38	37	9	80	28	2	WEBSTER
LT FK/HOLLY RIVER	KE-98-C-{10.0}	7/8/97	38	40	46.36	80	28	4.98	WEBSTER
LT FK/HOLLY RIVER	KE-98-C-{13.8}	7/8/97	38	41	35.48	80	25	22.45	WEBSTER
LAURELPATCH RUN	KE-98-C-1	7/7/97	38	40	57	80	31	4	BRAXTON
WILSON FORK	KE-98-C-1-0.5A	7/7/97	38	41	47	80	31	13	BRAXTON
LAUREL FORK	KE-98-C-11	7/8/97	38	39	3	80	22	51	WEBSTER
RIGHT FK/LAUREL FK	KE-98-C-11-C	7/22/97	38	40	3.42	80	18	47.72	WEBSTER
JOHNS RUN	KE-98-C-13	7/22/97	38	38	23	80	20	3	WEBSTER
FALL RUN	KE-98-C-14-{1.4}	7/22/97	38	38	26	80	18	6	WEBSTER
BIG RUN/LT FK HOLLY	KE-98-C-15-{1.0}	7/8/97	38	37	6.36	80	18	28.78	WEBSTER
OLDLICK RUN	KE-98-C-2	7/8/97	38	39	52.64	80	28	25.92	WEBSTER
COUGAR FORK	KE-98-C-2-D	7/14/97	38	37	27	80	25	45	WEBSTER
LONG RUN	KE-98-C-5	7/8/97	38	40	51.1	80	26	24.55	WEBSTER
BEAR RUN	KE-98-C-6	7/8/97	38	41	17.74	80	26	24.11	WEBSTER
LAUREL CREEK	KE-102-{14.6}	7/15/97	38	28	30.67	80	32	56.26	WEBSTER
LAUREL CREEK	KE-102-{2.8}	7/9/97	38	35	3.59	80	35	6.64	BRAXTON
CAMP CREEK	KE-102-A	7/9/97	38	35	48	80	34	21	BRAXTON
UNT OF BROOKS CK	KE-102-C-1-{0.4}	7/9/97	38	33	42.2	80	36	28.55	WEBSTER
BACK FORK	KE-111-{0.2}	7/9/97	38	28	49.01	80	24	48.82	WEBSTER
SUGAR CREEK	KE-111-K	7/9/97	38	33	22.77	80	19	29.17	WEBSTER
LITTLE SUGAR CREEK	KE-111-K-2	7/9/97	38	34	12	80	18	23	WEBSTER
BIG RUN/BACK FK ELK	KE-111-Q	7/9/97	38	34	5.18	80	12	32.67	WEBSTER
FLINT RUN	KE-111-S	7/9/97	38	34	56	80	11	10	RANDOLPH
STEPS RUN	KE-115	7/8/97	38	30	27.71	80	19	36.42	WEBSTER
LEATHERWOOD CREEK	KE-117	7/8/97	38	29	3.47	80	17	59.07	WEBSTER
RT FK / LEATHERWOOD	KE-117-B	7/8/97	38	27	40	80	15	41	WEBSTER
BERGOO CREEK	KE-118	7/8/97	38	29	35.3	80	16	34.34	WEBSTER
BIG RUN	KE-124	7/8/97	38	31	26	80	14	28	WEBSTER
HICKORYLICK RUN	KE-128	7/7/97	38	32	22	80	9	45	RANDOLPH
DRY FORK	KE-133	7/7/97	38	28	12	80	6	40	POCAHONTAS
BIG RUN	KE-135	7/7/97	38	26	57	80	7	42	POCAHONTAS
PROPS RUN	KE-136-{0.5}	7/7/97	38	25	25.04	80	8	11.47	POCAHONTAS
LAUREL RUN	KE-137	7/7/97	38	25	8	80	7	52	POCAHONTAS

Table 4. Sites sampled (continued)

Stream Name	Stream Code	Date	Latitude			Longitude			County
BIG SPRING FORK	KE-138	7/14/97	38	24	59.51	80	7	14.4	POCAHONTAS
CUP RUN	KE-138-B	7/7/97	38	24	48	80	1	59	POCAHONTAS
OLD FIELD FORK	KE-139	7/7/97	38	25	4	80	7	49	POCAHONTAS
SLATY FORK	KE-139-0.5A	7/7/97	38	24	38	80	7	21	POCAHONTAS
CROOKED FORK	KE-139-B	7/22/97	38	19	32.59	80	6	7.97	POCAHONTAS

Table 5. Physical characteristics of 100 meter stream reach

Stream Code	Stream Width (m)	Riffle Depth (m)	Run Depth (m)	Pool Depth (m)
WVK-43-{1.2}	80	0.25	0.4	2
WVK-43-{105.2}	*			
WVK-43-{156.2}	23.7	0.15	0.3	0.75
WVK-43-{16.0}				
WVK-43-{46.6}				
WVK-43-{49.8}				
WVK-43-{63.0}	80	0.2	0.6	1
WVK-43-{87.4}	38.5	0.4	0.6	
WVKE-2				
WVKE-2-E	0.6	0.03	0.03	0.1
WVKE-3	1.6	0.02	0.2	0.5
WVKE-4	1.8	0.05		0.3
WVKE-6-{5.6}	4.6	0.05	0.15	0.6
WVKE-7-E	0.9	0.02	0.03	0.1
WVKE-9				
WVKE-9-{1.5}	10	0.16	0.75	1.1
WVKE-9-{15.0}	3	0.12	0.2	0.5
WVKE-9-B-1	1.2	0.03	0.05	0.1
WVKE-9-C-{0.6}	1.6	0.06	0.12	0.4
WVKE-9-E	2.5	0.1	0.1	0.3
WVKE-9-G	1.9	0.02	0.03	0.25
WVKE-9-I-1-A	2.7	0.08	0.12	0.25
WVKE-9-J	2.8	0.1	0.2	
WVKE-13	2	0.08	0.1	0.25
WVKE-14-G-1-{0.8}	3.1	0.11	0.14	0.3
WVKE-14-G-2	2.6	0.12	0.15	0.7
WVKE-14-G-2-A	1.3	0.1	0.2	
WVKE-14-K.1	1.3	0.09	0.2	0.45
WVKE-14-M	7	0.15	0.35	
WVKE-14-M-2	2.2	0.08		0.35
WVKE-14-O-{5.2}	4.8	0.02	0.04	0.3
WVKE-14-O-0.5	1.5	0.05		0.15
WVKE-14-P	6.2	0.1		0.3
WVKE-19-B	1.9	0.03	0.17	0.5
WVKE-19-H	1	0.02	0.05	0.12
WVKE-21	6.8	0.09	0.15	0.25
WVKE-23-{0.43}	16.7	0.07	0.25	0.15
WVKE-23-{12.6}	25.3	0.05	0.09	1
WVKE-23-D-6	0.8	0.02	0.03	0.28
WVKE-23-F-1	1.2	0.02	0.1	0.3
WVKE-23-L-5				
WVKE-23-P-{3.0}	9.1			0.35
WVKE-23-P-1	1		0.02	0.2
WVKE-23-P-3-A	1.8	0.05	0.2	0.35
WVKE-23-P-3-B	1.7	0.05	0.15	0.3
WVKE-26				
WVKE-26-A-{0.16}	3.2	0.08	0.3	0.5
WVKE-26-A-{0.16}				
WVKE-32-{1.0}	2			0.15
WVKE-34	1.3	0.03	0.08	0.2

Table 5. Physical characteristics of 100 meter stream reach (continued)

Stream Code	Stream Width (m)	Riffle Depth (m)	Run Depth (m)	Pool Depth (m)
WVKE-37	7.2	0.2	0.3	0.7
WVKE-37	4.5	0.04	0.12	0.4
WVKE-37-B	3.1	0.1	0.15	0.2
WVKE-37-D	3.2	0.1	0.11	0.15
WVKE-40	7.6	0.15	0.2	0.45
WVKE-41	12.8	0.12	0.35	0.55
WVKE-41-A	1.1	0.03	0.05	0.4
WVKE-41-B-{0.2}	3.5	0.03	0.18	0.25
WVKE-41-B-1.5	1.2	0.03	0.07	0.2
WVKE-41-C-1	1.7	0.03	0.07	0.15
WVKE-41-H				
WVKE-45-B	2.2	0.05	0.1	0.2
WVKE-46-{1.2}	7.5	0.1	0.2	0.7
WVKE-49	1.5	0.03	0.08	0.12
WVKE-50-{0.2}	18.6	0.06	0.3	0.6
WVKE-50-B-{0.1}	11.4	0.1	0.2	0.31
WVKE-50-B-1-{2.0}	1.4	0.03	0.18	0.25
WVKE-50-B-10	2.3	0.02	0.12	0.3
WVKE-50-B-7-{0.1}	3.3	0.07	0.15	0.3
WVKE-50-B-8	5.2	0.03	0.1	0.4
WVKE-50-B-9	2	0.04	0.14	0.21
WVKE-50-F-{2.2}	3.9	0.05	0.1	0.2
WVKE-50-G	0.9	0.01		0.6
WVKE-50-I	4	0.1	0.15	0.2
WVKE-50-I-3	1.5	0.05	0.1	0.2
WVKE-50-K	0.7	0.02		0.2
WVKE-50-O	8.2	0.1	0.3	0.45
WVKE-50-P	4.7	0.03	0.2	0.5
WVKE-50-S	1.3	0.08	0.15	
WVKE-50-T	1.5	0.04	0.1	0.25
WVKE-56	1.5	0.02	0.12	0.18
WVKE-59	1	0.01	0.02	0.32
WVKE-64	7.3	0.08	0.1	0.3
WVKE-64-C-2				
WVKE-64-D				0.13
WVKE-64-E	1.5		0.02	0.25
WVKE-69-{5.6}	4.1	0.05	0.1	0.45
WVKE-70-A	2.6	0.01	0.02	0.11
WVKE-74-{10.4}	4.8	0.1	0.15	0.2
WVKE-74-E				
WVKE-74-F	1.3	0.01		0.25
WVKE-76-{0.9}	14.5	0.2	0.4	1
WVKE-76-A	3.8	0.07	0.15	0.3
WVKE-76-C	4.7	0.05	0.1	0.3
WVKE-76-D-1	1.3	0.03	0.01	0.3
WVKE-76-E-{2.6}	11.6	0.09	0.16	0.3
WVKE-76-E-3				
WVKE-76-E-5	2.7	0.04	0.1	0.2
WVKE-76-E-6-A	2.3	0.08	0.1	0.5
WVKE-76-E-7.5	1.3	0.05	0.1	0.15

Table 5. Physical characteristics of 100 meter stream reach (continued)

Stream Code	Stream Width (m)	Riffle Depth (m)	Run Depth (m)	Pool Depth (m)
WVKE-76-N-{2.4}	4.6	0.1	0.3	0.5
WVKE-76-N-6				
WVKE-76-N-8	3	0.1	0.15	0.3
WVKE-76-O	3.9	0.15	0.15	0.25
WVKE-76-O-5				
WVKE-76-S.3	1.2	0.02	0.03	0.3
WVKE-76-S.8	0.7	0.01	0.02	0.1
WVKE-76-U-{0.8}	1.3	0.01	0.02	0.15
WVKE-76-W	1.8	0.1	0.15	0.25
WVKE-78	2.5	0.02	0.14	0.42
WVKE-78-A				
WVKE-79	0.7			0.4
WVKE-82	1.4	0.01		0.3
WVKE-84.5	3.5	0.02		0.2
WVKE-85	2.8	0.02		0.25
WVKE-87-B	2.7	0.1	0.15	0.2
WVKE-87-C	0.7	0.04	0.15	0.25
WVKE-88	1.8	0.05	0.1	0.3
WVKE-91	2.5	0.12	0.18	0.4
WVKE-91-A-1	6.8	0.12	0.15	0.32
WVKE-94	1.1	0.07	0.15	0.25
WVKE-98-A	3.2	0.1	0.12	0.12
WVKE-98-B	6.5	0.1	0.2	0.4
WVKE-98-B-{13.6}	15	0.1	0.25	0.35
WVKE-98-B-16	3.7	0.1	0.15	0.25
WVKE-98-B-16.4	0.5	0.02		0.05
WVKE-98-B-16-B-{1.0}	1.2	0.05		0.2
WVKE-98-B-3-{0.6}	1.5	0.1	0.15	
WVKE-98-B-8	1.5	0.05	0.09	0.2
WVKE-98-C-{10.0}	18.3	0.25	0.35	0.5
WVKE-98-C-{13.8}	10.7	0.15	0.2	1.8
WVKE-98-C-1	4.1	0.05	0.1	0.3
WVKE-98-C-1-0.5A	1	0.05	0.1	0.15
WVKE-98-C-11	6.6	0.15	0.25	0.3
WVKE-98-C-11-C	6.6	0.03	0.05	0.8
WVKE-98-C-13				
WVKE-98-C-14-{1.4}	5.4	0.09	0.2	0.35
WVKE-98-C-15-{1.0}	2.5	0.08	0.2	0.35
WVKE-98-C-2	5.9	0.05	0.07	
WVKE-98-C-2-D	3.3	0.01	0.05	0.2
WVKE-98-C-5	3.7	0.08	0.15	0.2
WVKE-98-C-6	1.3	0.05	0.05	0.2
WVKE-102-{14.6}	13.7	0.1	0.2	0.6
WVKE-102-{2.8}	12.4	0.15	0.45	0.5
WVKE-102-A	6.3	0.05	0.1	0.5
WVKE-102-C-1-{0.4}	0.6	0.01	0.02	0.1
WVKE-111-{0.2}	12.1	0.15	0.45	0.55
WVKE-111-K	10.7	0.1	0.3	0.4
WVKE-111-K-2	5.5	0.15	0.2	0.3
WVKE-111-Q	2.9	0.1	0.25	0.5

Table 5. Physical characteristics of 100 meter stream reach (continued)

Stream Code	Stream Width (m)	Riffle Depth (m)	Run Depth (m)	Pool Depth (m)
WVKE-111-S	2.2	0.1	0.2	0.35
WVKE-115	3.7	0.07		0.25
WVKE-117	9	0.2	0.35	0.6
WVKE-117-B	4.9	0.15	0.3	0.45
WVKE-118	6.9	0.15		0.7
WVKE-124	5.2	0.15		0.4
WVKE-128	4.2	0.1	0.2	0.3
WVKE-133				
WVKE-135				
WVKE-136-{0.5}	4.5	0.1		0.35
WVKE-137	6.3	0.12	0.2	0.55
WVKE-138	7	0.1	0.3	0.45
WVKE-138-B				
WVKE-139	8.2	0.1		0.3
WVKE-139-0.5A	4			0.3
WVKE-139-B	2.9	0.03	0.09	0.12

Blanks indicate ‘not measured’ for stream width and ‘habitat type not present’ for depths

Table 6. Observed Sediment Characteristics

Stream Code	Sediment odors	Sediment oils	Sediment deposits
WVK-43-{1.2}	normal	absent	sand,silt
WVK-43-{156.2}	normal	absent	sand
WVK-43-{46.6}	b.g.algae	absent	silt
WVK-43-{49.8}	normal	absent	silt
WVK-43-{63.0}	normal	absent	sand,silt
WVK-43-{87.4}	normal	absent	silt
WVKE-2-E	normal	absent	sand,silt
WVKE-3	normal	absent	sand
WVKE-4	normal	absent	sand
WVKE-6-{5.6}	none	absent	sand,silt
WVKE-7-E	normal	absent	sand,silt
WVKE-9-{1.5}	none	absent	sand,silt
WVKE-9-{15.0}	anaerobic	absent	sand,silt
WVKE-9-B-1	petroleum	slight	sand,silt
WVKE-9-C-{0.6}	normal	absent	sand,silt
WVKE-9-E	normal	absent	sand,silt
WVKE-9-G	normal	absent	sand,silt
WVKE-9-I-1-A	none	absent	sand,silt
WVKE-9-J	normal	absent	sand,silt
WVKE-13	normal	absent	sand,silt
WVKE-14-G-1-{0.8	normal	absent	sand,silt
WVKE-14-G-2	normal	absent	sand
WVKE-14-G-2-A	normal	absent	sand
WVKE-14-K.1	normal	absent	sand,silt
WVKE-14-M	normal	absent	sand
WVKE-14-M-2	normal	absent	sand,metal hydroxides
WVKE-14-O-{5.2}	normal	absent	sand,silt
WVKE-14-O-0.5	normal	absent	sand
WVKE-14-P	normal	absent	sand
WVKE-19-B	none	absent	sand
WVKE-19-H	none	absent	sand,silt
WVKE-21	normal,slight iron	absent	sand,silt
WVKE-23-{0.43}	normal	absent	sand,silt
WVKE-23-{12.6}	none	absent	sand,silt
WVKE-23-D-6	none	absent	sand,silt
WVKE-23-F-1	none	absent	sand,silt
WVKE-23-P-{3.0}	anaerobic	absent	sand,silt
WVKE-23-P-1	normal	absent	sand,silt
WVKE-23-P-3-A	normal	absent	sand,silt
WVKE-23-P-3-B	normal	absent	sand,silt
WVKE-26-A-{0.16}	none	absent	sand,silt,metal hydroxides
WVKE-32-{1.0}	normal	absent	sand,silt
WVKE-34	normal	absent	sand,silt
WVKE-37	normal	absent	sand,silt
WVKE-37	normal	absent	sand,silt
WVKE-37-B	normal	absent	sand,silt
WVKE-37-D	normal	absent	sand,silt
WVKE-40	none	absent	sand,silt
WVKE-41	normal	absent	sand,silt
WVKE-41-A	normal	absent	sand,silt

Table 6. Observed Sediment Characteristics (continued)

Stream Code	Sediment odors	Sediment oils	Sediment deposits
WVKE-41-B-{0.2}	normal	absent	sand,silt
WVKE-41-B-1.5	normal	absent	sand,silt
WVKE-41-C-1	normal	absent	sand,silt
WVKE-45-B	normal	absent	sand,silt
WVKE-46-{1.2}	normal	absent	sand,silt
WVKE-49	normal	absent	sand,silt
WVKE-50-{0.2}	normal	absent	sand,silt,coal pieces
WVKE-50-B-{0.1}	normal	absent	sand,silt
WVKE-50-B-1-{2.0	normal	absent	sand,silt
WVKE-50-B-10	normal	absent	sand,silt
WVKE-50-B-7-{0.1	normal	absent	sand,silt
WVKE-50-B-8	normal	absent	sand,silt
WVKE-50-B-9	normal	absent	sand,silt
WVKE-50-F-{2.2}	normal	absent	sand,silt
WVKE-50-G	normal	absent	sand,silt
WVKE-50-I	normal	absent	sand,silt
WVKE-50-I-3	normal	absent	sand,silt
WVKE-50-K	normal	absent	sand,silt
WVKE-50-O	normal	absent	sand,silt
WVKE-50-P	normal	absent	silt,clay,coal fines
WVKE-50-S	normal	absent	sand
WVKE-50-T	normal	absent	sand,silt,coal fines
WVKE-56	normal	absent	sand,silt
WVKE-59	normal	absent	sand,silt
WVKE-64	normal	absent	sand,silt
WVKE-64-D	normal	absent	sand,silt
WVKE-64-E	anaerobic	absent	sand,silt
WVKE-69-{5.6}	normal	absent	sand,silt
WVKE-70-A	normal	absent	sand,silt
WVKE-74-{10.4}	normal	absent	sand,silt
WVKE-74-F	normal	absent	sand,silt
WVKE-76-{0.9}	none	absent	sand,silt
WVKE-76-A	normal	absent	sand,silt
WVKE-76-C	normal	absent	sand,silt
WVKE-76-D-1	normal	absent	sand,silt
WVKE-76-E-{2.6}	normal	absent	sand,silt,clay
WVKE-76-E-5	normal	absent	sand,silt
WVKE-76-E-6-A	none	absent	sand,silt
WVKE-76-E-7.5	normal	absent	sand,silt
WVKE-76-N-{2.4}	normal	absent	sand
WVKE-76-N-8	normal	absent	sand,silt
WVKE-76-O	normal	absent	sand,silt
WVKE-76-S.3	normal	absent	sand
WVKE-76-S.8	normal	absent	sand
WVKE-76-U-{0.8}	normal	absent	sand,silt
WVKE-76-W	none	absent	sand,silt
WVKE-78	none	absent	sand,silt,clay
WVKE-79	normal	absent	sand,silt
WVKE-82	normal	slight	sand,silt
WVKE-84.5	normal	absent	sand,silt

Table 6. Observed Sediment Characteristics (continued)

Stream Code	Sediment odors	Sediment oils	Sediment deposits
WVKE-85	normal	absent	sand,silt
WVKE-87-B	normal	absent	sand
WVKE-87-C	normal	absent	sand,silt
WVKE-88	normal	absent	sand
WVKE-91	normal	absent	sand,silt
WVKE-91-A-1	anaerobic	absent	sand,silt
WVKE-94	normal	absent	sand,silt
WVKE-98-A	normal	absent	sand
WVKE-98-B	normal	absent	sand,silt
WVKE-98-B-{13.6}	normal	absent	sand,silt
WVKE-98-B-16	normal	absent	sand,silt
WVKE-98-B-16.4	normal	absent	sand,silt
WVKE-98-B-16-B-{	normal	absent	
WVKE-98-B-3-{0.6	normal	absent	sand,silt
WVKE-98-B-8	normal	absent	sand,silt
WVKE-98-C-{10.0}	chemical	absent	sand,silt
WVKE-98-C-{13.8}	none	absent	sand
WVKE-98-C-1	normal	absent	sand,silt
WVKE-98-C-1-0.5	normal	absent	sand,silt
WVKE-98-C-11	normal	absent	sand,silt
WVKE-98-C-11-C	anaerobic (slight)	absent	sand
WVKE-98-C-14-{1.	normal	absent	sand
WVKE-98-C-15-{1.	normal	absent	sand,silt
WVKE-98-C-2	normal	absent	sand,silt
WVKE-98-C-2-D	normal	absent	sand,silt
WVKE-98-C-5	normal	absent	sand,silt
WVKE-98-C-6	normal	absent	sand,silt
WVKE-102-{14.6}	normal	absent	sand,silt
WVKE-102-{2.8}	normal	absent	sand,silt,metal hydroxides
WVKE-102-A	normal	absent	sand,silt
WVKE-102-C-1-{0.	none	absent	sand,silt
WVKE-111-{0.2}	normal	absent	sand,silt
WVKE-111-K	normal	absent	sand,silt
WVKE-111-K-2	normal	absent	sand,silt
WVKE-111-Q	normal	absent	sand,silt
WVKE-111-S	normal	absent	sand,silt
WVKE-115	normal	absent	silt
WVKE-117	normal	absent	silt
WVKE-117-B	normal	absent	sand
WVKE-118	normal	absent	
WVKE-124	normal	absent	sand,silt
WVKE-128	normal	absent	sand,silt
WVKE-136-{0.5}	normal	absent	silt
WVKE-137	none	absent	silt
WVKE-138	normal	absent	sand,silt
WVKE-139	normal	absent	silt
WVKE-139-0.5A	normal	absent	
WVKE-139-B	normal	absent	sand,silt

Table 7. Substrate composition in area of macrobenthic collection

Stream Code	% bedrock	% boulder	% cobble	% gravel	% sand	% silt	% clay
WVK-43-{1.2}	0	0	30	30	35	5	0
WVK-43-{156.2}	0	30	55	10	5	0	0
WVK-43-{63.0}	0	20	50	20	10	0	0
WVK-43-{87.4}	0	10	60	20	10	0	0
WVKE-2-E	0	0	40	45	10	5	0
WVKE-3	0	0	5	60	30	5	0
WVKE-4	0	0	30	50	10	10	0
WVKE-6-{5.6}	0	0	30	40	20	10	0
WVKE-7-E	10	0	20	40	20	10	0
WVKE-9-{1.5}	0	0	20	30	45	5	0
WVKE-9-{15.0}	0	0	60	20	15	5	0
WVKE-9-B-1	0	0	45	45	9	1	0
WVKE-9-C-{0.6}	0	0	60	25	10	5	0
WVKE-9-E	0	5	40	40	15	0	0
WVKE-9-G	0	0	40	45	14	1	0
WVKE-9-I-1-A	0	25	50	15	10	0	0
WVKE-9-J	0	0	60	25	15	0	0
WVKE-13	0	0	45	45	8	2	0
WVKE-14-G-1-{0.8}	0	10	50	25	10	5	0
WVKE-14-G-2	0	5	40	40	5	10	0
WVKE-14-G-2-A	10	5	30	35	10	10	0
WVKE-14-K.1	0	5	25	30	30	10	0
WVKE-14-M	0	0	55	35	10	0	0
WVKE-14-M-2	0	0	45	45	5	5	0
WVKE-14-O-{5.2}	0	0	45	50	3	2	0
WVKE-14-O-0.5	65	0	10	10	10	5	0
WVKE-14-P	0	0	30	60	10	0	0
WVKE-19-B	0	20	60	15	5	0	0
WVKE-19-H	20	0	65	10	5	0	0
WVKE-21	0	0	35	50	10	0	0
WVKE-23-{0.43}	0	5	40	35	15	5	0
WVKE-23-{12.6}	0	0	30	50	15	5	0
WVKE-23-D-6	0	0	40	50	6	4	0
WVKE-23-F-1	0	0	40	40	15	5	0
WVKE-23-P-3-A	0	0	20	45	30	5	0
WVKE-23-P-3-B	0	0	15	50	30	5	0
WVKE-26-A-{0.16}	5	45	35	10	5	0	0
WVKE-32-{1.0}	0	0	100	0	0	0	0
WVKE-34	0	20	30	40	5	5	0
WVKE-37	0	5	45	40	10	0	0
WVKE-37	0	5	40	45	8	2	0
WVKE-37-B	0	0	50	45	5	0	0
WVKE-37-D	0	10	50	30	10	0	0
WVKE-40	0	0	30	50	15	5	0
WVKE-41	0	0	40	40	15	5	0
WVKE-41-A	0	0	45	45	7	3	0
WVKE-41-B-{0.2}	5	0	40	50	3	2	0
WVKE-41-B-1.5	0	5	40	50	3	2	0

Table 7. Substrate composition in area of macrobenthic collection (cont.)

Stream Code	% bedrock	% boulder	% cobble	% gravel	% sand	% silt	% clay
WVKE-41-C-1	0	0	45	45	7	3	0
WVKE-45-B	0	5	30	25	35	5	0
WVKE-46-{1.2}	0	0	40	25	30	5	0
WVKE-49	0	5	50	35	8	2	0
WVKE-50-{0.2}	0	5	30	50	15	0	0
WVKE-50-B-{0.1}	0	0	35	40	20	5	0
WVKE-50-B-1-{2.0}	0	5	45	40	9	1	0
WVKE-50-B-10	0	10	50	30	8	2	0
WVKE-50-B-7-{0.1}	0	0	40	25	25	10	0
WVKE-50-B-8	0	5	50	30	10	5	0
WVKE-50-B-9	0	10	40	35	10	5	0
WVKE-50-F-{2.2}	0	10	40	30	20	0	0
WVKE-50-G	50	0	25	25	0	0	0
WVKE-50-I	0	0	50	30	20	0	0
WVKE-50-I-3	0	0	35	25	30	5	5
WVKE-50-K	0	0	100	0	0	0	0
WVKE-50-O	0	5	40	25	25	5	0
WVKE-50-P	0	0	40	25	25	0	10
WVKE-50-S	0	3	40	30	20	5	2
WVKE-50-T	0	5	30	40	15	5	5
WVKE-56	5	5	50	30	5	3	2
WVKE-59	0	10	50	30	5	3	2
WVKE-64	0	0	20	50	20	10	0
WVKE-64-D	0	0	0	5	70	20	5
WVKE-64-E	0	0	0	5	10	70	15
WVKE-69-{5.6}	0	5	50	30	20	5	0
WVKE-70-A	0	0	45	35	10	5	5
WVKE-74-{10.4}	0	5	35	30	25	5	0
WVKE-74-F	0	5	30	40	25	0	0
WVKE-76-{0.9}	0	0	40	35	18	5	2
WVKE-76-A	0	5	20	40	30	5	0
WVKE-76-C	0	0	25	40	30	5	0
WVKE-76-D-1	0	3	55	30	10	2	0
WVKE-76-E-{2.6}	0	0	40	30	15	10	5
WVKE-76-E-5	0	0	20	30	30	15	5
WVKE-76-E-6-A	0	0	35	30	20	12	3
WVKE-76-E-7.5	0	0	30	50	15	5	0
WVKE-76-N-{2.4}	0	10	40	40	10	0	0
WVKE-76-N-8	0	0	50	30	15	5	0
WVKE-76-O	0	30	40	25	5	0	0
WVKE-76-S.3	0	10	30	55	5	0	0
WVKE-76-S.8	5	10	30	45	10	0	0
WVKE-76-U-{0.8}	0	0	30	65	5	0	0
WVKE-76-W	0	10	60	10	0	20	0
WVKE-78	0	0	15	50	15	15	5
WVKE-79	0	5	20	20	50	5	0
WVKE-82	0	10	10	20	40	20	0
WVKE-84.5	0	5	40	45	5	5	0

Table 7. Substrate composition in area of macrobenthic collection (cont.)

Stream Code	% bedrock	% boulder	% cobble	% gravel	% sand	% silt	% clay
WVKE-85	0	0	30	45	20	5	0
WVKE-87-B	5	15	30	30	20	0	0
WVKE-87-C	0	0	5	15	70	10	0
WVKE-88	0	0	40	50	10	0	0
WVKE-91	0	5	60	20	10	5	0
WVKE-91-A-1	0	0	40	40	15	5	0
WVKE-94	0	0	20	40	30	10	0
WVKE-98-A	0	5	50	45	0	0	0
WVKE-98-B	0	20	50	20	10	0	0
WVKE-98-B-{13.6}	0	30	50	10	10	0	0
WVKE-98-B-16	0	20	60	10	10	0	0
WVKE-98-B-16.4	0	20	50	20	10	0	0
WVKE-98-B-16-B-{1.0}	0	5	20	65	5	0	5
WVKE-98-B-3-{0.6}	0	25	40	35	0	0	0
WVKE-98-B-8	0	10	50	30	10	0	0
WVKE-98-C-{10.0}	0	30	50	10	10	0	0
WVKE-98-C-{13.8}	0	40	40	10	10	0	0
WVKE-98-C-1	0	15	50	25	10	0	0
WVKE-98-C-1-0.5A	0	20	50	20	10	0	0
WVKE-98-C-11	0	40	30	20	10	0	0
WVKE-98-C-11-C	0	5	45	40	10	0	0
WVKE-98-C-14-{1.4}	0	10	50	35	5	0	0
WVKE-98-C-15-{1.0}	0	5	30	40	20	5	0
WVKE-98-C-2	0	0	20	50	20	10	0
WVKE-98-C-2-D	0	40	30	15	15	0	0
WVKE-98-C-5	0	20	50	20	10	0	0
WVKE-98-C-6	0	10	50	30	10	0	0
WVKE-102-{14.6}	0	10	50	30	10	0	0
WVKE-102-{2.8}	0	40	30	20	10	0	0
WVKE-102-A	0	30	50	10	10	0	0
WVKE-102-C-1-{0.4}	0	0	0	0	90	10	0
WVKE-111-{0.2}	25	0	30	30	10	5	0
WVKE-111-K	5	0	30	45	15	5	0
WVKE-111-K-2	0	10	30	40	15	5	0
WVKE-111-Q	0	10	25	25	35	5	0
WVKE-111-S	0	15	25	35	20	5	0
WVKE-115	5	20	40	20	15	0	0
WVKE-117	50	0	25	10	10	5	0
WVKE-117-B	0	15	40	35	10	0	0
WVKE-118	5	10	40	30	10	5	0
WVKE-124	15	20	30	20	15	0	0
WVKE-128	0	15	50	25	10	0	0
WVKE-136-{0.5}	0	20	50	20	5	5	0
WVKE-137	0	10	60	20	5	5	0
WVKE-138	0	20	60	10	10	0	0
WVKE-139	0	20	60	15	5	0	0
WVKE-139-0.5A	70	10	10	5	5	0	0
WVKE-139-B	0	0	35	60	5	0	0

Table 8. Macrobenthic community metrics and WVSCI scores

Stream Code	Total Taxa	EPT taxa	% EPT	% 2 dom	% chiros	HBI	WVSCI
WVK-43-{1.2}	14	7	75.00	46.55	0.86	4.47	77.26
WVK-43-{156.2}	18	11	65.47	49.78	26.01	4.26	79.27
WVK-43-{63.0}	19	13	87.60	45.74	3.10	3.64	92.99
WVK-43-{87.4}	16	10	84.96	66.08	0.88	3.25	82.26
WVKE-2-E	11	4	7.44	78.51	65.29	5.91	36.25
WVKE-3	7	0	0.00	85.42	34.38	7.82	25.51
WVKE-4	12	4	34.78	67.83	44.35	4.96	50.55
WVKE-6-{5.6}	14	6	38.71	49.46	3.23	3.91	69.56
WVKE-7-E	9	3	32.00	78.67	48.00	5.41	41.87
WVKE-9-{1.5}	12	6	48.31	41.57	20.22	4.62	67.25
WVKE-9-{15.0}	8	3	78.87	70.42	5.63	3.77	62.70
WVKE-9-B-1	11	2	12.84	71.62	60.81	5.49	38.19
WVKE-9-C-{0.6}	13	5	65.00	54.00	2.00	4.14	70.75
WVKE-9-E	13	7	64.44	42.22	15.56	3.96	74.43
WVKE-9-G	15	9	52.82	64.08	38.03	4.44	65.85
WVKE-9-I-1-A	16	8	80.56	52.78	4.17	3.79	80.57
WVKE-9-J	11	4	71.05	71.05	10.53	4.37	62.56
WVKE-13	9	6	84.69	57.14	0.00	4.13	71.80
WVKE-14-G-1-{0.8}	12	6	84.21	75.79	4.21	2.14	71.58
WVKE-14-G-2	5	3	94.12	92.16	0.00	1.73	59.86
WVKE-14-G-2-A	7	4	87.16	86.24	5.50	1.65	62.65
WVKE-14-K.1	8	3	78.13	75.00	6.25	4.00	60.74
WVKE-14-M	7	3	90.91	78.79	3.03	2.43	64.40
WVKE-14-M-2	6	1	75.76	84.85	0.00	1.88	57.06
WVKE-14-O-{5.2}	16	8	60.51	48.41	8.28	3.76	77.45
WVKE-14-O-0.5	16	9	67.86	33.93	7.14	4.29	82.25
WVKE-14-P	13	9	85.97	68.33	6.79	2.10	78.05
WVKE-19-B	15	9	64.15	30.19	5.66	4.15	81.35
WVKE-19-H	12	6	59.04	49.40	3.61	4.14	71.07
WVKE-21	15	8	30.04	68.24	27.90	5.38	58.85
WVKE-23-{0.43}	13	6	56.72	51.49	3.73	4.00	71.22
WVKE-23-{12.6}	11	5	32.91	59.49	26.58	5.03	55.69
WVKE-23-D-6	8	4	65.12	62.79	0.00	3.91	63.95
WVKE-23-F-1	12	5	60.98	43.90	0.00	3.49	73.56
WVKE-23-P-{3.0}	6	2	26.67	60.00	33.33	4.67	46.32
WVKE-23-P-1	5	3	53.33	76.67	0.00	4.13	54.00
WVKE-23-P-3-A	15	8	64.14	37.93	9.66	4.18	78.83
WVKE-23-P-3-B	13	5	53.42	43.84	13.70	4.52	68.43
WVKE-26-A-{0.16}	5	1	53.85	76.92	23.08	3.15	50.04
WVKE-32-{1.0}	10	5	70.59	52.94	5.88	4.06	69.18
WVKE-34	7	3	64.96	54.70	22.22	5.01	57.79
WVKE-37	15	7	63.19	65.47	27.04	4.59	66.32
WVKE-37	11	5	83.48	67.83	1.74	4.28	68.63
WVKE-37-B	14	4	53.73	60.20	33.83	5.07	59.06
WVKE-37-D	15	5	43.17	74.17	46.49	5.30	52.91
WVKE-40	9	5	89.89	71.91	5.62	2.57	69.72
WVKE-41	15	6	80.33	49.73	6.01	4.01	77.14
WVKE-41-A	19	12	81.25	44.64	10.71	3.41	90.11
WVKE-41-B-{0.2}	13	5	85.83	58.27	1.57	4.27	73.18
WVKE-41-B-1.5	16	6	87.25	74.51	0.98	4.46	72.52
WVKE-41-C-1	9	4	57.38	55.74	32.79	4.80	57.72

Table 8. Macrobenthic community metrics and WVSCI scores

Stream Code	Total Taxa	EPT taxa	% EPT	% 2 dom	% chiros	HBI	WVSCI
WVKE-45-B	13	5	63.57	50.00	3.57	4.94	69.38
WVKE-46-{1.2}	15	7	54.72	49.06	13.21	4.55	71.48
WVKE-49	20	11	74.77	54.05	3.60	2.48	88.39
WVKE-50-{0.2}	13	7	80.91	56.36	10.91	3.62	75.31
WVKE-50-B-{0.1}	16	9	80.39	40.20	2.94	3.76	85.36
WVKE-50-B-1-{2.0}	16	10	77.10	56.49	5.34	2.30	83.43
WVKE-50-B-10	16	10	79.10	44.78	2.99	3.24	86.45
WVKE-50-B-7-{0.1}	7	2	50.00	63.64	9.09	3.95	56.15
WVKE-50-B-8	13	8	86.72	49.22	3.13	3.56	80.94
WVKE-50-B-9	14	9	70.83	56.94	11.11	3.68	76.50
WVKE-50-F-{2.2}	16	8	70.70	45.22	12.74	3.42	80.17
WVKE-50-G	19	11	79.49	41.88	8.55	3.06	90.42
WVKE-50-I	13	7	78.13	30.21	1.04	3.22	82.70
WVKE-50-I-3	3	2	95.45	95.45	0.00	5.09	50.99
WVKE-50-K	11	9	75.00	37.50	0.00	2.81	83.48
WVKE-50-O	16	8	63.89	43.06	6.94	3.65	79.93
WVKE-50-P	2	1	50.00	100.00	50.00	3.50	35.61
WVKE-50-S	6	3	98.93	98.57	0.00	2.09	58.98
WVKE-50-T	6	3	44.29	91.43	2.86	3.93	49.47
WVKE-56	14	9	92.31	67.95	1.28	3.29	80.02
WVKE-59	5	1	22.22	55.56	0.00	4.44	50.56
WVKE-64	13	6	88.64	74.13	6.62	4.35	69.80
WVKE-64-D	10	2	13.33	43.33	26.67	4.72	52.40
WVKE-64-E	11	2	7.14	71.43	61.90	5.57	36.84
WVKE-69-{5.6}	19	11	82.25	37.28	7.10	3.39	91.58
WVKE-70-A	11	5	68.81	53.21	8.26	4.28	68.68
WVKE-74-{10.4}	14	9	68.04	44.33	7.22	3.05	81.41
WVKE-74-F	21	12	59.48	27.59	12.93	3.23	90.04
WVKE-76-{0.9}	10	5	64.38	49.32	19.18	4.00	66.91
WVKE-76-A	13	7	62.18	47.06	4.20	3.00	76.91
WVKE-76-C	14	9	85.43	57.62	7.95	3.08	80.92
WVKE-76-D-1	15	9	64.67	37.33	12.67	4.17	79.88
WVKE-76-E-{2.6}	13	6	43.70	53.78	28.57	4.57	62.74
WVKE-76-E-5	13	9	77.52	46.51	6.20	3.82	80.13
WVKE-76-E-6-A	12	7	90.48	75.40	2.38	4.04	71.74
WVKE-76-E-7.5	17	9	70.24	52.38	17.86	4.52	76.85
WVKE-76-N-{2.4}	20	10	86.97	46.36	0.77	3.02	91.48
WVKE-76-N-8	20	12	75.15	44.85	5.45	3.13	91.28
WVKE-76-O	17	10	92.46	62.70	2.38	3.12	85.27
WVKE-76-S.3	18	10	71.57	37.25	5.88	3.35	87.87
WVKE-76-S.8	17	11	75.82	43.96	1.10	3.22	88.50
WVKE-76-U-{0.8}	13	9	76.22	62.16	2.70	2.52	78.58
WVKE-76-W	7	2	10.00	80.00	22.50	5.53	38.69
WVKE-78	13	5	38.89	50.93	29.63	4.89	60.40
WVKE-79	10	5	47.37	57.89	31.58	5.00	57.16
WVKE-82	12	4	51.35	56.76	1.35	4.34	65.12
WVKE-84.5	10	4	33.33	65.08	47.62	5.08	48.57
WVKE-85	16	8	63.08	71.54	26.92	4.44	67.16
WVKE-87-B	16	5	47.42	47.42	16.49	5.38	66.30
WVKE-87-C	6	1	20.00	50.00	10.00	6.67	45.67
WVKE-88	10	3	9.63	79.26	21.48	7.98	36.89

Table 8. Macrobenthic community metrics and WVSCI scores

Stream Code	Total Taxa	EPT taxa	% EPT	% 2 dom	% chiros	HBI	WVSCI
WVKE-91	15	6	63.93	36.07	14.75	3.78	76.79
WVKE-91-A-1	12	9	69.10	61.24	28.65	4.63	68.29
WVKE-94	16	7	37.63	43.01	4.30	3.84	73.91
WVKE-98-A	12	8	67.31	72.12	27.88	4.63	63.98
WVKE-98-B	20	12	80.82	44.90	5.31	3.53	91.39
WVKE-98-B-{13.6}	19	9	68.96	45.37	18.51	4.09	80.94
WVKE-98-B-16	16	10	85.08	40.88	5.52	2.87	88.91
WVKE-98-B-16.4	13	9	85.71	69.84	9.52	3.90	74.81
WVKE-98-B-16-B-{1.0}	11	9	57.30	64.04	0.00	2.29	73.36
WVKE-98-B-3-{0.6}	20	12	75.65	58.03	15.03	2.76	86.88
WVKE-98-B-8	14	7	82.20	66.10	4.24	3.94	74.16
WVKE-98-C-{10.0}	15	9	73.72	45.39	20.82	4.07	78.28
WVKE-98-C-{13.8}	16	10	84.59	45.49	3.76	3.64	86.18
WVKE-98-C-1	17	8	81.25	57.81	11.98	3.60	79.31
WVKE-98-C-1-0.5A	13	8	83.57	63.85	6.10	2.59	77.61
WVKE-98-C-11	15	10	61.74	40.87	9.57	3.30	82.26
WVKE-98-C-11-C	11	7	92.16	89.22	4.90	1.76	69.85
WVKE-98-C-14-{1.4}	18	12	90.50	72.62	5.20	3.67	84.03
WVKE-98-C-15-{1.0}	15	11	90.00	46.00	3.00	2.97	89.22
WVKE-98-C-2	13	6	68.45	47.62	23.21	4.25	70.49
WVKE-98-C-2-D	13	10	76.42	38.68	4.72	3.20	84.97
WVKE-98-C-5	12	8	89.33	58.67	4.00	3.75	77.58
WVKE-98-C-6	18	10	77.30	59.57	7.09	3.52	82.49
WVKE-102-{14.6}	20	11	81.95	44.74	1.13	3.86	90.27
WVKE-102-{2.8}	10	6	91.88	75.63	5.00	4.22	68.20
WVKE-102-A	18	12	86.82	54.26	6.98	3.04	89.32
WVKE-102-C-1-{0.4}	10	4	60.34	70.69	22.41	4.52	57.57
WVKE-111-{0.2}	15	10	58.00	58.00	36.00	4.34	70.24
WVKE-111-K	17	13	61.21	45.45	23.03	3.90	82.75
WVKE-111-K-2	16	10	78.57	48.41	5.56	2.60	85.77
WVKE-111-Q	15	10	87.10	60.83	5.07	3.29	82.46
WVKE-111-S	12	8	93.10	70.69	2.87	2.41	77.09
WVKE-115	12	6	76.47	62.75	3.92	3.86	71.36
WVKE-117	15	11	82.88	42.34	9.91	3.45	86.59
WVKE-117-B	14	11	86.75	54.97	4.64	3.28	84.49
WVKE-118	15	10	77.22	37.97	13.92	3.41	84.85
WVKE-124	17	11	85.33	46.67	6.67	2.75	89.34
WVKE-128	20	14	79.05	41.90	4.76	3.34	93.66
WVKE-136-{0.5}	15	11	91.41	50.78	1.56	3.45	87.36
WVKE-137	16	12	79.63	36.11	14.81	3.20	89.45
WVKE-138	15	8	42.23	51.39	19.52	4.35	69.29
WVKE-139	14	11	89.92	70.97	6.45	3.95	79.03
WVKE-139-B	17	12	71.73	56.96	15.19	4.33	80.67

Table 9. Benthic macroinvertebrates indentified

Stream Code	Taxa	count
WVK-43-{1.2}	Oligochaeta	1
WVK-43-{1.2}	Corbiculidae	2
WVK-43-{1.2}	Hydrobiidae	2
WVK-43-{1.2}	Baetidae	20
WVK-43-{1.2}	Heptageniidae	12
WVK-43-{1.2}	Tricorythidae	8
WVK-43-{1.2}	Isonychiidae	3
WVK-43-{1.2}	Brachycentridae	1
WVK-43-{1.2}	Hydropsychidae	34
WVK-43-{1.2}	Philopotamidae	9
WVK-43-{1.2}	Elmidae	10
WVK-43-{1.2}	Corydalidae	2
WVK-43-{1.2}	Simuliidae	11
WVK-43-{1.2}	Chironomidae	1
WVK-43-{156.2}	Oligochaeta	2
WVK-43-{156.2}	Baetidae	28
WVK-43-{156.2}	Ephemerellidae	7
WVK-43-{156.2}	Heptageniidae	18
WVK-43-{156.2}	Isonychiidae	19
WVK-43-{156.2}	Hydropsychidae	53
WVK-43-{156.2}	Rhyacophilidae	1
WVK-43-{156.2}	Philopotamidae	1
WVK-43-{156.2}	Capniidae/Leuctrid	4
WVK-43-{156.2}	Chloroperlidae	2
WVK-43-{156.2}	Perlidae	12
WVK-43-{156.2}	Pteronarcyidae	1
WVK-43-{156.2}	Elmidae	2
WVK-43-{156.2}	Corydalidae	1
WVK-43-{156.2}	Veliidae	2
WVK-43-{156.2}	Athericidae	11
WVK-43-{156.2}	Simuliidae	1
WVK-43-{156.2}	Chironomidae	58
WVK-43-{63.0}	Corbiculidae	1
WVK-43-{63.0}	Baetidae	17
WVK-43-{63.0}	Caenidae	1
WVK-43-{63.0}	Ephemerellidae	7
WVK-43-{63.0}	Ephemeridae	2
WVK-43-{63.0}	Heptageniidae	15
WVK-43-{63.0}	Tricorythidae	8
WVK-43-{63.0}	Isonychiidae	61
WVK-43-{63.0}	Brachycentridae	2
WVK-43-{63.0}	Hydropsychidae	57
WVK-43-{63.0}	Hydroptilidae	15
WVK-43-{63.0}	Philopotamidae	37
WVK-43-{63.0}	Leptoceridae	2
WVK-43-{63.0}	Perlidae	2
WVK-43-{63.0}	Elmidae	15
WVK-43-{63.0}	Corydalidae	4
WVK-43-{63.0}	Tipulidae	2
WVK-43-{63.0}	Simuliidae	2
WVK-43-{63.0}	Chironomidae	8
WVK-43-{87.4}	Oligochaeta	1
WVK-43-{87.4}	Corbiculidae	15
WVK-43-{87.4}	Ephemerellidae	9
WVK-43-{87.4}	Heptageniidae	18
WVK-43-{87.4}	Tricorythidae	7
WVK-43-{87.4}	Isonychiidae	164
WVK-43-{87.4}	Brachycentridae	16
WVK-43-{87.4}	Hydropsychidae	60
WVK-43-{87.4}	Hydroptilidae	1
WVK-43-{87.4}	Philopotamidae	9
WVK-43-{87.4}	Leptoceridae	3
WVK-43-{87.4}	Polycentropodidae	1
WVK-43-{87.4}	Elmidae	27
WVK-43-{87.4}	Corydalidae	3
WVK-43-{87.4}	Simuliidae	2
WVK-43-{87.4}	Chironomidae	3
WVKE-102-A	Baetidae	33
WVKE-102-A	Ephemerellidae	1
WVKE-102-A	Heptageniidae	14
WVKE-102-A	Leptophlebiidae	3
WVKE-102-A	Glossosomatidae	1
WVKE-102-A	Hydropsychidae	9
WVKE-102-A	Rhyacophilidae	1
WVKE-102-A	Philopotamidae	7
WVKE-102-A	Capniidae/Leuctrid	37
WVKE-102-A	Chloroperlidae	1
WVKE-102-A	Perlidae	4
WVKE-102-A	Pteronarcyidae	1
WVKE-102-A	Dryopidae	2
WVKE-102-A	Elmidae	1
WVKE-102-A	Psephenidae	1
WVKE-102-A	Tipulidae	3
WVKE-102-A	Simuliidae	1
WVKE-102-A	Chironomidae	9
WVKE-102-C-1-{0.4}	Baetidae	28
WVKE-102-C-1-{0.4}	Ephemerellidae	1
WVKE-102-C-1-{0.4}	Hydropsychidae	1
WVKE-102-C-1-{0.4}	Phryganeidae	5
WVKE-102-C-1-{0.4}	Corydalidae	2
WVKE-102-C-1-{0.4}	Sialidae	1
WVKE-102-C-1-{0.4}	Corixidae	2
WVKE-102-C-1-{0.4}	Gerridae	1
WVKE-102-C-1-{0.4}	Tipulidae	4
WVKE-102-C-1-{0.4}	Chironomidae	13
WVKE-102-{14.6}	Oligochaeta	1
WVKE-102-{14.6}	Cambaridae	1
WVKE-102-{14.6}	Baetidae	35
WVKE-102-{14.6}	Caenidae	1
WVKE-102-{14.6}	Ephemerellidae	1
WVKE-102-{14.6}	Heptageniidae	51
WVKE-102-{14.6}	Isonychiidae	20
WVKE-102-{14.6}	Hydropsychidae	68
WVKE-102-{14.6}	Rhyacophilidae	2

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-102-{14.6}	Philopotamidae	20
WVKE-102-{14.6}	Polycentropodidae	1
WVKE-102-{14.6}	Capniidae/Leuctrid	10
WVKE-102-{14.6}	Perlidae	9
WVKE-102-{14.6}	Elmidae	12
WVKE-102-{14.6}	Psephenidae	3
WVKE-102-{14.6}	Corydalidae	7
WVKE-102-{14.6}	Athericidae	9
WVKE-102-{14.6}	Tipulidae	3
WVKE-102-{14.6}	Simuliidae	9
WVKE-102-{14.6}	Chironomidae	3
WVKE-102-{2.8}	Oligochaeta	2
WVKE-102-{2.8}	Baetidae	84
WVKE-102-{2.8}	Heptageniidae	14
WVKE-102-{2.8}	Isonychiidae	4
WVKE-102-{2.8}	Hydropsychidae	37
WVKE-102-{2.8}	Capniidae/Leuctrid	1
WVKE-102-{2.8}	Perlidae	7
WVKE-102-{2.8}	Athericidae	1
WVKE-102-{2.8}	Simuliidae	2
WVKE-102-{2.8}	Chironomidae	8
WVKE-111-K	Baetidae	37
WVKE-111-K	Ephemerellidae	8
WVKE-111-K	Heptageniidae	7
WVKE-111-K	Leptophlebiidae	3
WVKE-111-K	Hydropsychidae	11
WVKE-111-K	Rhyacophilidae	1
WVKE-111-K	Philopotamidae	1
WVKE-111-K	Polycentropodidae	1
WVKE-111-K	Capniidae/Leuctrid	10
WVKE-111-K	Chloroperlidae	11
WVKE-111-K	Perlidae	9
WVKE-111-K	Pteronarcyidae	1
WVKE-111-K	Perlodidae	1
WVKE-111-K	Corydalidae	1
WVKE-111-K	Tipulidae	14
WVKE-111-K	Simuliidae	11
WVKE-111-K	Chironomidae	38
WVKE-111-K-2	Baetidae	8
WVKE-111-K-2	Ephemerellidae	4
WVKE-111-K-2	Heptageniidae	11
WVKE-111-K-2	Leptophlebiidae	4
WVKE-111-K-2	Hydropsychidae	12
WVKE-111-K-2	Rhyacophilidae	1
WVKE-111-K-2	Philopotamidae	1
WVKE-111-K-2	Capniidae/Leuctrid	47
WVKE-111-K-2	Chloroperlidae	7
WVKE-111-K-2	Perlidae	4
WVKE-111-K-2	Elmidae	2
WVKE-111-K-2	Cossidae	1
WVKE-111-K-2	Tipulidae	14
WVKE-111-K-2	Ceratopogonidae	1
WVKE-111-K-2	Simuliidae	2
WVKE-111-K-2	Chironomidae	7
WVKE-111-Q	Baetidae	106
WVKE-111-Q	Ephemerellidae	10
WVKE-111-Q	Heptageniidae	5
WVKE-111-Q	Leptophlebiidae	8
WVKE-111-Q	Glossosomatidae	3
WVKE-111-Q	Hydropsychidae	2
WVKE-111-Q	Philopotamidae	15
WVKE-111-Q	Capniidae/Leuctrid	12
WVKE-111-Q	Chloroperlidae	26
WVKE-111-Q	Perlodidae	2
WVKE-111-Q	Elmidae	5
WVKE-111-Q	Psephenidae	1
WVKE-111-Q	Tipulidae	10
WVKE-111-Q	Simuliidae	1
WVKE-111-Q	Chironomidae	11
WVKE-111-S	Oligochaeta	1
WVKE-111-S	Baetidae	27
WVKE-111-S	Caenidae	1
WVKE-111-S	Heptageniidae	34
WVKE-111-S	Capniidae/Leuctrid	89
WVKE-111-S	Chloroperlidae	5
WVKE-111-S	Nemouridae	4
WVKE-111-S	Peltoperlidae	1
WVKE-111-S	Perlodidae	1
WVKE-111-S	Gerridae	1
WVKE-111-S	Tipulidae	5
WVKE-111-S	Chironomidae	5
WVKE-111-{0.2}	Oligochaeta	2
WVKE-111-{0.2}	Cambaridae	2
WVKE-111-{0.2}	Baetidae	22
WVKE-111-{0.2}	Caenidae	1
WVKE-111-{0.2}	Ephemerellidae	2
WVKE-111-{0.2}	Heptageniidae	9
WVKE-111-{0.2}	Leptophlebiidae	1
WVKE-111-{0.2}	Isonychiidae	6
WVKE-111-{0.2}	Hydropsychidae	3
WVKE-111-{0.2}	Capniidae/Leuctrid	6
WVKE-111-{0.2}	Perlidae	7
WVKE-111-{0.2}	Perlodidae	1
WVKE-111-{0.2}	Elmidae	1
WVKE-111-{0.2}	Tipulidae	1
WVKE-111-{0.2}	Chironomidae	36
WVKE-115	Oligochaeta	1
WVKE-115	Cambaridae	1
WVKE-115	Gammaridae	4
WVKE-115	Baetidae	12
WVKE-115	Heptageniidae	20
WVKE-115	Leptophlebiidae	1
WVKE-115	Oligoneuriidae	1

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-115	Capniidae/Leuctrid	2
WVKE-115	Peltoperlidae	3
WVKE-115	Elmidae	2
WVKE-115	Tipulidae	2
WVKE-115	Chironomidae	2
WVKE-117	Baetidae	33
WVKE-117	Ephemerellidae	4
WVKE-117	Heptageniidae	6
WVKE-117	Leptophlebiidae	1
WVKE-117	Hydropsychidae	14
WVKE-117	Rhyacophilidae	1
WVKE-117	Philopotamidae	4
WVKE-117	Capniidae/Leuctrid	3
WVKE-117	Chloroperlidae	12
WVKE-117	Perlidae	13
WVKE-117	Pteronarcyidae	1
WVKE-117	Elmidae	4
WVKE-117	Tipulidae	1
WVKE-117	Simuliidae	3
WVKE-117	Chironomidae	11
WVKE-117-B	Baetidae	48
WVKE-117-B	Heptageniidae	35
WVKE-117-B	Leptophlebiidae	1
WVKE-117-B	Rhyacophilidae	2
WVKE-117-B	Philopotamidae	5
WVKE-117-B	Lepidostomatidae	1
WVKE-117-B	Capniidae/Leuctrid	17
WVKE-117-B	Chloroperlidae	16
WVKE-117-B	Perlidae	2
WVKE-117-B	Pteronarcyidae	1
WVKE-117-B	Perlodidae	3
WVKE-117-B	Tipulidae	5
WVKE-117-B	Simuliidae	8
WVKE-117-B	Chironomidae	7
WVKE-118	Oligochaeta	1
WVKE-118	Baetidae	19
WVKE-118	Heptageniidae	2
WVKE-118	Leptophlebiidae	5
WVKE-118	Hydropsychidae	7
WVKE-118	Rhyacophilidae	1
WVKE-118	Philopotamidae	5
WVKE-118	Capniidae/Leuctrid	7
WVKE-118	Chloroperlidae	6
WVKE-118	Perlidae	8
WVKE-118	Perlodidae	1
WVKE-118	Corydalidae	1
WVKE-118	Tipulidae	3
WVKE-118	Simuliidae	2
WVKE-118	Chironomidae	11
WVKE-124	Oligochaeta	1
WVKE-124	Baetidae	8
WVKE-124	Heptageniidae	4
WVKE-124	Leptophlebiidae	4
WVKE-124	Hydropsychidae	1
WVKE-124	Rhyacophilidae	4
WVKE-124	Philopotamidae	20
WVKE-124	Capniidae/Leuctrid	15
WVKE-124	Chloroperlidae	5
WVKE-124	Peltoperlidae	1
WVKE-124	Pteronarcyidae	1
WVKE-124	Perlodidae	1
WVKE-124	Curculionidae	1
WVKE-124	Elmidae	1
WVKE-124	Tipulidae	2
WVKE-124	Simuliidae	1
WVKE-124	Chironomidae	5
WVKE-128	Cambaridae	2
WVKE-128	Gammaridae	4
WVKE-128	Baetidae	22
WVKE-128	Ephemerellidae	4
WVKE-128	Heptageniidae	22
WVKE-128	Leptophlebiidae	6
WVKE-128	Glossosomatidae	1
WVKE-128	Hydropsychidae	1
WVKE-128	Rhyacophilidae	2
WVKE-128	Philopotamidae	1
WVKE-128	Capniidae/Leuctrid	9
WVKE-128	Chloroperlidae	4
WVKE-128	Peltoperlidae	1
WVKE-128	Perlidae	3
WVKE-128	Pteronarcyidae	3
WVKE-128	Perlodidae	4
WVKE-128	Elmidae	1
WVKE-128	Tipulidae	1
WVKE-128	Simuliidae	9
WVKE-128	Chironomidae	5
WVKE-13	Asellidae	1
WVKE-13	Baetidae	24
WVKE-13	Heptageniidae	32
WVKE-13	Leptophlebiidae	1
WVKE-13	Hydropsychidae	22
WVKE-13	Perlidae	3
WVKE-13	Perlodidae	1
WVKE-13	Elmidae	9
WVKE-13	Psephenidae	5
WVKE-136-{0.5}	Oligochaeta	6
WVKE-136-{0.5}	Baetidae	31
WVKE-136-{0.5}	Ephemerellidae	10
WVKE-136-{0.5}	Heptageniidae	34
WVKE-136-{0.5}	Leptophlebiidae	3
WVKE-136-{0.5}	Hydropsychidae	4
WVKE-136-{0.5}	Rhyacophilidae	5
WVKE-136-{0.5}	Philopotamidae	7
WVKE-136-{0.5}	Capniidae/Leuctrid	5

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-136-{0.5}	Chloroperlidae	11
WVKE-136-{0.5}	Pteronarcyidae	4
WVKE-136-{0.5}	Perlodidae	3
WVKE-136-{0.5}	Elmidae	1
WVKE-136-{0.5}	Tipulidae	2
WVKE-136-{0.5}	Chironomidae	2
WVKE-137	Baetidae	18
WVKE-137	Ephemerellidae	3
WVKE-137	Heptageniidae	6
WVKE-137	Leptophlebiidae	4
WVKE-137	Hydropsychidae	4
WVKE-137	Rhyacophilidae	2
WVKE-137	Philopotamidae	12
WVKE-137	Polycentropodidae	3
WVKE-137	Capniidae/Leuctrid	21
WVKE-137	Chloroperlidae	11
WVKE-137	Perlidae	1
WVKE-137	Pteronarcyidae	1
WVKE-137	Tipulidae	2
WVKE-137	Empididae	1
WVKE-137	Simuliidae	3
WVKE-137	Chironomidae	16
WVKE-138	Oligochaeta	1
WVKE-138	Gammaridae	66
WVKE-138	Baetidae	63
WVKE-138	Ephemerellidae	2
WVKE-138	Heptageniidae	3
WVKE-138	Glossosomatidae	3
WVKE-138	Hydropsychidae	15
WVKE-138	Hydroptilidae	2
WVKE-138	Rhyacophilidae	3
WVKE-138	Capniidae/Leuctrid	15
WVKE-138	Elmidae	7
WVKE-138	Hydrochidae	1
WVKE-138	Tipulidae	1
WVKE-138	Simuliidae	20
WVKE-138	Chironomidae	49
WVKE-139	Oligochaeta	2
WVKE-139	Baetidae	158
WVKE-139	Ephemerellidae	1
WVKE-139	Heptageniidae	15
WVKE-139	Leptophlebiidae	1
WVKE-139	Isonychiidae	1
WVKE-139	Glossosomatidae	1
WVKE-139	Hydropsychidae	10
WVKE-139	Philopotamidae	18
WVKE-139	Capniidae/Leuctrid	16
WVKE-139	Chloroperlidae	1
WVKE-139	Perlidae	1
WVKE-139	Simuliidae	7
WVKE-139	Chironomidae	16
WVKE-139-B	Cambaridae	1
WVKE-139-B	Baetidae	17
WVKE-139-B	Ephemerellidae	2
WVKE-139-B	Heptageniidae	13
WVKE-139-B	Isonychiidae	5
WVKE-139-B	Glossosomatidae	2
WVKE-139-B	Hydropsychidae	99
WVKE-139-B	Rhyacophilidae	3
WVKE-139-B	Philopotamidae	14
WVKE-139-B	Polycentropodidae	1
WVKE-139-B	Capniidae/Leuctrid	10
WVKE-139-B	Chloroperlidae	2
WVKE-139-B	Perlidae	2
WVKE-139-B	Corydalidae	10
WVKE-139-B	Tipulidae	19
WVKE-139-B	Simuliidae	1
WVKE-139-B	Chironomidae	36
WVKE-14-G-1-{0.8}	Cambaridae	2
WVKE-14-G-1-{0.8}	Baetidae	2
WVKE-14-G-1-{0.8}	Heptageniidae	3
WVKE-14-G-1-{0.8}	Hydropsychidae	10
WVKE-14-G-1-{0.8}	Capniidae/Leuctrid	62
WVKE-14-G-1-{0.8}	Chloroperlidae	1
WVKE-14-G-1-{0.8}	Perlidae	2
WVKE-14-G-1-{0.8}	Dryopidae	1
WVKE-14-G-1-{0.8}	Elmidae	1
WVKE-14-G-1-{0.8}	Corydalidae	2
WVKE-14-G-1-{0.8}	Tipulidae	5
WVKE-14-G-1-{0.8}	Chironomidae	4
WVKE-14-G-2	Heptageniidae	1
WVKE-14-G-2	Hydropsychidae	6
WVKE-14-G-2	Capniidae/Leuctrid	41
WVKE-14-G-2	Corydalidae	2
WVKE-14-G-2	Tipulidae	1
WVKE-14-G-2-A	Hydropsychidae	4
WVKE-14-G-2-A	Capniidae/Leuctrid	88
WVKE-14-G-2-A	Nemouridae	2
WVKE-14-G-2-A	Perlodidae	1
WVKE-14-G-2-A	Corydalidae	3
WVKE-14-G-2-A	Tipulidae	5
WVKE-14-G-2-A	Chironomidae	6
WVKE-14-K.1	Oligochaeta	1
WVKE-14-K.1	Cambaridae	1
WVKE-14-K.1	Hydropsychidae	16
WVKE-14-K.1	Capniidae/Leuctrid	8
WVKE-14-K.1	Nemouridae	1
WVKE-14-K.1	Corydalidae	1
WVKE-14-K.1	Tipulidae	2
WVKE-14-K.1	Chironomidae	2
WVKE-14-M	Baetidae	20
WVKE-14-M	Hydropsychidae	12

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-14-M	Capniidae/Leuctrid	58
WVKE-14-M	Dryopidae	2
WVKE-14-M	Elmidae	3
WVKE-14-M	Tipulidae	1
WVKE-14-M	Chironomidae	3
WVKE-14-M-2	Turbellaria	1
WVKE-14-M-2	Oligochaeta	1
WVKE-14-M-2	Cambaridae	2
WVKE-14-M-2	Gammaridae	1
WVKE-14-M-2	Capniidae/Leuctrid	25
WVKE-14-M-2	Tipulidae	3
WVKE-14-O-0.5	Oligochaeta	1
WVKE-14-O-0.5	Cambaridae	3
WVKE-14-O-0.5	Baetidae	12
WVKE-14-O-0.5	Heptageniidae	4
WVKE-14-O-0.5	Leptophlebiidae	5
WVKE-14-O-0.5	Hydropsychidae	6
WVKE-14-O-0.5	Philopotamidae	2
WVKE-14-O-0.5	Limnephilidae	1
WVKE-14-O-0.5	Capniidae/Leuctrid	6
WVKE-14-O-0.5	Chloroperlidae	1
WVKE-14-O-0.5	Perlodidae	1
WVKE-14-O-0.5	Elmidae	1
WVKE-14-O-0.5	Corydalidae	1
WVKE-14-O-0.5	Gerridae	7
WVKE-14-O-0.5	Tipulidae	1
WVKE-14-O-0.5	Chironomidae	4
WVKE-14-O-{5.2}	Baetidae	13
WVKE-14-O-{5.2}	Heptageniidae	2
WVKE-14-O-{5.2}	Isonychiidae	2
WVKE-14-O-{5.2}	Glossosomatidae	3
WVKE-14-O-{5.2}	Hydropsychidae	43
WVKE-14-O-{5.2}	Philopotamidae	2
WVKE-14-O-{5.2}	Capniidae/Leuctrid	27
WVKE-14-O-{5.2}	Perlidae	3
WVKE-14-O-{5.2}	Aeshnidae	1
WVKE-14-O-{5.2}	Gomphidae	2
WVKE-14-O-{5.2}	Dryopidae	1
WVKE-14-O-{5.2}	Elmidae	33
WVKE-14-O-{5.2}	Corydalidae	5
WVKE-14-O-{5.2}	Gerridae	1
WVKE-14-O-{5.2}	Tipulidae	6
WVKE-14-O-{5.2}	Chironomidae	13
WVKE-14-P	Baetidae	13
WVKE-14-P	Ephemerellidae	2
WVKE-14-P	Heptageniidae	12
WVKE-14-P	Leptophlebiidae	4
WVKE-14-P	Hydropsychidae	5
WVKE-14-P	Rhyacophilidae	1
WVKE-14-P	Philopotamidae	15
WVKE-14-P	Capniidae/Leuctrid	136
WVKE-14-P	Perlidae	2
WVKE-14-P	Elmidae	2
WVKE-14-P	Tipulidae	13
WVKE-14-P	Simuliidae	1
WVKE-14-P	Chironomidae	15
WVKE-19-B	Oligochaeta	7
WVKE-19-B	Ephemerellidae	1
WVKE-19-B	Heptageniidae	3
WVKE-19-B	Leptophlebiidae	5
WVKE-19-B	Hydropsychidae	6
WVKE-19-B	Philopotamidae	9
WVKE-19-B	Polycentropodidae	1
WVKE-19-B	Capniidae/Leuctrid	7
WVKE-19-B	Perlidae	1
WVKE-19-B	Perlodidae	1
WVKE-19-B	Dryopidae	2
WVKE-19-B	Elmidae	1
WVKE-19-B	Corydalidae	1
WVKE-19-B	Tipulidae	5
WVKE-19-B	Chironomidae	3
WVKE-19-H	Cambaridae	5
WVKE-19-H	Asellidae	2
WVKE-19-H	Baetidae	4
WVKE-19-H	Heptageniidae	11
WVKE-19-H	Leptophlebiidae	6
WVKE-19-H	Hydropsychidae	23
WVKE-19-H	Limnephilidae	1
WVKE-19-H	Perlidae	4
WVKE-19-H	Aeshnidae	1
WVKE-19-H	Elmidae	18
WVKE-19-H	Tipulidae	5
WVKE-19-H	Chironomidae	3
WVKE-2-E	Oligochaeta	11
WVKE-2-E	Cambaridae	2
WVKE-2-E	Baetidae	2
WVKE-2-E	Heptageniidae	1
WVKE-2-E	Hydropsychidae	5
WVKE-2-E	Perlidae	1
WVKE-2-E	Calopterygidae	1
WVKE-2-E	Elmidae	16
WVKE-2-E	Psephenidae	2
WVKE-2-E	Veliidae	1
WVKE-2-E	Chironomidae	79
WVKE-21	Oligochaeta	1
WVKE-21	Baetidae	76
WVKE-21	Heptageniidae	2
WVKE-21	Leptophlebiidae	3
WVKE-21	Isonychiidae	2
WVKE-21	Hydropsychidae	45
WVKE-21	Capniidae/Leuctrid	5
WVKE-21	Nemouridae	1

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-21	Perlidae	6
WVKE-21	Elmidae	4
WVKE-21	Corydalidae	1
WVKE-21	Empididae	1
WVKE-21	Simuliidae	188
WVKE-21	Chironomidae	130
WVKE-21	Dolichopodidae	1
WVKE-23-D-6	Cambaridae	3
WVKE-23-D-6	Heptageniidae	20
WVKE-23-D-6	Hydropsychidae	1
WVKE-23-D-6	Limnephilidae	4
WVKE-23-D-6	Perlidae	3
WVKE-23-D-6	Dryopidae	1
WVKE-23-D-6	Elmidae	4
WVKE-23-D-6	Psephenidae	7
WVKE-23-F-1	Hirudinidae	2
WVKE-23-F-1	Cambaridae	9
WVKE-23-F-1	Baetidae	2
WVKE-23-F-1	Heptageniidae	9
WVKE-23-F-1	Hydropsychidae	3
WVKE-23-F-1	Capniidae/Leuctrid	3
WVKE-23-F-1	Perlidae	8
WVKE-23-F-1	Dryopidae	1
WVKE-23-F-1	Elmidae	1
WVKE-23-F-1	Psephenidae	1
WVKE-23-F-1	Corydalidae	1
WVKE-23-F-1	Tipulidae	1
WVKE-23-P-1	Physidae	3
WVKE-23-P-1	Heptageniidae	12
WVKE-23-P-1	Hydropsychidae	1
WVKE-23-P-1	Perlidae	3
WVKE-23-P-1	Psephenidae	11
WVKE-23-P-3-A	Oligochaeta	6
WVKE-23-P-3-A	Baetidae	2
WVKE-23-P-3-A	Heptageniidae	21
WVKE-23-P-3-A	Isonychiidae	5
WVKE-23-P-3-A	Hydropsychidae	34
WVKE-23-P-3-A	Philopotamidae	21
WVKE-23-P-3-A	Capniidae/Leuctrid	4
WVKE-23-P-3-A	Chloroperlidae	5
WVKE-23-P-3-A	Perlidae	1
WVKE-23-P-3-A	Aeshnidae	1
WVKE-23-P-3-A	Elmidae	17
WVKE-23-P-3-A	Psephenidae	1
WVKE-23-P-3-A	Tipulidae	12
WVKE-23-P-3-A	Empididae	1
WVKE-23-P-3-A	Chironomidae	14
WVKE-23-P-3-B	Oligochaeta	3
WVKE-23-P-3-B	Cambaridae	1
WVKE-23-P-3-B	Baetidae	1
WVKE-23-P-3-B	Heptageniidae	10
WVKE-23-P-3-B	Hydropsychidae	22
WVKE-23-P-3-B	Capniidae/Leuctrid	1
WVKE-23-P-3-B	Perlidae	5
WVKE-23-P-3-B	Elmidae	5
WVKE-23-P-3-B	Psephenidae	4
WVKE-23-P-3-B	Veliidae	1
WVKE-23-P-3-B	Tipulidae	9
WVKE-23-P-3-B	Empididae	1
WVKE-23-P-3-B	Chironomidae	10
WVKE-23-P-{3.0}	Cambaridae	1
WVKE-23-P-{3.0}	Baetidae	1
WVKE-23-P-{3.0}	Heptageniidae	3
WVKE-23-P-{3.0}	Aeshnidae	1
WVKE-23-P-{3.0}	Elmidae	4
WVKE-23-P-{3.0}	Chironomidae	5
WVKE-23-{0.43}	Oligochaeta	3
WVKE-23-{0.43}	Heptageniidae	5
WVKE-23-{0.43}	Isonychiidae	8
WVKE-23-{0.43}	Hydropsychidae	22
WVKE-23-{0.43}	Philopotamidae	37
WVKE-23-{0.43}	Capniidae/Leuctrid	3
WVKE-23-{0.43}	Chloroperlidae	1
WVKE-23-{0.43}	Elmidae	32
WVKE-23-{0.43}	Corydalidae	12
WVKE-23-{0.43}	Veliidae	2
WVKE-23-{0.43}	Tipulidae	3
WVKE-23-{0.43}	Empididae	1
WVKE-23-{0.43}	Chironomidae	5
WVKE-23-{12.6}	Oligochaeta	2
WVKE-23-{12.6}	Baetidae	3
WVKE-23-{12.6}	Heptageniidae	7
WVKE-23-{12.6}	Isonychiidae	12
WVKE-23-{12.6}	Hydraenidae	1
WVKE-23-{12.6}	Hydropsychidae	2
WVKE-23-{12.6}	Capniidae/Leuctrid	2
WVKE-23-{12.6}	Elmidae	2
WVKE-23-{12.6}	Simuliidae	26
WVKE-23-{12.6}	Tabanidae	1
WVKE-23-{12.6}	Chironomidae	21
WVKE-26-A-{0.16}	Capniidae/Leuctrid	7
WVKE-26-A-{0.16}	Dytiscidae	1
WVKE-26-A-{0.16}	Corydalidae	1
WVKE-26-A-{0.16}	Veliidae	1
WVKE-26-A-{0.16}	Chironomidae	3
WVKE-3	Oligochaeta	49
WVKE-3	Asellidae	1
WVKE-3	Elmidae	8
WVKE-3	Tipulidae	3
WVKE-3	Empididae	1
WVKE-3	Chironomidae	33
WVKE-3	Muscidae	1

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-32-{1.0}	Heptageniidae	6
WVKE-32-{1.0}	Leptophlebiidae	1
WVKE-32-{1.0}	Hydropsychidae	1
WVKE-32-{1.0}	Polycentropodidae	1
WVKE-32-{1.0}	Capniidae/Leuctrid	3
WVKE-32-{1.0}	Psephenidae	1
WVKE-32-{1.0}	Hydraenidae	1
WVKE-32-{1.0}	Gerridae	1
WVKE-32-{1.0}	Chironomidae	1
WVKE-32-{1.0}	Stratiomyidae	1
WVKE-34	Asellidae	10
WVKE-34	Baetidae	22
WVKE-34	Heptageniidae	38
WVKE-34	Hydropsychidae	16
WVKE-34	Veliidae	1
WVKE-34	Simuliidae	4
WVKE-34	Chironomidae	26
WVKE-37 (dup 1)	Oligochaeta	1
WVKE-37 (dup 1)	Baetidae	118
WVKE-37 (dup 1)	Heptageniidae	15
WVKE-37 (dup 1)	Isonychiidae	18
WVKE-37 (dup 1)	Hydropsychidae	39
WVKE-37 (dup 1)	Philopotamidae	1
WVKE-37 (dup 1)	Capniidae/Leuctrid	1
WVKE-37 (dup 1)	Perlidae	2
WVKE-37 (dup 1)	Aeshnidae	1
WVKE-37 (dup 1)	Elmidae	9
WVKE-37 (dup 1)	Corydalidae	1
WVKE-37 (dup 1)	Tipulidae	7
WVKE-37 (dup 1)	Ceratopogonidae	2
WVKE-37 (dup 1)	Simuliidae	9
WVKE-37 (dup 1)	Chironomidae	83
WVKE-37 (dup 2)	Oligochaeta	1
WVKE-37 (dup 2)	Baetidae	39
WVKE-37 (dup 2)	Heptageniidae	39
WVKE-37 (dup 2)	Isonychiidae	2
WVKE-37 (dup 2)	Hydropsychidae	14
WVKE-37 (dup 2)	Philopotamidae	2
WVKE-37 (dup 2)	Elmidae	7
WVKE-37 (dup 2)	Corydalidae	4
WVKE-37 (dup 2)	Empididae	1
WVKE-37 (dup 2)	Simuliidae	4
WVKE-37 (dup 2)	Chironomidae	2
WVKE-37-B	Oligochaeta	2
WVKE-37-B	Cambaridae	2
WVKE-37-B	Baetidae	49
WVKE-37-B	Heptageniidae	3
WVKE-37-B	Hydropsychidae	53
WVKE-37-B	Capniidae/Leuctrid	3
WVKE-37-B	Aeshnidae	1
WVKE-37-B	Elmidae	1
WVKE-37-B	Corydalidae	1
WVKE-37-B	Tipulidae	5
WVKE-37-B	Ceratopogonidae	4
WVKE-37-B	Empididae	1
WVKE-37-B	Simuliidae	8
WVKE-37-B	Chironomidae	68
WVKE-37-D	Oligochaeta	1
WVKE-37-D	Baetidae	31
WVKE-37-D	Heptageniidae	7
WVKE-37-D	Isonychiidae	2
WVKE-37-D	Hydropsychidae	75
WVKE-37-D	Philopotamidae	2
WVKE-37-D	Dryopidae	1
WVKE-37-D	Elmidae	11
WVKE-37-D	Psephenidae	1
WVKE-37-D	Corydalidae	1
WVKE-37-D	Veliidae	1
WVKE-37-D	Tipulidae	1
WVKE-37-D	Empididae	1
WVKE-37-D	Simuliidae	10
WVKE-37-D	Chironomidae	126
WVKE-4	Oligochaeta	2
WVKE-4	Baetidae	27
WVKE-4	Hydropsychidae	5
WVKE-4	Perlidae	5
WVKE-4	Perlodidae	3
WVKE-4	Curculionidae	1
WVKE-4	Elmidae	4
WVKE-4	Hydrophilidae	1
WVKE-4	Pyralidae	1
WVKE-4	Tipulidae	7
WVKE-4	Simuliidae	8
WVKE-4	Chironomidae	51
WVKE-40	Baetidae	7
WVKE-40	Heptageniidae	19
WVKE-40	Hydropsychidae	6
WVKE-40	Capniidae/Leuctrid	45
WVKE-40	Perlidae	3
WVKE-40	Dryopidae	1
WVKE-40	Tipulidae	2
WVKE-40	Empididae	1
WVKE-40	Chironomidae	5
WVKE-41	Oligochaeta	2
WVKE-41	Baetidae	19
WVKE-41	Heptageniidae	54
WVKE-41	Isonychiidae	37
WVKE-41	Hydropsychidae	35
WVKE-41	Capniidae/Leuctrid	1
WVKE-41	Perlidae	1
WVKE-41	Elmidae	7
WVKE-41	Gyrinidae	6
WVKE-41	Corydalidae	2
WVKE-41	Sialidae	1

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-41	Tipulidae	1
WVKE-41	Simuliidae	4
WVKE-41	Chironomidae	11
WVKE-41	Tanyderidae	2
WVKE-41-A	Cambaridae	1
WVKE-41-A	Baetidae	2
WVKE-41-A	Ephemerellidae	3
WVKE-41-A	Heptageniidae	27
WVKE-41-A	Isonychiidae	1
WVKE-41-A	Glossosomatidae	2
WVKE-41-A	Hydropsychidae	17
WVKE-41-A	Rhyacophilidae	1
WVKE-41-A	Philopotamidae	6
WVKE-41-A	Limnephilidae	1
WVKE-41-A	Capniidae/Leuctrid	23
WVKE-41-A	Perlidae	7
WVKE-41-A	Perlodidae	1
WVKE-41-A	Dryopidae	1
WVKE-41-A	Elmidae	1
WVKE-41-A	Veliidae	3
WVKE-41-A	Tipulidae	2
WVKE-41-A	Ceratopogonidae	1
WVKE-41-A	Chironomidae	12
WVKE-41-B-1.5	Oligochaeta	1
WVKE-41-B-1.5	Baetidae	9
WVKE-41-B-1.5	Heptageniidae	27
WVKE-41-B-1.5	Glossosomatidae	2
WVKE-41-B-1.5	Hydropsychidae	49
WVKE-41-B-1.5	Capniidae/Leuctrid	1
WVKE-41-B-1.5	Nemouridae	1
WVKE-41-B-1.5	Aeshnidae	1
WVKE-41-B-1.5	Gomphidae	2
WVKE-41-B-1.5	Dryopidae	2
WVKE-41-B-1.5	Elmidae	2
WVKE-41-B-1.5	Veliidae	1
WVKE-41-B-1.5	Tipulidae	1
WVKE-41-B-1.5	Empididae	1
WVKE-41-B-1.5	Chironomidae	1
WVKE-41-B-1.5	Branchiobdellidae	1
WVKE-41-B-{0.2}	Cambaridae	1
WVKE-41-B-{0.2}	Baetidae	29
WVKE-41-B-{0.2}	Heptageniidae	44
WVKE-41-B-{0.2}	Isonychiidae	5
WVKE-41-B-{0.2}	Hydropsychidae	30
WVKE-41-B-{0.2}	Capniidae/Leuctrid	1
WVKE-41-B-{0.2}	Gomphidae	2
WVKE-41-B-{0.2}	Dryopidae	1
WVKE-41-B-{0.2}	Elmidae	5
WVKE-41-B-{0.2}	Corydalidae	1
WVKE-41-B-{0.2}	Veliidae	4
WVKE-41-B-{0.2}	Simuliidae	2
WVKE-41-B-{0.2}	Chironomidae	2
WVKE-41-C-1	Baetidae	14
WVKE-41-C-1	Heptageniidae	5
WVKE-41-C-1	Isonychiidae	4
WVKE-41-C-1	Hydropsychidae	12
WVKE-41-C-1	Aeshnidae	1
WVKE-41-C-1	Gomphidae	1
WVKE-41-C-1	Corydalidae	1
WVKE-41-C-1	Simuliidae	3
WVKE-41-C-1	Chironomidae	20
WVKE-45-B	Oligochaeta	14
WVKE-45-B	Cambaridae	1
WVKE-45-B	Baetidae	4
WVKE-45-B	Caenidae	4
WVKE-45-B	Heptageniidae	25
WVKE-45-B	Isonychiidae	11
WVKE-45-B	Hydropsychidae	45
WVKE-45-B	Elmidae	8
WVKE-45-B	Corydalidae	6
WVKE-45-B	Sialidae	1
WVKE-45-B	Tipulidae	12
WVKE-45-B	Empididae	4
WVKE-45-B	Chironomidae	5
WVKE-46-{1.2}	Oligochaeta	2
WVKE-46-{1.2}	Baetidae	8
WVKE-46-{1.2}	Heptageniidae	1
WVKE-46-{1.2}	Glossosomatidae	1
WVKE-46-{1.2}	Hydropsychidae	38
WVKE-46-{1.2}	Rhyacophilidae	1
WVKE-46-{1.2}	Capniidae/Leuctrid	4
WVKE-46-{1.2}	Perlidae	5
WVKE-46-{1.2}	Elmidae	13
WVKE-46-{1.2}	Psephenidae	2
WVKE-46-{1.2}	Corydalidae	7
WVKE-46-{1.2}	Veliidae	1
WVKE-46-{1.2}	Tipulidae	4
WVKE-46-{1.2}	Chironomidae	14
WVKE-46-{1.2}	Tanyderidae	5
WVKE-49	Hirudinidae	1
WVKE-49	Oligochaeta	2
WVKE-49	Cambaridae	3
WVKE-49	Asellidae	2
WVKE-49	Gammaridae	2
WVKE-49	Heptageniidae	8
WVKE-49	Leptophlebiidae	3
WVKE-49	Glossosomatidae	1
WVKE-49	Hydropsychidae	7
WVKE-49	Rhyacophilidae	2
WVKE-49	Philopotamidae	2
WVKE-49	Capniidae/Leuctrid	48
WVKE-49	Chloroperlidae	1
WVKE-49	Peltoperlidae	4
WVKE-49	Perlidae	4
WVKE-49	Perlodidae	3

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-49	Collembola	1
WVKE-49	Corydalidae	1
WVKE-49	Tipulidae	12
WVKE-49	Chironomidae	4
WVKE-50-B-1-{2.0}	Cambaridae	1
WVKE-50-B-1-{2.0}	Heptageniidae	3
WVKE-50-B-1-{2.0}	Leptophlebiidae	4
WVKE-50-B-1-{2.0}	Hydropsychidae	13
WVKE-50-B-1-{2.0}	Rhyacophilidae	2
WVKE-50-B-1-{2.0}	Philopotamidae	5
WVKE-50-B-1-{2.0}	Capniidae/Leuctrid	61
WVKE-50-B-1-{2.0}	Chloroperlidae	2
WVKE-50-B-1-{2.0}	Perlidae	6
WVKE-50-B-1-{2.0}	Pteronarcyidae	4
WVKE-50-B-1-{2.0}	Perlodidae	1
WVKE-50-B-1-{2.0}	Elmidae	3
WVKE-50-B-1-{2.0}	Corydalidae	4
WVKE-50-B-1-{2.0}	Tipulidae	13
WVKE-50-B-1-{2.0}	Tabanidae	2
WVKE-50-B-1-{2.0}	Chironomidae	7
WVKE-50-B-10	Cambaridae	1
WVKE-50-B-10	Baetidae	1
WVKE-50-B-10	Heptageniidae	15
WVKE-50-B-10	Leptophlebiidae	1
WVKE-50-B-10	Glossosomatidae	1
WVKE-50-B-10	Hydropsychidae	13
WVKE-50-B-10	Rhyacophilidae	3
WVKE-50-B-10	Philopotamidae	1
WVKE-50-B-10	Polycentropodidae	2
WVKE-50-B-10	Perlidae	15
WVKE-50-B-10	Pteronarcyidae	1
WVKE-50-B-10	Aeshnidae	1
WVKE-50-B-10	Tipulidae	8
WVKE-50-B-10	Ceratopogonidae	1
WVKE-50-B-10	Tabanidae	1
WVKE-50-B-10	Chironomidae	2
WVKE-50-B-7-{0.1}	Baetidae	9
WVKE-50-B-7-{0.1}	Hydropsychidae	2
WVKE-50-B-7-{0.1}	Dryopidae	2
WVKE-50-B-7-{0.1}	Elmidae	1
WVKE-50-B-7-{0.1}	Carabidae	1
WVKE-50-B-7-{0.1}	Tipulidae	5
WVKE-50-B-7-{0.1}	Chironomidae	2
WVKE-50-B-8	Baetidae	4
WVKE-50-B-8	Heptageniidae	23
WVKE-50-B-8	Glossosomatidae	1
WVKE-50-B-8	Hydropsychidae	40
WVKE-50-B-8	Philopotamidae	13
WVKE-50-B-8	Capniidae/Leuctrid	18
WVKE-50-B-8	Perlidae	11
WVKE-50-B-8	Pteronarcyidae	1
WVKE-50-B-8	Dryopidae	1
WVKE-50-B-8	Elmidae	6
WVKE-50-B-8	Tipulidae	3
WVKE-50-B-8	Simuliidae	3
WVKE-50-B-8	Chironomidae	4
WVKE-50-B-9	Oligochaeta	7
WVKE-50-B-9	Baetidae	2
WVKE-50-B-9	Heptageniidae	2
WVKE-50-B-9	Hydropsychidae	14
WVKE-50-B-9	Rhyacophilidae	1
WVKE-50-B-9	Polycentropodidae	1
WVKE-50-B-9	Capniidae/Leuctrid	27
WVKE-50-B-9	Perlidae	2
WVKE-50-B-9	Pteronarcyidae	1
WVKE-50-B-9	Perlodidae	1
WVKE-50-B-9	Aeshnidae	1
WVKE-50-B-9	Tipulidae	3
WVKE-50-B-9	Tabanidae	2
WVKE-50-B-9	Chironomidae	8
WVKE-50-B-{0.1}	Baetidae	21
WVKE-50-B-{0.1}	Heptageniidae	20
WVKE-50-B-{0.1}	Leptophlebiidae	1
WVKE-50-B-{0.1}	Isonychiidae	11
WVKE-50-B-{0.1}	Brachycentridae	1
WVKE-50-B-{0.1}	Hydropsychidae	16
WVKE-50-B-{0.1}	Philopotamidae	2
WVKE-50-B-{0.1}	Capniidae/Leuctrid	3
WVKE-50-B-{0.1}	Perlidae	7
WVKE-50-B-{0.1}	Dryopidae	1
WVKE-50-B-{0.1}	Elmidae	8
WVKE-50-B-{0.1}	Corydalidae	1
WVKE-50-B-{0.1}	Tipulidae	1
WVKE-50-B-{0.1}	Empididae	1
WVKE-50-B-{0.1}	Chironomidae	3
WVKE-50-B-{0.1}	Tanyderidae	5
WVKE-50-F-{2.2}	Cambaridae	1
WVKE-50-F-{2.2}	Baetidae	8
WVKE-50-F-{2.2}	Heptageniidae	14
WVKE-50-F-{2.2}	Leptophlebiidae	5
WVKE-50-F-{2.2}	Isonychiidae	1
WVKE-50-F-{2.2}	Hydropsychidae	27
WVKE-50-F-{2.2}	Philopotamidae	6
WVKE-50-F-{2.2}	Capniidae/Leuctrid	44
WVKE-50-F-{2.2}	Perlidae	6
WVKE-50-F-{2.2}	Elmidae	12
WVKE-50-F-{2.2}	Corydalidae	4
WVKE-50-F-{2.2}	Gerridae	1
WVKE-50-F-{2.2}	Veliidae	2
WVKE-50-F-{2.2}	Tipulidae	5
WVKE-50-F-{2.2}	Empididae	1
WVKE-50-F-{2.2}	Chironomidae	20
WVKE-50-G	Cambaridae	1
WVKE-50-G	Baetidae	1

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-50-G	Heptageniidae	4
WVKE-50-G	Hydropsychidae	21
WVKE-50-G	Rhyacophilidae	2
WVKE-50-G	Philopotamidae	3
WVKE-50-G	Limnephilidae	10
WVKE-50-G	Capniidae/Leuctrid	28
WVKE-50-G	Peltoperlidae	20
WVKE-50-G	Perlidae	1
WVKE-50-G	Pteronarcyidae	2
WVKE-50-G	Perlodidae	1
WVKE-50-G	Elmidae	3
WVKE-50-G	Hydrophilidae	2
WVKE-50-G	Psephenidae	1
WVKE-50-G	Tipulidae	5
WVKE-50-G	Ceratopogonidae	1
WVKE-50-G	Chironomidae	10
WVKE-50-G	Dixidae	1
WVKE-50-I	Cambaridae	1
WVKE-50-I	Baetidae	12
WVKE-50-I	Heptageniidae	9
WVKE-50-I	Leptophlebiidae	4
WVKE-50-I	Hydropsychidae	15
WVKE-50-I	Philopotamidae	14
WVKE-50-I	Capniidae/Leuctrid	8
WVKE-50-I	Perlidae	13
WVKE-50-I	Dryopidae	1
WVKE-50-I	Elmidae	5
WVKE-50-I	Corydalidae	2
WVKE-50-I	Tipulidae	11
WVKE-50-I	Chironomidae	1
WVKE-50-I-3	Ephemeridae	1
WVKE-50-I-3	Hydropsychidae	20
WVKE-50-I-3	Gerridae	1
WVKE-50-K	Baetidae	1
WVKE-50-K	Ephemerellidae	1
WVKE-50-K	Heptageniidae	1
WVKE-50-K	Glossosomatidae	2
WVKE-50-K	Hydropsychidae	3
WVKE-50-K	Philopotamidae	1
WVKE-50-K	Polycentropodidae	1
WVKE-50-K	Capniidae/Leuctrid	1
WVKE-50-K	Perlodidae	1
WVKE-50-K	Psephenidae	1
WVKE-50-K	Dixidae	3
WVKE-50-O	Turbellaria	1
WVKE-50-O	Baetidae	1
WVKE-50-O	Heptageniidae	10
WVKE-50-O	Isonychiidae	1
WVKE-50-O	Hydropsychidae	14
WVKE-50-O	Philopotamidae	1
WVKE-50-O	Capniidae/Leuctrid	17
WVKE-50-O	Chloroperlidae	1
WVKE-50-O	Perlidae	1
WVKE-50-O	Dryopidae	1
WVKE-50-O	Elmidae	11
WVKE-50-O	Corydalidae	4
WVKE-50-O	Tipulidae	2
WVKE-50-O	Empididae	1
WVKE-50-O	Chironomidae	5
WVKE-50-O	Psychodidae	1
WVKE-50-P	Capniidae/Leuctrid	1
WVKE-50-P	Chironomidae	1
WVKE-50-S	Hydropsychidae	73
WVKE-50-S	Capniidae/Leuctrid	203
WVKE-50-S	Peltoperlidae	1
WVKE-50-S	Corydalidae	1
WVKE-50-S	Veliidae	1
WVKE-50-S	Tipulidae	1
WVKE-50-T	Cambaridae	1
WVKE-50-T	Hydropsychidae	28
WVKE-50-T	Polycentropodidae	1
WVKE-50-T	Nemouridae	2
WVKE-50-T	Tipulidae	36
WVKE-50-T	Chironomidae	2
WVKE-50-{0.2}	Oligochaeta	1
WVKE-50-{0.2}	Baetidae	27
WVKE-50-{0.2}	Heptageniidae	16
WVKE-50-{0.2}	Isonychiidae	35
WVKE-50-{0.2}	Hydropsychidae	6
WVKE-50-{0.2}	Hydroptilidae	1
WVKE-50-{0.2}	Capniidae/Leuctrid	3
WVKE-50-{0.2}	Perlidae	1
WVKE-50-{0.2}	Dryopidae	1
WVKE-50-{0.2}	Elmidae	3
WVKE-50-{0.2}	Gyrinidae	1
WVKE-50-{0.2}	Corydalidae	3
WVKE-50-{0.2}	Chironomidae	12
WVKE-56	Cambaridae	1
WVKE-56	Baetidae	5
WVKE-56	Heptageniidae	40
WVKE-56	Leptophlebiidae	1
WVKE-56	Hydropsychidae	5
WVKE-56	Rhyacophilidae	3
WVKE-56	Capniidae/Leuctrid	13
WVKE-56	Perlidae	3
WVKE-56	Pteronarcyidae	1
WVKE-56	Perlodidae	1
WVKE-56	Elmidae	2
WVKE-56	Corydalidae	1
WVKE-56	Gerridae	1
WVKE-56	Chironomidae	1

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-59	Oligochaeta	2
WVKE-59	Capniidae/Leuctrid	2
WVKE-59	Dryopidae	1
WVKE-59	Elmidae	1
WVKE-59	Tipulidae	3
WVKE-6-{5.6}	Oligochaeta	3
WVKE-6-{5.6}	Cambaridae	2
WVKE-6-{5.6}	Baetidae	3
WVKE-6-{5.6}	Heptageniidae	16
WVKE-6-{5.6}	Tricorythidae	10
WVKE-6-{5.6}	Hydropsychidae	2
WVKE-6-{5.6}	Capniidae/Leuctrid	4
WVKE-6-{5.6}	Perlidae	1
WVKE-6-{5.6}	Gomphidae	1
WVKE-6-{5.6}	Elmidae	23
WVKE-6-{5.6}	Veliidae	1
WVKE-6-{5.6}	Corydalidae	1
WVKE-6-{5.6}	Tipulidae	23
WVKE-6-{5.6}	Chironomidae	3
WVKE-64	Oligochaeta	6
WVKE-64	Baetidae	2
WVKE-64	Ephemerellidae	1
WVKE-64	Heptageniidae	137
WVKE-64	Isonychiidae	27
WVKE-64	Hydropsychidae	98
WVKE-64	Philopotamidae	16
WVKE-64	Dryopidae	1
WVKE-64	Elmidae	2
WVKE-64	Psephenidae	2
WVKE-64	Tipulidae	1
WVKE-64	Empididae	3
WVKE-64	Chironomidae	21
WVKE-64-D	Cambaridae	3
WVKE-64-D	Baetidae	2
WVKE-64-D	Psycomyiidae	1
WVKE-64-D	Polycentropodidae	2
WVKE-64-D	Gerridae	1
WVKE-64-D	Aeshnidae	5
WVKE-64-D	Gomphidae	1
WVKE-64-D	Elmidae	5
WVKE-64-D	Sialidae	2
WVKE-64-D	Chironomidae	8
WVKE-64-E	Turbellaria	1
WVKE-64-E	Oligochaeta	2
WVKE-64-E	Cambaridae	1
WVKE-64-E	Baetidae	2
WVKE-64-E	Philopotamidae	1
WVKE-64-E	Aeshnidae	2
WVKE-64-E	Elmidae	4
WVKE-64-E	Hydrophilidae	1
WVKE-64-E	Sialidae	1
WVKE-64-E	Chironomidae	26
WVKE-64-E	Ephydridae	1
WVKE-69-{5.6}	Baetidae	19
WVKE-69-{5.6}	Caenidae	1
WVKE-69-{5.6}	Heptageniidae	12
WVKE-69-{5.6}	Isonychiidae	1
WVKE-69-{5.6}	Hydropsychidae	40
WVKE-69-{5.6}	Rhyacophilidae	2
WVKE-69-{5.6}	Philopotamidae	19
WVKE-69-{5.6}	Capniidae/Leuctrid	23
WVKE-69-{5.6}	Chloroperlidae	2
WVKE-69-{5.6}	Perlidae	17
WVKE-69-{5.6}	Pteronarcyidae	3
WVKE-69-{5.6}	Aeshnidae	1
WVKE-69-{5.6}	Gomphidae	4
WVKE-69-{5.6}	Dryopidae	1
WVKE-69-{5.6}	Elmidae	7
WVKE-69-{5.6}	Veliidae	1
WVKE-69-{5.6}	Tipulidae	3
WVKE-69-{5.6}	Empididae	1
WVKE-69-{5.6}	Chironomidae	12
WVKE-7-E	Oligochaeta	3
WVKE-7-E	Baetidae	46
WVKE-7-E	Leptophlebiidae	1
WVKE-7-E	Hydropsychidae	1
WVKE-7-E	Hydrophilidae	2
WVKE-7-E	Tipulidae	1
WVKE-7-E	Culicidae	1
WVKE-7-E	Simuliidae	23
WVKE-7-E	Chironomidae	72
WVKE-70-A	Oligochaeta	1
WVKE-70-A	Baetidae	19
WVKE-70-A	Heptageniidae	39
WVKE-70-A	Isonychiidae	1
WVKE-70-A	Hydropsychidae	14
WVKE-70-A	Perlidae	2
WVKE-70-A	Elmidae	18
WVKE-70-A	Psephenidae	3
WVKE-70-A	Tipulidae	2
WVKE-70-A	Empididae	1
WVKE-70-A	Chironomidae	9
WVKE-74-F	Hirudinidae	1
WVKE-74-F	Oligochaeta	1
WVKE-74-F	Baetidae	2
WVKE-74-F	Heptageniidae	3
WVKE-74-F	Leptophlebiidae	2
WVKE-74-F	Isonychiidae	1
WVKE-74-F	Glossosomatidae	1
WVKE-74-F	Hydropsychidae	12
WVKE-74-F	Rhyacophilidae	5
WVKE-74-F	Philopotamidae	16
WVKE-74-F	Polycentropodidae	1
WVKE-74-F	Capniidae/Leuctrid	11

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-74-F	Perlidae	13
WVKE-74-F	Pteronarcyidae	2
WVKE-74-F	Dryopidae	1
WVKE-74-F	Elmidae	3
WVKE-74-F	Corydalidae	2
WVKE-74-F	Veliidae	5
WVKE-74-F	Tipulidae	16
WVKE-74-F	Chironomidae	15
WVKE-74-F	Dixidae	3
WVKE-74-{10.4}	Oligochaeta	1
WVKE-74-{10.4}	Baetidae	27
WVKE-74-{10.4}	Heptageniidae	10
WVKE-74-{10.4}	Leptophlebiidae	1
WVKE-74-{10.4}	Isonychiidae	2
WVKE-74-{10.4}	Glossosomatidae	16
WVKE-74-{10.4}	Rhyacophilidae	2
WVKE-74-{10.4}	Capniidae/Leuctrid	2
WVKE-74-{10.4}	Chloroperlidae	1
WVKE-74-{10.4}	Perlidae	5
WVKE-74-{10.4}	Elmidae	10
WVKE-74-{10.4}	Tipulidae	12
WVKE-74-{10.4}	Simuliidae	1
WVKE-74-{10.4}	Chironomidae	7
WVKE-76-A	Oligochaeta	6
WVKE-76-A	Heptageniidae	4
WVKE-76-A	Glossosomatidae	1
WVKE-76-A	Hydropsychidae	14
WVKE-76-A	Capniidae/Leuctrid	35
WVKE-76-A	Chloroperlidae	1
WVKE-76-A	Perlidae	18
WVKE-76-A	Perlodidae	1
WVKE-76-A	Dryopidae	1
WVKE-76-A	Elmidae	3
WVKE-76-A	Corydalidae	9
WVKE-76-A	Tipulidae	21
WVKE-76-A	Chironomidae	5
WVKE-76-C	Oligochaeta	2
WVKE-76-C	Baetidae	3
WVKE-76-C	Heptageniidae	7
WVKE-76-C	Glossosomatidae	1
WVKE-76-C	Hydropsychidae	18
WVKE-76-C	Philopotamidae	55
WVKE-76-C	Capniidae/Leuctrid	32
WVKE-76-C	Chloroperlidae	1
WVKE-76-C	Perlidae	11
WVKE-76-C	Perlodidae	1
WVKE-76-C	Corydalidae	1
WVKE-76-C	Tipulidae	5
WVKE-76-C	Simuliidae	2
WVKE-76-C	Chironomidae	12
WVKE-76-D-1	Baetidae	25
WVKE-76-D-1	Heptageniidae	31
WVKE-76-D-1	Isonychiidae	3
WVKE-76-D-1	Hydropsychidae	19
WVKE-76-D-1	Philopotamidae	5
WVKE-76-D-1	Limnephilidae	2
WVKE-76-D-1	Polycentropodidae	1
WVKE-76-D-1	Capniidae/Leuctrid	6
WVKE-76-D-1	Perlidae	5
WVKE-76-D-1	Elmidae	21
WVKE-76-D-1	Corydalidae	3
WVKE-76-D-1	Veliidae	6
WVKE-76-D-1	Athericidae	1
WVKE-76-D-1	Tipulidae	3
WVKE-76-D-1	Chironomidae	19
WVKE-76-E-5	Baetidae	39
WVKE-76-E-5	Heptageniidae	13
WVKE-76-E-5	Leptophlebiidae	1
WVKE-76-E-5	Isonychiidae	5
WVKE-76-E-5	Hydropsychidae	21
WVKE-76-E-5	Philopotamidae	7
WVKE-76-E-5	Capniidae/Leuctrid	9
WVKE-76-E-5	Chloroperlidae	1
WVKE-76-E-5	Perlidae	4
WVKE-76-E-5	Elmidae	18
WVKE-76-E-5	Corydalidae	2
WVKE-76-E-5	Tipulidae	1
WVKE-76-E-5	Chironomidae	8
WVKE-76-E-6-A	Baetidae	22
WVKE-76-E-6-A	Heptageniidae	73
WVKE-76-E-6-A	Isonychiidae	3
WVKE-76-E-6-A	Hydropsychidae	11
WVKE-76-E-6-A	Philopotamidae	1
WVKE-76-E-6-A	Perlidae	2
WVKE-76-E-6-A	Perlodidae	2
WVKE-76-E-6-A	Elmidae	4
WVKE-76-E-6-A	Psephenidae	1
WVKE-76-E-6-A	Veliidae	3
WVKE-76-E-6-A	Tipulidae	1
WVKE-76-E-6-A	Chironomidae	3
WVKE-76-E-7.5	Oligochaeta	2
WVKE-76-E-7.5	Cambaridae	1
WVKE-76-E-7.5	Baetidae	23
WVKE-76-E-7.5	Ephemerellidae	1
WVKE-76-E-7.5	Ephemeridae	1
WVKE-76-E-7.5	Heptageniidae	2
WVKE-76-E-7.5	Leptophlebiidae	3
WVKE-76-E-7.5	Glossosomatidae	1
WVKE-76-E-7.5	Hydropsychidae	21
WVKE-76-E-7.5	Limnephilidae	5
WVKE-76-E-7.5	Capniidae/Leuctrid	2
WVKE-76-E-7.5	Aeshnidae	1

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count	Stream Code	Taxa	count
WVKE-76-E-7.5	Dryopidae	1	WVKE-76-N-{2.4}	Pyralidae	1
WVKE-76-E-7.5	Elmidae	1	WVKE-76-N-{2.4}	Athericidae	4
WVKE-76-E-7.5	Sialidae	1	WVKE-76-N-{2.4}	Tipulidae	10
WVKE-76-E-7.5	Tipulidae	3	WVKE-76-N-{2.4}	Simuliidae	1
WVKE-76-E-7.5	Chironomidae	15	WVKE-76-N-{2.4}	Chironomidae	2
WVKE-76-E-{2.6}	Baetidae	30	WVKE-76-O	Baetidae	8
WVKE-76-E-{2.6}	Ephemeridae	1	WVKE-76-O	Heptageniidae	12
WVKE-76-E-{2.6}	Heptageniidae	12	WVKE-76-O	Isonychiidae	7
WVKE-76-E-{2.6}	Hydropsychidae	5	WVKE-76-O	Glossosomatidae	1
WVKE-76-E-{2.6}	Chloroperlidae	1	WVKE-76-O	Hydropsychidae	37
WVKE-76-E-{2.6}	Perlidae	3	WVKE-76-O	Philopotamidae	120
WVKE-76-E-{2.6}	Elmidae	23	WVKE-76-O	Capniidae/Leuctrid	38
WVKE-76-E-{2.6}	Corydalidae	3	WVKE-76-O	Peltoperlidae	5
WVKE-76-E-{2.6}	Athericidae	1	WVKE-76-O	Perlidae	3
WVKE-76-E-{2.6}	Tipulidae	2	WVKE-76-O	Pteronarcyidae	2
WVKE-76-E-{2.6}	Empididae	1	WVKE-76-O	Dryopidae	2
WVKE-76-E-{2.6}	Chironomidae	34	WVKE-76-O	Elmidae	3
WVKE-76-E-{2.6}	Tanyderidae	3	WVKE-76-O	Corydalidae	5
			WVKE-76-O	Athericidae	1
WVKE-76-N-8	Oligochaeta	8	WVKE-76-O	Empididae	1
WVKE-76-N-8	Baetidae	12	WVKE-76-O	Simuliidae	1
WVKE-76-N-8	Ephemerellidae	1	WVKE-76-O	Chironomidae	6
WVKE-76-N-8	Heptageniidae	2			
WVKE-76-N-8	Glossosomatidae	4	WVKE-76-S.3	Oligochaeta	2
WVKE-76-N-8	Hydropsychidae	8	WVKE-76-S.3	Heptageniidae	16
WVKE-76-N-8	Rhyacophilidae	4	WVKE-76-S.3	Leptophlebiidae	5
WVKE-76-N-8	Philopotamidae	37	WVKE-76-S.3	Hydropsychidae	21
WVKE-76-N-8	Polycentropodidae	5	WVKE-76-S.3	Rhyacophilidae	2
WVKE-76-N-8	Capniidae/Leuctrid	37	WVKE-76-S.3	Limnephilidae	1
WVKE-76-N-8	Perlidae	4	WVKE-76-S.3	Capniidae/Leuctrid	17
WVKE-76-N-8	Pteronarcyidae	9	WVKE-76-S.3	Peltoperlidae	1
WVKE-76-N-8	Perlodidae	1	WVKE-76-S.3	Perlidae	2
WVKE-76-N-8	Elmidae	1	WVKE-76-S.3	Pteronarcyidae	4
WVKE-76-N-8	Corydalidae	1	WVKE-76-S.3	Perlodidae	4
WVKE-76-N-8	Tipulidae	12	WVKE-76-S.3	Elmidae	2
WVKE-76-N-8	Empididae	1	WVKE-76-S.3	Haliplidae	1
WVKE-76-N-8	Simuliidae	8	WVKE-76-S.3	Psephenidae	3
WVKE-76-N-8	Chironomidae	9	WVKE-76-S.3	Corydalidae	1
WVKE-76-N-8	Dixidae	1	WVKE-76-S.3	Pyralidae	1
			WVKE-76-S.3	Tipulidae	13
WVKE-76-N-{2.4}	Oligochaeta	1	WVKE-76-S.3	Chironomidae	6
WVKE-76-N-{2.4}	Cambaridae	1			
WVKE-76-N-{2.4}	Baetidae	24	WVKE-76-S.8	Turbellaria	1
WVKE-76-N-{2.4}	Heptageniidae	8	WVKE-76-S.8	Oligochaeta	3
WVKE-76-N-{2.4}	Isonychiidae	10	WVKE-76-S.8	Cambaridae	3
WVKE-76-N-{2.4}	Glossosomatidae	8	WVKE-76-S.8	Heptageniidae	21
WVKE-76-N-{2.4}	Hydropsychidae	46	WVKE-76-S.8	Leptophlebiidae	3
WVKE-76-N-{2.4}	Rhyacophilidae	10	WVKE-76-S.8	Glossosomatidae	2
WVKE-76-N-{2.4}	Philopotamidae	75	WVKE-76-S.8	Hydropsychidae	13
WVKE-76-N-{2.4}	Capniidae/Leuctrid	18	WVKE-76-S.8	Limnephilidae	1
WVKE-76-N-{2.4}	Chloroperlidae	2	WVKE-76-S.8	Capniidae/Leuctrid	19
WVKE-76-N-{2.4}	Perlidae	26	WVKE-76-S.8	Chloroperlidae	2
WVKE-76-N-{2.4}	Elmidae	8	WVKE-76-S.8	Nemouridae	2
WVKE-76-N-{2.4}	Corydalidae	4	WVKE-76-S.8	Peltoperlidae	2
WVKE-76-N-{2.4}	Veliidae	2	WVKE-76-S.8	Perlidae	1

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-76-S.8	Perlodidae	3
WVKE-76-S.8	Elmidae	1
WVKE-76-S.8	Tipulidae	13
WVKE-76-S.8	Chironomidae	1
WVKE-76-U-{0.8}	Oligochaeta	8
WVKE-76-U-{0.8}	Heptageniidae	10
WVKE-76-U-{0.8}	Leptophlebiidae	4
WVKE-76-U-{0.8}	Hydropsychidae	17
WVKE-76-U-{0.8}	Rhyacophilidae	3
WVKE-76-U-{0.8}	Philopotamidae	3
WVKE-76-U-{0.8}	Capniidae/Leuctrid	86
WVKE-76-U-{0.8}	Chloroperlidae	2
WVKE-76-U-{0.8}	Pteronarcyidae	1
WVKE-76-U-{0.8}	Perlodidae	15
WVKE-76-U-{0.8}	Corydalidae	2
WVKE-76-U-{0.8}	Tipulidae	29
WVKE-76-U-{0.8}	Chironomidae	5
WVKE-76-W	Cambaridae	1
WVKE-76-W	Hydropsychidae	6
WVKE-76-W	Rhyacophilidae	2
WVKE-76-W	Corydalidae	1
WVKE-76-W	Tipulidae	6
WVKE-76-W	Simuliidae	46
WVKE-76-W	Chironomidae	18
WVKE-76-{0.9}	Baetidae	4
WVKE-76-{0.9}	Heptageniidae	11
WVKE-76-{0.9}	Isonychiidae	22
WVKE-76-{0.9}	Hydropsychidae	9
WVKE-76-{0.9}	Perlidae	1
WVKE-76-{0.9}	Elmidae	6
WVKE-76-{0.9}	Corydalidae	2
WVKE-76-{0.9}	Empididae	1
WVKE-76-{0.9}	Simuliidae	3
WVKE-76-{0.9}	Chironomidae	14
WVKE-78	Baetidae	23
WVKE-78	Heptageniidae	11
WVKE-78	Isonychiidae	1
WVKE-78	Hydropsychidae	6
WVKE-78	Philopotamidae	1
WVKE-78	Elmidae	14
WVKE-78	Psephenidae	1
WVKE-78	Corydalidae	3
WVKE-78	Veliidae	7
WVKE-78	Tipulidae	2
WVKE-78	Empididae	1
WVKE-78	Simuliidae	6
WVKE-78	Chironomidae	32
WVKE-79	Physidae	1
WVKE-79	Baetidae	1
WVKE-79	Heptageniidae	15
WVKE-79	Hydropsychidae	8
WVKE-79	Limnephilidae	2
WVKE-79	Polycentropodidae	1
WVKE-79	Psephenidae	7
WVKE-79	Corydalidae	1
WVKE-79	Veliidae	3
WVKE-79	Chironomidae	18
WVKE-82	Cambaridae	1
WVKE-82	Baetidae	5
WVKE-82	Heptageniidae	31
WVKE-82	Hydropsychidae	1
WVKE-82	Limnephilidae	1
WVKE-82	Aeshnidae	1
WVKE-82	Elmidae	7
WVKE-82	Psephenidae	11
WVKE-82	Corydalidae	2
WVKE-82	Veliidae	11
WVKE-82	Tipulidae	2
WVKE-82	Chironomidae	1
WVKE-84.5	Nematoda	1
WVKE-84.5	Cambaridae	2
WVKE-84.5	Baetidae	1
WVKE-84.5	Heptageniidae	11
WVKE-84.5	Hydropsychidae	8
WVKE-84.5	Perlidae	1
WVKE-84.5	Elmidae	3
WVKE-84.5	Tipulidae	4
WVKE-84.5	Empididae	2
WVKE-84.5	Chironomidae	30
WVKE-85	Cambaridae	1
WVKE-85	Baetidae	2
WVKE-85	Heptageniidae	58
WVKE-85	Isonychiidae	2
WVKE-85	Hydropsychidae	9
WVKE-85	Philopotamidae	4
WVKE-85	Capniidae/Leuctrid	1
WVKE-85	Chloroperlidae	1
WVKE-85	Perlidae	5
WVKE-85	Macromiidae	1
WVKE-85	Elmidae	5
WVKE-85	Corydalidae	2
WVKE-85	Tipulidae	1
WVKE-85	Empididae	1
WVKE-85	Simuliidae	2
WVKE-85	Chironomidae	35
WVKE-87-B	Turbellaria	1
WVKE-87-B	Oligochaeta	3
WVKE-87-B	Cambaridae	4
WVKE-87-B	Asellidae	15
WVKE-87-B	Baetidae	8
WVKE-87-B	Heptageniidae	2
WVKE-87-B	Hydropsychidae	30
WVKE-87-B	Rhyacophilidae	1

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-87-B	Philopotamidae	5
WVKE-87-B	Gomphidae	1
WVKE-87-B	Elmidae	1
WVKE-87-B	Psephenidae	2
WVKE-87-B	Corydalidae	1
WVKE-87-B	Tipulidae	5
WVKE-87-B	Empididae	2
WVKE-87-B	Chironomidae	16
WVKE-87-C	Hirudinidae	1
WVKE-87-C	Oligochaeta	3
WVKE-87-C	Cambaridae	2
WVKE-87-C	Hydropsychidae	2
WVKE-87-C	Elmidae	1
WVKE-87-C	Chironomidae	1
WVKE-88	Oligochaeta	78
WVKE-88	Asellidae	2
WVKE-88	Baetidae	2
WVKE-88	Heptageniidae	10
WVKE-88	Hydropsychidae	1
WVKE-88	Elmidae	8
WVKE-88	Psephenidae	2
WVKE-88	Corydalidae	2
WVKE-88	Sialidae	1
WVKE-88	Chironomidae	29
WVKE-9-B-1	Cambaridae	6
WVKE-9-B-1	Baetidae	3
WVKE-9-B-1	Hydropsychidae	16
WVKE-9-B-1	Dryopidae	2
WVKE-9-B-1	Dytiscidae	1
WVKE-9-B-1	Elmidae	3
WVKE-9-B-1	Psephenidae	1
WVKE-9-B-1	Tipulidae	12
WVKE-9-B-1	Ceratopogonidae	1
WVKE-9-B-1	Simuliidae	13
WVKE-9-B-1	Chironomidae	90
WVKE-9-C-{0.6}	Nematoda	1
WVKE-9-C-{0.6}	Oligochaeta	3
WVKE-9-C-{0.6}	Cambaridae	3
WVKE-9-C-{0.6}	Baetidae	34
WVKE-9-C-{0.6}	Heptageniidae	20
WVKE-9-C-{0.6}	Isonychiidae	3
WVKE-9-C-{0.6}	Hydroptilidae	7
WVKE-9-C-{0.6}	Perlidae	1
WVKE-9-C-{0.6}	Aeshnidae	1
WVKE-9-C-{0.6}	Elmidae	19
WVKE-9-C-{0.6}	Corydalidae	2
WVKE-9-C-{0.6}	Tipulidae	4
WVKE-9-C-{0.6}	Chironomidae	2
WVKE-9-E	Oligochaeta	1
WVKE-9-E	Cambaridae	1
WVKE-9-E	Baetidae	12
WVKE-9-E	Heptageniidae	4
WVKE-9-E	Hydropsychidae	3
WVKE-9-E	Capniidae/Leuctrid	3
WVKE-9-E	Nemouridae	1
WVKE-9-E	Perlidae	3
WVKE-9-E	Perlodidae	3
WVKE-9-E	Elmidae	5
WVKE-9-E	Chrysomelidae	1
WVKE-9-E	Tipulidae	1
WVKE-9-E	Chironomidae	7
WVKE-9-G	Cambaridae	1
WVKE-9-G	Baetidae	37
WVKE-9-G	Ephemerellidae	1
WVKE-9-G	Heptageniidae	12
WVKE-9-G	Leptophlebiidae	7
WVKE-9-G	Ameletidae	1
WVKE-9-G	Hydropsychidae	7
WVKE-9-G	Capniidae/Leuctrid	7
WVKE-9-G	Nemouridae	1
WVKE-9-G	Perlidae	2
WVKE-9-G	Dryopidae	3
WVKE-9-G	Elmidae	5
WVKE-9-G	Tipulidae	2
WVKE-9-G	Chironomidae	54
WVKE-9-G	Dixidae	2
WVKE-9-I-1-A	Oligochaeta	1
WVKE-9-I-1-A	Cambaridae	1
WVKE-9-I-1-A	Baetidae	10
WVKE-9-I-1-A	Heptageniidae	28
WVKE-9-I-1-A	Leptophlebiidae	1
WVKE-9-I-1-A	Hydropsychidae	7
WVKE-9-I-1-A	Capniidae/Leuctrid	3
WVKE-9-I-1-A	Nemouridae	2
WVKE-9-I-1-A	Perlidae	2
WVKE-9-I-1-A	Perlodidae	5
WVKE-9-I-1-A	Gomphidae	2
WVKE-9-I-1-A	Cordulegastridae	1
WVKE-9-I-1-A	Hydrophilidae	1
WVKE-9-I-1-A	Tipulidae	4
WVKE-9-I-1-A	Ceratopogonidae	1
WVKE-9-I-1-A	Chironomidae	3
WVKE-9-J	Oligochaeta	1
WVKE-9-J	Baetidae	23
WVKE-9-J	Hydropsychidae	2
WVKE-9-J	Capniidae/Leuctrid	1
WVKE-9-J	Peltoperlidae	1
WVKE-9-J	Aeshnidae	1
WVKE-9-J	Elmidae	2
WVKE-9-J	Chrysomelidae	1
WVKE-9-J	Pyralidae	1
WVKE-9-J	Simuliidae	1
WVKE-9-J	Chironomidae	4

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-9-{1.5}	Baetidae	7
WVKE-9-{1.5}	Heptageniidae	19
WVKE-9-{1.5}	Isonychiidae	5
WVKE-9-{1.5}	Hydropsychidae	9
WVKE-9-{1.5}	Capniidae/Leuctrid	2
WVKE-9-{1.5}	Perlidae	1
WVKE-9-{1.5}	Gomphidae	2
WVKE-9-{1.5}	Dryopidae	1
WVKE-9-{1.5}	Elmidae	7
WVKE-9-{1.5}	Tipulidae	2
WVKE-9-{1.5}	Simuliidae	16
WVKE-9-{1.5}	Chironomidae	18
WVKE-9-{15.0}	Oligochaeta	1
WVKE-9-{15.0}	Baetidae	6
WVKE-9-{15.0}	Heptageniidae	35
WVKE-9-{15.0}	Isonychiidae	15
WVKE-9-{15.0}	Elmidae	8
WVKE-9-{15.0}	Corydalidae	1
WVKE-9-{15.0}	Tipulidae	1
WVKE-9-{15.0}	Chironomidae	4
WVKE-91	Oligochaeta	1
WVKE-91	Baetidae	18
WVKE-91	Heptageniidae	1
WVKE-91	Hydropsychidae	11
WVKE-91	Philopotamidae	26
WVKE-91	Capniidae/Leuctrid	7
WVKE-91	Perlidae	15
WVKE-91	Gomphidae	2
WVKE-91	Dryopidae	3
WVKE-91	Elmidae	9
WVKE-91	Corydalidae	2
WVKE-91	Veliidae	1
WVKE-91	Tipulidae	3
WVKE-91	Simuliidae	5
WVKE-91	Chironomidae	18
WVKE-91-A-1	Baetidae	58
WVKE-91-A-1	Heptageniidae	2
WVKE-91-A-1	Glossosomatidae	1
WVKE-91-A-1	Hydropsychidae	38
WVKE-91-A-1	Hydroptilidae	3
WVKE-91-A-1	Rhyacophilidae	1
WVKE-91-A-1	Philopotamidae	16
WVKE-91-A-1	Capniidae/Leuctrid	3
WVKE-91-A-1	Perlodidae	1
WVKE-91-A-1	Empididae	2
WVKE-91-A-1	Simuliidae	2
WVKE-91-A-1	Chironomidae	51
WVKE-94	Cambaridae	4
WVKE-94	Heptageniidae	18
WVKE-94	Leptophlebiidae	1
WVKE-94	Ameletidae	1
WVKE-94	Hydropsychidae	7
WVKE-94	Philopotamidae	1
WVKE-94	Veliidae	2
WVKE-94	Chloroperlidae	2
WVKE-94	Perlidae	5
WVKE-94	Gomphidae	1
WVKE-94	Dryopidae	7
WVKE-94	Elmidae	13
WVKE-94	Corydalidae	4
WVKE-94	Tipulidae	22
WVKE-94	Tabanidae	1
WVKE-94	Chironomidae	4
WVKE-98-A	Oligochaeta	1
WVKE-98-A	Baetidae	46
WVKE-98-A	Heptageniidae	9
WVKE-98-A	Isonychiidae	2
WVKE-98-A	Hydropsychidae	8
WVKE-98-A	Philopotamidae	2
WVKE-98-A	Chloroperlidae	1
WVKE-98-A	Peltoperlidae	1
WVKE-98-A	Perlidae	1
WVKE-98-A	Veliidae	2
WVKE-98-A	Simuliidae	2
WVKE-98-A	Chironomidae	29
WVKE-98-B	Cambaridae	1
WVKE-98-B	Baetidae	54
WVKE-98-B	Ephemerellidae	1
WVKE-98-B	Heptageniidae	11
WVKE-98-B	Isonychiidae	10
WVKE-98-B	Glossosomatidae	1
WVKE-98-B	Hydropsychidae	56
WVKE-98-B	Rhyacophilidae	9
WVKE-98-B	Philopotamidae	18
WVKE-98-B	Capniidae/Leuctrid	26
WVKE-98-B	Perlidae	10
WVKE-98-B	Pteronarcyidae	1
WVKE-98-B	Perlodidae	1
WVKE-98-B	Gomphidae	1
WVKE-98-B	Dryopidae	3
WVKE-98-B	Elmidae	16
WVKE-98-B	Psephenidae	3
WVKE-98-B	Tipulidae	9
WVKE-98-B	Simuliidae	1
WVKE-98-B	Chironomidae	13
WVKE-98-B-16	Cambaridae	1
WVKE-98-B-16	Baetidae	22
WVKE-98-B-16	Ephemerellidae	7
WVKE-98-B-16	Heptageniidae	25
WVKE-98-B-16	Leptophlebiidae	7
WVKE-98-B-16	Isonychiidae	3
WVKE-98-B-16	Hydropsychidae	14
WVKE-98-B-16	Rhyacophilidae	2
WVKE-98-B-16	Philopotamidae	13
WVKE-98-B-16	Capniidae/Leuctrid	49

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-98-B-16	Perlidae	12
WVKE-98-B-16	Elmidae	2
WVKE-98-B-16	Corydalidae	1
WVKE-98-B-16	Veliidae	1
WVKE-98-B-16	Tipulidae	12
WVKE-98-B-16	Chironomidae	10
WVKE-98-B-16-B-{1.0}	Baetidae	1
WVKE-98-B-16-B-{1.0}	Heptageniidae	7
WVKE-98-B-16-B-{1.0}	Leptophlebiidae	13
WVKE-98-B-16-B-{1.0}	Philopotamidae	2
WVKE-98-B-16-B-{1.0}	Capniidae/Leuctrid	22
WVKE-98-B-16-B-{1.0}	Chloroperlidae	2
WVKE-98-B-16-B-{1.0}	Nemouridae	2
WVKE-98-B-16-B-{1.0}	Peltoperlidae	1
WVKE-98-B-16-B-{1.0}	Perlodidae	1
WVKE-98-B-16-B-{1.0}	Tipulidae	35
WVKE-98-B-16-B-{1.0}	Dixidae	3
WVKE-98-B-16.4	Baetidae	43
WVKE-98-B-16.4	Ephemerellidae	1
WVKE-98-B-16.4	Heptageniidae	45
WVKE-98-B-16.4	Leptophlebiidae	8
WVKE-98-B-16.4	Hydropsychidae	2
WVKE-98-B-16.4	Philopotamidae	4
WVKE-98-B-16.4	Capniidae/Leuctrid	2
WVKE-98-B-16.4	Perlidae	1
WVKE-98-B-16.4	Pteronarcyidae	2
WVKE-98-B-16.4	Elmidae	2
WVKE-98-B-16.4	Tipulidae	3
WVKE-98-B-16.4	Simuliidae	1
WVKE-98-B-16.4	Chironomidae	12
WVKE-98-B-3-{0.6}	Oligochaeta	2
WVKE-98-B-3-{0.6}	Gammaridae	1
WVKE-98-B-3-{0.6}	Baetidae	13
WVKE-98-B-3-{0.6}	Ephemerellidae	2
WVKE-98-B-3-{0.6}	Heptageniidae	4
WVKE-98-B-3-{0.6}	Leptophlebiidae	6
WVKE-98-B-3-{0.6}	Glossosomatidae	1
WVKE-98-B-3-{0.6}	Hydropsychidae	7
WVKE-98-B-3-{0.6}	Philopotamidae	23
WVKE-98-B-3-{0.6}	Lepidostomatidae	1
WVKE-98-B-3-{0.6}	Capniidae/Leuctrid	83
WVKE-98-B-3-{0.6}	Peltoperlidae	1
WVKE-98-B-3-{0.6}	Perlidae	2
WVKE-98-B-3-{0.6}	Pteronarcyidae	3
WVKE-98-B-3-{0.6}	Elmidae	2
WVKE-98-B-3-{0.6}	Pyralidae	1
WVKE-98-B-3-{0.6}	Tipulidae	8
WVKE-98-B-3-{0.6}	Simuliidae	3
WVKE-98-B-3-{0.6}	Chironomidae	29
WVKE-98-B-3-{0.6}	Dixidae	1
WVKE-98-B-8	Cambaridae	1
WVKE-98-B-8	Baetidae	32
WVKE-98-B-8	Heptageniidae	46
WVKE-98-B-8	Leptophlebiidae	1
WVKE-98-B-8	Hydropsychidae	3
WVKE-98-B-8	Philopotamidae	2
WVKE-98-B-8	Capniidae/Leuctrid	12
WVKE-98-B-8	Nemouridae	1
WVKE-98-B-8	Elmidae	1
WVKE-98-B-8	Corydalidae	1
WVKE-98-B-8	Tipulidae	2
WVKE-98-B-8	Empididae	1
WVKE-98-B-8	Simuliidae	10
WVKE-98-B-8	Chironomidae	5
WVKE-98-B-{13.6}	Oligochaeta	1
WVKE-98-B-{13.6}	Baetidae	45
WVKE-98-B-{13.6}	Ephemerellidae	3
WVKE-98-B-{13.6}	Heptageniidae	22
WVKE-98-B-{13.6}	Isonychiidae	35
WVKE-98-B-{13.6}	Hydropsychidae	90
WVKE-98-B-{13.6}	Rhyacophilidae	3
WVKE-98-B-{13.6}	Philopotamidae	12
WVKE-98-B-{13.6}	Capniidae/Leuctrid	7
WVKE-98-B-{13.6}	Perlidae	14
WVKE-98-B-{13.6}	Elmidae	3
WVKE-98-B-{13.6}	Psephenidae	4
WVKE-98-B-{13.6}	Corydalidae	3
WVKE-98-B-{13.6}	Athericidae	20
WVKE-98-B-{13.6}	Tipulidae	1
WVKE-98-B-{13.6}	Empididae	2
WVKE-98-B-{13.6}	Simuliidae	6
WVKE-98-B-{13.6}	Chironomidae	62
WVKE-98-B-{13.6}	Blephariceridae	2
WVKE-98-C-1	Oligochaeta	2
WVKE-98-C-1	Cambaridae	1
WVKE-98-C-1	Baetidae	66
WVKE-98-C-1	Heptageniidae	23
WVKE-98-C-1	Leptophlebiidae	1
WVKE-98-C-1	Isonychiidae	1
WVKE-98-C-1	Hydropsychidae	10
WVKE-98-C-1	Philopotamidae	7
WVKE-98-C-1	Capniidae/Leuctrid	45
WVKE-98-C-1	Perlidae	3
WVKE-98-C-1	Aeshnidae	1
WVKE-98-C-1	Dryopidae	1
WVKE-98-C-1	Dytiscidae	1
WVKE-98-C-1	Tipulidae	2
WVKE-98-C-1	Empididae	1
WVKE-98-C-1	Simuliidae	4
WVKE-98-C-1	Chironomidae	23
WVKE-98-C-1-0.5A	Cambaridae	2
WVKE-98-C-1-0.5A	Baetidae	12
WVKE-98-C-1-0.5A	Heptageniidae	35
WVKE-98-C-1-0.5A	Leptophlebiidae	9
WVKE-98-C-1-0.5A	Hydropsychidae	16

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count
WVKE-98-C-1-0.5A	Rhyacophilidae	1
WVKE-98-C-1-0.5A	Philopotamidae	2
WVKE-98-C-1-0.5A	Capniidae/Leuctrid	101
WVKE-98-C-1-0.5A	Perlidae	2
WVKE-98-C-1-0.5A	Psephenidae	4
WVKE-98-C-1-0.5A	Corydalidae	2
WVKE-98-C-1-0.5A	Tipulidae	14
WVKE-98-C-1-0.5A	Chironomidae	13
WVKE-98-C-11	Cambaridae	1
WVKE-98-C-11	Baetidae	5
WVKE-98-C-11	Heptageniidae	7
WVKE-98-C-11	Leptophlebiidae	6
WVKE-98-C-11	Hydropsychidae	3
WVKE-98-C-11	Rhyacophilidae	1
WVKE-98-C-11	Philopotamidae	9
WVKE-98-C-11	Polycentropodidae	1
WVKE-98-C-11	Capniidae/Leuctrid	26
WVKE-98-C-11	Chloroperlidae	3
WVKE-98-C-11	Perlidae	10
WVKE-98-C-11	Elmidae	3
WVKE-98-C-11	Tipulidae	8
WVKE-98-C-11	Simuliidae	21
WVKE-98-C-11	Chironomidae	11
WVKE-98-C-11-C	Cambaridae	1
WVKE-98-C-11-C	Ephemerellidae	1
WVKE-98-C-11-C	Hydropsychidae	44
WVKE-98-C-11-C	Rhyacophilidae	1
WVKE-98-C-11-C	Capniidae/Leuctrid	320
WVKE-98-C-11-C	Chloroperlidae	1
WVKE-98-C-11-C	Nemouridae	3
WVKE-98-C-11-C	Perlidae	6
WVKE-98-C-11-C	Corydalidae	3
WVKE-98-C-11-C	Tipulidae	8
WVKE-98-C-11-C	Chironomidae	20
WVKE-98-C-14-{1.4}	Cambaridae	1
WVKE-98-C-14-{1.4}	Baetidae	2
WVKE-98-C-14-{1.4}	Heptageniidae	27
WVKE-98-C-14-{1.4}	Leptophlebiidae	2
WVKE-98-C-14-{1.4}	Hydropsychidae	220
WVKE-98-C-14-{1.4}	Rhyacophilidae	3
WVKE-98-C-14-{1.4}	Philopotamidae	19
WVKE-98-C-14-{1.4}	Capniidae/Leuctrid	101
WVKE-98-C-14-{1.4}	Chloroperlidae	3
WVKE-98-C-14-{1.4}	Peltoperlidae	1
WVKE-98-C-14-{1.4}	Perlidae	15
WVKE-98-C-14-{1.4}	Pteronarcyidae	3
WVKE-98-C-14-{1.4}	Perlodidae	4
WVKE-98-C-14-{1.4}	Elmidae	6
WVKE-98-C-14-{1.4}	Tipulidae	8
WVKE-98-C-14-{1.4}	Empididae	2
WVKE-98-C-14-{1.4}	Simuliidae	2
WVKE-98-C-14-{1.4}	Chironomidae	23
WVKE-98-C-15-{1.0}	Cambaridae	1
WVKE-98-C-15-{1.0}	Baetidae	13
WVKE-98-C-15-{1.0}	Ephemerellidae	3
WVKE-98-C-15-{1.0}	Heptageniidae	19
WVKE-98-C-15-{1.0}	Leptophlebiidae	4
WVKE-98-C-15-{1.0}	Hydropsychidae	13
WVKE-98-C-15-{1.0}	Rhyacophilidae	1
WVKE-98-C-15-{1.0}	Polycentropodidae	2
WVKE-98-C-15-{1.0}	Capniidae/Leuctrid	27
WVKE-98-C-15-{1.0}	Chloroperlidae	4
WVKE-98-C-15-{1.0}	Perlidae	1
WVKE-98-C-15-{1.0}	Pteronarcyidae	3
WVKE-98-C-15-{1.0}	Elmidae	2
WVKE-98-C-15-{1.0}	Tipulidae	4
WVKE-98-C-15-{1.0}	Chironomidae	3
WVKE-98-C-2	Oligochaeta	2
WVKE-98-C-2	Baetidae	41
WVKE-98-C-2	Heptageniidae	7
WVKE-98-C-2	Isonychiidae	18
WVKE-98-C-2	Hydropsychidae	23
WVKE-98-C-2	Philopotamidae	17
WVKE-98-C-2	Capniidae/Leuctrid	9
WVKE-98-C-2	Dryopidae	1
WVKE-98-C-2	Athericidae	2
WVKE-98-C-2	Tipulidae	2
WVKE-98-C-2	Empididae	1
WVKE-98-C-2	Simuliidae	6
WVKE-98-C-2	Chironomidae	39
WVKE-98-C-2-D	Baetidae	18
WVKE-98-C-2-D	Heptageniidae	19
WVKE-98-C-2-D	Leptophlebiidae	8
WVKE-98-C-2-D	Hydropsychidae	3
WVKE-98-C-2-D	Rhyacophilidae	2
WVKE-98-C-2-D	Capniidae/Leuctrid	22
WVKE-98-C-2-D	Chloroperlidae	3
WVKE-98-C-2-D	Perlidae	1
WVKE-98-C-2-D	Pteronarcyidae	1
WVKE-98-C-2-D	Perlodidae	4
WVKE-98-C-2-D	Tipulidae	8
WVKE-98-C-2-D	Simuliidae	12
WVKE-98-C-2-D	Chironomidae	5
WVKE-98-C-5	Baetidae	22
WVKE-98-C-5	Ephemerellidae	1
WVKE-98-C-5	Heptageniidae	14
WVKE-98-C-5	Tricorythidae	2
WVKE-98-C-5	Hydropsychidae	3
WVKE-98-C-5	Philopotamidae	22
WVKE-98-C-5	Perlidae	2
WVKE-98-C-5	Pteronarcyidae	1
WVKE-98-C-5	Elmidae	1
WVKE-98-C-5	Tipulidae	1
WVKE-98-C-5	Simuliidae	3
WVKE-98-C-5	Chironomidae	3

Table 9. Benthic macroinvertebrates indentified (continued)

Stream Code	Taxa	count	Stream Code	Taxa	count
WVKE-98-C-6	Baetidae	64			
WVKE-98-C-6	Ephemerellidae	1			
WVKE-98-C-6	Heptageniidae	5			
WVKE-98-C-6	Glossosomatidae	1			
WVKE-98-C-6	Hydropsychidae	3			
WVKE-98-C-6	Rhyacophilidae	4			
WVKE-98-C-6	Philopotamidae	8			
WVKE-98-C-6	Limnephilidae	1			
WVKE-98-C-6	Capniidae/Leuctrid	20			
WVKE-98-C-6	Perlidae	2			
WVKE-98-C-6	Dryopidae	6			
WVKE-98-C-6	Elmidae	7			
WVKE-98-C-6	Psephenidae	1			
WVKE-98-C-6	Veliidae	1			
WVKE-98-C-6	Tipulidae	4			
WVKE-98-C-6	Simuliidae	2			
WVKE-98-C-6	Chironomidae	10			
WVKE-98-C-6	Dixidae	1			
WVKE-98-C-{10.0}	Oligochaeta	1			
WVKE-98-C-{10.0}	Baetidae	72			
WVKE-98-C-{10.0}	Ephemerellidae	1			
WVKE-98-C-{10.0}	Heptageniidae	15			
WVKE-98-C-{10.0}	Isonychiidae	15			
WVKE-98-C-{10.0}	Glossosomatidae	1			
WVKE-98-C-{10.0}	Hydropsychidae	51			
WVKE-98-C-{10.0}	Philopotamidae	33			
WVKE-98-C-{10.0}	Capniidae/Leuctrid	11			
WVKE-98-C-{10.0}	Perlidae	17			
WVKE-98-C-{10.0}	Elmidae	6			
WVKE-98-C-{10.0}	Athericidae	6			
WVKE-98-C-{10.0}	Ceratopogonidae	1			
WVKE-98-C-{10.0}	Simuliidae	2			
WVKE-98-C-{10.0}	Chironomidae	61			
WVKE-98-C-{13.8}	Oligochaeta	1			
WVKE-98-C-{13.8}	Baetidae	78			
WVKE-98-C-{13.8}	Ephemerellidae	10			
WVKE-98-C-{13.8}	Heptageniidae	34			
WVKE-98-C-{13.8}	Isonychiidae	5			
WVKE-98-C-{13.8}	Hydropsychidae	43			
WVKE-98-C-{13.8}	Rhyacophilidae	1			
WVKE-98-C-{13.8}	Philopotamidae	27			
WVKE-98-C-{13.8}	Capniidae/Leuctrid	8			
WVKE-98-C-{13.8}	Chloroperlidae	1			
WVKE-98-C-{13.8}	Perlidae	18			
WVKE-98-C-{13.8}	Elmidae	5			
WVKE-98-C-{13.8}	Psephenidae	1			
WVKE-98-C-{13.8}	Athericidae	20			
WVKE-98-C-{13.8}	Simuliidae	4			
WVKE-98-C-{13.8}	Chironomidae	10			

Table 10. Water quality - parameters measured in the field and Fecal coliform bacteria

Stream Code	Temp (^{o}C)	pH	DO (mg/l)	Conductivity umos	Fecal coliform bacteria colonies/ 100 ml
WVK-43-{1.2}	23.5	7.2	6.9	145	200
WVK-43-{105.2}	21.8	7.4	7.4	96	420
WVK-43-{156.2}	22.2	7.9	8.8	129	193
WVK-43-{16.0}	24.7	7.4	7.7	130	200
WVK-43-{46.6}	26.9	7.7	8.4	128	280
WVK-43-{49.8}	26.2	7.6	8.2	142	2800
WVK-43-{63.0}	26.8	7.9	8.5	112	260
WVK-43-{87.4}	25.6	7.4	7.5	111	220
WVKE-2					5200
WVKE-2-E	22.3	7.4	7.4	136	360
WVKE-3	18.9	7.8	8.4	431	10000
WVKE-4	21.9	8		433	260
WVKE-6-{5.6}	20	6.9	8.8	79	500
WVKE-7-E	27.4	8	6.9	435	4200
WVKE-9					13000
WVKE-9-{1.5}	20.8	7.4	8.5	233	5000
WVKE-9-{15.0}	24.9	7.2	8	126	2200
WVKE-9-B-1	20.6	7.9	7.6	324	3000
WVKE-9-C-{0.6}	22.2	7.3	8.3	207	4800
WVKE-9-E	19.3	7.2	9	109	160000
WVKE-9-G	20.8	7.9	7.1	274	1200
WVKE-9-I-1-A	19.4	7.3	8.8	101	900
WVKE-9-J	21.5	7.7	8.4	158	57000
WVKE-13	19.7	7.5	7.2	190	4200
WVKE-14-G-1-{0.8}	17.2	6.8	9.3	117	110
WVKE-14-G-2	19.8	4.2	8.4	303	68
WVKE-14-G-2-A	17.7	3.8	8.5	317	84
WVKE-14-K.1	19	6.9	8.2	183	120
WVKE-14-M	19.6	7.1	8.1	500	160
WVKE-14-M-2	18	4.2	8.1	1026	300
WVKE-14-O-{5.2}	20.1	7.1	7.9	149	28
WVKE-14-O-0.5	17.6	6.5	8.4	179	700
WVKE-14-P	17.8	6.6	8.5	75	68
WVKE-19-B	18.3	7	8.8	63	560
WVKE-19-H	17.9	7.5	8.1	100	1000
WVKE-21	21	7.5	7.3	153	1600
WVKE-23-{0.43}	25.3	7.3	7.9	215	1800
WVKE-23-{12.6}	28.9	7.3	7.2	214	28
WVKE-23-D-6	24.5	6.7	5.8	120	240
WVKE-23-F-1	21.5	7	6.8	97	320
WVKE-23-P-{3.0}	23.6	7.3	6.3	295	1200
WVKE-23-P-1	21.9	7	2.8	203	220
WVKE-23-P-3-A	21	7.7	6.8	141	3000
WVKE-23-P-3-B	21.1	7.9	7.9	178	5800
WVKE-26-A-{0.16}	17.7	3.5	7.2	494	2
WVKE-26-A-{0.16}	18.5	3.4	8.8	485	2
WVKE-32-{1.0}	19.4	6.6	6	58	200

Table 10. Water quality - parameters measured in the field and Fecal coliform bacteria

Stream Code	Temp (°C)	pH	DO (mg/l)	Conductivity umos	Fecal coliform bacteria colonies/ 100 ml
WVKE-34	21	6.9	7.6	62	2200
WVKE-37	22.5	7.6	8.7	171	4000
WVKE-37	23.3	7.5	8.6	147	900
WVKE-37-B	20.6	7.2	7.9	186	1000
WVKE-37-D	21.1	7.9	8.5	599	76
WVKE-40	19.9	6.7	8.7	48	3000
WVKE-41	21.9	7.2	8.3	178	480
WVKE-41-A	21	7	7.3	42	1600
WVKE-41-B-{0.2}	21.3	7.4	8.7	116	1600
WVKE-41-B-1.5	22.8	7.5	8.5	148	700
WVKE-41-C-1	25.8	8.3	7.3	552	5200
WVKE-45-B	25	7.5	8.1	198	4400
WVKE-46-{1.2}	20	7.7	9.3	684	700
WVKE-49	18.8	6.6	8.8	74	1500
WVKE-50-{0.2}	21.3	7.1	8.8	217	44
WVKE-50-B-{0.1}	20.9	7.2	8.7	236	800
WVKE-50-B-1-{2.0}	16.9	6.8	8.3	36	110
WVKE-50-B-10	20.1	6.7	8.3	34	180
WVKE-50-B-7-{0.1}	21.2	7	8.3	64	1200
WVKE-50-B-8	23.2	6.9	8	77	80
WVKE-50-B-9	19.7	7	7.8	34	300
WVKE-50-F-{2.2}	18.4	7.4	7.9	61	100
WVKE-50-G	18.8	7.4	8.3	45	16
WVKE-50-I	19.9	7.5	8.2	172	300
WVKE-50-I-3	15.9	4.7	8.3	254	4
WVKE-50-K	18.2	7.3	6.8	54	32
WVKE-50-O	23.6	7.3	7.7	145	2000
WVKE-50-P	23.1	4.5	8	364	2
WVKE-50-S	20.2	4.1	7.8	262	20
WVKE-50-T	24.4	7.5	7.3	99	130
WVKE-56	20.9	6.8	7.3	52	420
WVKE-59	18.7	6.1	6.1	51	200
WVKE-64	29.4	8.2	8.4	200	600
WVKE-64-D	24.2	7.2	4.1	129	80
WVKE-64-E	22.7	7.2	4.1	289	120
WVKE-69-{5.6}	20.6	7.2	8.3	171	200
WVKE-70-A	25.1	7.6	7.5	126	2000
WVKE-74-{10.4}	20.2	7.7	8.1	274	3600
WVKE-74-F	19.4	7	7.4	48	76
WVKE-76-{0.9}	24.6	7.8	7.3	190	52
WVKE-76-A	20.2	7.9	8.2	120	1500
WVKE-76-C	19.4	7.8	5	94	44
WVKE-76-D-1	21.9	7.3	6.3	151	1600
WVKE-76-E-{2.6}	22.3	7.9	8.4	239	200
WVKE-76-E-5	30.2	8.9	8.6	76	10
WVKE-76-E-6-A	25.3	8	7.2	103	2800
WVKE-76-E-7.5	22.8	6.6	7.8	43	3000
WVKE-76-N-{2.4}	22	7.2	7.8	202	110

Table 10. Water quality - parameters measured in the field and Fecal coliform bacteria

Stream Code	Temp (^{o}C)	pH	DO (mg/l)	Conductivity umos	Fecal coliform bacteria colonies/ 100 ml
WVKE-76-N-8	19	7.5	8.5	212	2800
WVKE-76-O	21.6	7	8.2	114	420
WVKE-76-S.3	19.7	6.4	7.9	35	1400
WVKE-76-S.8	19.4	6.7	8	43	110
WVKE-76-U-{0.8}	17.8	6.4	8	26	56
WVKE-78	24	8.5	9.1	195	320
WVKE-79	19.3	7.3	1.6	243	12
WVKE-82	20.3	7.6	6.8	202	1800
WVKE-84.5	26.8	7.9	6.7	195	1200
WVKE-85	27.7	8.3	8.9	318	700
WVKE-87-B	23.2	7.6	7.7	144	2400
WVKE-87-C	22.2	7.5	4.2	175	7800
WVKE-88	21.5	7.6	7.3	174	3000
WVKE-91	20	8.5	8.7	640	160
WVKE-91-A-1	17.1	8.7	9.2	887	30
WVKE-94	21.6	7.5	7	136	1200
WVKE-98-A	21.5	8.2	9.2	120	40
WVKE-98-B	21.8	6.7	8	54	47
WVKE-98-B-{13.6}	20.6	6.7	8.1	99	1300
WVKE-98-B-16	19.8	6.9	7.4	39	107
WVKE-98-B-16.4	19.1	6.8	6.9	79	51
WVKE-98-B-16-B-{1.0}	18	7.4	8.1	55	263
WVKE-98-B-3-{0.6}	17.8	6.9	8.8	43	80
WVKE-98-B-8	20.4	6.7	8.3	55	120
WVKE-98-C-{10.0}	18.6	7.2	9	51	151
WVKE-98-C-{13.8}	22.8	7.2	8.1	48	35
WVKE-98-C-1	20	7.2	8.5	54	143
WVKE-98-C-1-0.5A	17.5	6.8	8.3	46	97
WVKE-98-C-11	17.8	7	8.8	59	149
WVKE-98-C-11-C	19.2	5	6.1	16	133
WVKE-98-C-14-{1.4}	18.7	6.1	8.1	21	84
WVKE-98-C-15-{1.0}	16.6	7.5	8.3	48	21
WVKE-98-C-2	20.1	6.9	8.7	50	610
WVKE-98-C-2-D	16.8	6.8	8.5	34	80
WVKE-98-C-5	18.2	7.2	8.9	51	87
WVKE-98-C-6	21.7	7.5	8.4	60	1500
WVKE-102-{14.6}	19.8	8.4	8.8	436	140
WVKE-102-{2.8}	22.2	8.4	8.8	568	64
WVKE-102-A	18.2	7.2	8.1	188	120
WVKE-102-C-1-{0.4}	17.2	6.7	6.2	52	220
WVKE-111-{0.2}	19.3	7.4	8.2	137	360
WVKE-111-K	17.2	7.5	8.8	48	500
WVKE-111-K-2	15.7	7.5	9	42	28
WVKE-111-Q	15.3	7.5	8.9	56	8
WVKE-111-S	14.8	6.7	8.8	44	12
WVKE-115	15.9	7.3	8.6	74	40
WVKE-117	16.2	7.3	9.5	63	87

Table 10. Water quality - parameters measured in the field and Fecal coliform bacteria

Stream Code	Temp (°C)	pH	DO (mg/l)	Conductivity umos	Fecal coliform bacteria colonies/ 100 ml
WVKE-117-B	14.2	7.1	9.4	36	8
WVKE-118	15.2	7.2	9.4	63	77
WVKE-124	14.3	7.2	9.2	113	33
WVKE-128	16.2	7.2	8.9	189	77
WVKE-136-{0.5}	14.6	7.1	8.8	52	0
WVKE-137	15.6	7.1	8.6	55	60
WVKE-138	15.2	7.1	9.8	211	53
WVKE-139	20.2	7.9	8.1	175	23
WVKE-139-0.5A	22.7	8.5	11.4	219	633
WVKE-139-B	20.5	6.7	6.8	52	83

Table 11. Additional WQ parameters taken from suspected AMD streams

Stream Code	Total Al (mg/l)	Total Fe (mg/l)	Total Mn (mg/l)	Hot acidity (mg/l)	Alkanlinity (mg/l)	Sulfate (mg/l)
WVK-43-{105.2}	0.16	0.25	0.084	<1	48	17
WVK-43-{16.0}	0.18	0.44	0.081	<1	31	23
WVK-43-{46.6}	0.13	2.00	0.088	<1	31	28
WVK-43-{49.8}	0.24	0.46	0.069	<1	30	31
WVKE-6-{5.6}	0.55	0.85	0.04	<1	20	14
WVKE-9-{1.5}	0.071	0.28	0.035	<1	66	16
WVKE-14-G-1-{0.8}	0.44	0.51	0.34	<1	13	31
WVKE-14-G-2-A	2.700		1.100	38	<1	100
WVKE-14-M-2	1.400	0.450	1.900	15	<1	160
WVKE-14-O-{5.2}	0.08	0.19	0.069	<1	25	44
WVKE-23-P-{3.0}	0.19	0.66	0.29	<1	99	12
WVKE-26	2.5	0.54	0.72	20	3	97
WVKE-26-A-{0.16}	7.300	2.000	1.900	74	<1	240
WVKE-26-A-{0.16}	8.0	2.1	2.0	71	<1	200
WVKE-32-{1.0}	0.15	0.06	0.032	<1	16	11
WVKE-37-D					78	11
WVKE-41-B-{0.2}	0.086	0.18	0.025	<1	26	26
WVKE-41-C-1				<1	67	200
WVKE-46-{1.2}	0.083	0.097	0.021	<1	57	240
WVKE-50-{0.2}	0.067	0.120	0.054	<1	14	94
WVKE-50-B-1-{2.0}	0.075	0.071	<0.02	<1	7	10
WVKE-50-B-7-{0.1}	0.28	0.38	0.023	<1	9	19
WVKE-50-F-{2.2}	0.066	0.59	0.027	<1	18	5
WVKE-50-I-3	1.7	0.55	0.34	27	2	94
WVKE-50-O	0.07					
WVKE-50-P	1.2	1.1	1.0	25	<1	160
WVKE-50-S	1.7	0.068	0.660	35	<1	130
WVKE-69-{5.6}	0.079	0.098	<0.02	<1	12	
WVKE-74-{10.4}	0.13	0.062	<0.02	<1	26	100
WVKE-76-{0.9}	0.11	0.30	0.066	<1	45	41
WVKE-76-E-{2.6}	0.13	0.29	0.057	<1	89	47
WVKE-76-N-{2.4}	0.11	0.056	<0.02	<1	21	71
WVKE-76-N-8	0.31					
WVKE-76-U-{0.8}	0.12	0.18	<0.02	<1	7	6
WVKE-76-W	0.071	0.058	1.80	<1	180	430
WVKE-82	0.05					
WVKE-94	0.28					
WVKE-98-B-16-B-{1.0}	0.27	0.81	0.16	<1	8	7
WVKE-98-B-3-{0.6}	0.099	0.14	<0.02	<1	6	9
WVKE-98-C-11	0.07					
WVKE-98-C-11-C	0.24					
WVKE-98-C-14-{1.4}	0.098	0.12	<0.02	2	6	5
WVKE-98-C-15-{1.0}	0.052	0.11	<0.02	<1	7	6
WVKE-102-{14.6}	0.067	0.13	<0.02	<1	220	23
WVKE-102-A	0.06					
WVKE-102-C-1-{0.4}	0.12	1.20	0.40	<1	13	7
WVKE-118	0.056					
WVKE-137	0.056					
WVKE-138	0.13					
WVKE-139-0.5A	0.055					

Table 12. Rapid Habitat Assessment Scores

Stream Code	cover	substrate	embed	veloc	alteration	sediment	riffle freq.	flow	bank stab.	bank veg	grazing	rip veg	Total
WVK-43-{156.2}	17	15	18	15	18	18	15	10	16	16	16	15	189
WVK-43-{63.0}	16	14	14	17	18	15	15	15	16	15	11	11	177
WVK-43-{87.4}	19	19	17	15	19	17	16	13	17	16	13	14	195
WVKE-102-{14.6}	17	15	17	18	19	17	17	9	17	15	18	15	194
WVKE-102-{2.8}	15	16	18	15	10	17	16	16	17	15	11	7	173
WVKE-102-A	18	18	18	13	16	16	17	17	18	15	12	11	189
WVKE-102-C-1-{0.4}	5	5	6	5	19	6	3	11	18	16	17	15	126
WVKE-111-{0.2}	11	13	16	14	9	16	11	10	18	7	7	2	134
WVKE-111-K	13	12	14	13	15	14	12	11	15	10	16	8	153
WVKE-111-K-2	12	13	17	14	16	16	17	7	18	15	18	13	176
WVKE-111-Q	12	15	14	13	19	13	14	9	14	11	19	19	172
WVKE-111-S	17	15	16	13	20	17	16	8	17	11	20	20	190
WVKE-115	15	9	18	10	20	18	13	8	19	18	19	19	186
WVKE-117	12	9	15	14	13	17	13	9	16	17	15	9	159
WVKE-117-B	19	13	16	15	18	17	18	8	18	18	19	18	197
WVKE-118	18	16	18	15	14	18	17	9	18	10	13	10	176
WVKE-124	19	10	16	15	18	13	16	8	18	12	18	12	175
WVKE-128	15	15	14	14	19	12	17	9	16	11	17	15	174
WVKE-13	15	18	18	10	14	14	18	14	8	11	13	3	156
WVKE-136-{0.5}	19	15	18	15	19	17	17	7	16	15	20	20	198
WVKE-137	14	16	16	14	16	17	16	8	13	17	16	17	180
WVKE-138	10	12	13	10	14	14	11	8	16	11	16	8	143
WVKE-139	13	13	16	14	16	14	11	8	12	15	18	15	165
WVKE-139-0.5A	11	12	5	9	18	18	6	3	18	17	18	15	150
WVKE-139-B	16	16	17	15	14	15	16	10	14	15	10	5	163
WVKE-14-G-1-{0.8}	16	17	14	15	12	16	18	17	14	14	9	5	167
WVKE-14-G-2	13	19	12	14	18	11	18	11	11	11	13	10	161
WVKE-14-G-2-A	11	13	15	10	18	12	17	10	12	12	15	9	154
WVKE-14-K.1	15	18	15	15	17	11	19	9	12	11	16	9	167
WVKE-14-M	11	16	15	13	14	11	18	15	16	17	16	10	172
WVKE-14-M-2	17	17	12	14	18	14	19	9	7	5	18	18	168
WVKE-14-O-{5.2}	17	18	17	10	18	15	17	19	14	16	19	6	186
WVKE-14-O-0.5	17	16	14	10	19	14	18	9	18	16	18	19	188
WVKE-14-P	13	17	17	10	18	16	15	10	14	13	18	16	177
WVKE-19-B	18	19	17	15	18	15	19	10	15	17	17	8	188
WVKE-19-H	17	18	19	10	10	19	13	19	16	15	13	0	169
WVKE-21	6	8	13	14	18	5	14	7	8	10	14	15	132
WVKE-23-{0.43}	13	14	12	13	19	11	16	10	14	9	16	10	157
WVKE-23-{12.6}	16	6	11	11	13	8	3	8	14	10	9	8	117
WVKE-23-D-6	13	7	16	6	16	16	16	4	7	9	1	3	114
WVKE-23-F-1	18	6	12	6	18	13	12	7	13	13	10	5	133
WVKE-23-P-{3.0}	15	12	8	16	18	9	5	18	12	12	14	11	150
WVKE-23-P-1	14	17	18	10	14	14	18	4	18	18	10	7	162
WVKE-23-P-3-A	11	16	14	10	14	14	17	9	15	13	13	3	149
WVKE-23-P-3-B	12	15	12	9	16	10	16	8	6	9	3	2	118
WVKE-26-A-{0.16}	19	18	18	17	13	18	19	18	8	13	17	0	178
WVKE-2-E	12	11	12	10	9	11	16	16	16	17	4	3	137
WVKE-3	9	12	7	18	19	10	17	15	18	17	20	7	169
WVKE-32-{1.0}	10	5	14	3	18	10	4	4	16	16	15	12	127
WVKE-34	16	17	15	10	14	14	19	14	17	19	6	5	166
WVKE-37	15	15	14	18	15	10	12	13	16	17	10	6	161
WVKE-37	19	17	16	15	17	14	19	11	16	17	17	15	193

Table 12. Rapid Habitat Assessment Scores

Stream Code	cover	substrate	embed	veloc.	alteration	sediment	riffle freq.	flow	bank stab.	bank veg	grazing	rip veg	Total
WVKE-37-B	15	17	12	15	13	11	17	16	15	16	7	4	158
WVKE-37-D	13	18	14	14	15	14	17	14	15	15	10	5	164
WVKE-4	8	9	12	10	16	7	16	10	12	13	17	17	147
WVKE-40	16	17	17	16	15	13	16	11	14	13	15	13	176
WVKE-41	17	16	16	17	15	13	16	11	10	9	14	14	168
WVKE-41-A	19	16	16	13	15	14	19	8	17	18	13	10	178
WVKE-41-B-{0.2}	6	16	16	10	19	17	19	15	19	18	13	8	176
WVKE-41-B-1.5	18	16	19	10	17	16	19	14	15	19	4	5	172
WVKE-41-C-1	13	18	19	10	16	15	19	16	14	18	6	2	166
WVKE-45-B	14	16	18	10	17	18	17	16	16	17	10	14	183
WVKE-46-{1.2}	18	18	18	17	19	15	17	16	13	10	19	15	195
WVKE-49	15	19	18	11	11	17	19	19	14	17	12	14	186
WVKE-50-{0.2}	11	14	13	17	12	14	16	11	12	13	14	10	157
WVKE-50-B-{0.1}	17	17	16	15	14	16	16	16	14	14	17	14	186
WVKE-50-B-1-{2.0}	15	17	17	10	20	14	18	15	13	18	19	20	196
WVKE-50-B-10	15	19	17	14	20	17	19	18	17	16	18	16	206
WVKE-50-B-7-{0.1}	15	17	16	14	7	13	14	15	15	15	18	12	171
WVKE-50-B-8	16	17	12	14	15	15	19	17	16	15	15	14	185
WVKE-50-B-9	18	19	17	10	19	16	18	15	16	15	19	14	196
WVKE-50-F-{2.2}	14	13	14	10	16	13	15	9	13	13	18	9	157
WVKE-50-G	11	10	16	14	18	16	15	7	16	12	19	10	164
WVKE-50-I	14	17	13	10	15	14	17	9	14	14	18	17	172
WVKE-50-I-3	16	16	12	9	17	10	14	8	14	12	18	16	162
WVKE-50-K	12	10	15	10	19	15	16	3	14	13	19	19	165
WVKE-50-O	16	14	12	14	13	14	15	9	14	12	16	9	158
WVKE-50-P	11	16	9	9	10	8	16	8	6	7	9	4	113
WVKE-50-S	9	17	16	9	17	15	18	8	15	12	17	15	168
WVKE-50-T	13	17	8	7	11	7	18	16	14	15	11	7	144
WVKE-56	17	17	14	10	9	9	16	10	13	14	11	9	149
WVKE-59	15	11	17	10	18	9	16	5	7	13	15	15	151
WVKE-6-{5.6}	15	14	11	14	15	10	16	15	12	12	11	5	150
WVKE-64	10	13	14	10	14	11	17	7	7	8	12	5	128
WVKE-64-D	1	7	12	1	16	2	9	1	7	8	10	5	79
WVKE-64-E	2	12	9	2	14	13	8	8	9	14	12	3	106
WVKE-69-{5.6}	16	17	15	10	15	16	17	14	13	14	13	8	168
WVKE-70-A	15	16	12	9	11	9	16	7	15	16	6	3	135
WVKE-74-{10.4}	12	18	11	10	18	12	18	8	17	18	17	8	167
WVKE-74-F	12	14	14	10	18	13	16	7	16	16	18	8	162
WVKE-76-{0.9}	18	17	16	17	19	18	16	11	15	15	20	19	201
WVKE-76-A	13	16	13	10	18	11	17	8	15	12	17	8	158
WVKE-76-C	12	14	14	13	17	14	17	7	11	11	17	15	162
WVKE-76-D-1	16	19	16	8	18	15	19	14	15	15	5	3	163
WVKE-76-E-{2.6}	16	18	14	9	18	10	19	18	16	16	10	7	171
WVKE-76-E-5	14	12	9	9	14	8	16	8	9	14	8	3	124
WVKE-76-E-6-A	16	16	13	11	15	14	16	10	11	12	6	3	143
WVKE-76-E-7.5	13	12	11	9	15	12	18	9	15	14	11	5	144
WVKE-76-N-{2.4}	18	17	16	18	12	16	17	15	16	15	10	5	175
WVKE-76-N-8	18	18	17	15	19	14	19	14	15	18	16	10	193
WVKE-76-O	17	19	18	10	13	18	19	15	13	10	11	7	170
WVKE-76-S.3	17	18	19	10	14	17	17	16	17	16	10	6	177
WVKE-76-S.8	12	12	17	10	18	17	12	10	19	19	19	17	182
WVKE-76-U-{0.8}	14	17	19	10	17	15	16	10	19	18	19	17	191

Table 12. Rapid Habitat Assessment Scores

Stream Code	cover	substrate	embed	veloc.	alteration	sediment	riffle freq.	flow	bank stab.	bank veg	grazing	rip veg	Total
WVKE-76-W	16	14	15	9	17	17	16	10	11	11	17	16	169
WVKE-78	8	14	8	9	6	7	15	8	7	6	7	4	99
WVKE-79	12	12	13	7	17	8	14	7	9	12	18	15	144
WVKE-7-E	12	16	9	10	11	7	16	8	15	12	2	3	121
WVKE-82	13	12	11	8	17	8	16	8	7	8	16	14	138
WVKE-84.5	11	17	12	9	12	13	17	7	14	12	17	3	144
WVKE-85	11	17	13	9	6	13	17	9	8	6	17	3	129
WVKE-87-B	17	18	13	10	11	13	18	18	16	16	10	4	164
WVKE-87-C	10	11	9	9	13	6	14	14	8	7	6	3	110
WVKE-88	12	17	15	9	15	15	17	15	16	16	7	2	156
WVKE-9-{1.5}	11	12	14	18	19	9	13	17	5	10	18	14	160
WVKE-9-{15.0}	15	13	10	14	16	10	9	11	12	8	10	5	133
WVKE-91	15	16	15	14	10	15	16	15	14	15	6	4	155
WVKE-91-A-1	12	16	15	9	7	13	19	16	7	3	4	5	126
WVKE-94	10	14	11	9	15	7	15	16	10	10	8	3	128
WVKE-98-A	17	18	16	9	6	14	19	10	4	3	7	3	126
WVKE-98-B	13	10	14	10	17	13	15	9	18	16	12	6	153
WVKE-98-B-{13.6}	14	12	16	10	19	15	16	9	17	16	18	9	171
WVKE-98-B-16	18	12	16	10	19	13	13	9	17	14	9	8	158
WVKE-98-B-16.4	10	14	14	9	10	17	18	10	13	7	8	6	136
WVKE-98-B-16-B-{1.0}	6	8	14	9	19	15	9	7	14	11	19	19	150
WVKE-98-B-3-{0.6}	18	19	18	10	19	16	19	18	17	14	14	8	190
WVKE-98-B-8	16	17	13	9	16	11	18	16	14	15	10	5	160
WVKE-98-C-{10.0}	19	19	16	19	16	12	18	17	16	16	7	5	180
WVKE-98-C-{13.8}	18	17	18	19	16	17	16	16	15	15	11	5	183
WVKE-98-C-1	15	17	11	10	15	10	19	16	13	16	14	10	166
WVKE-98-C-1-0.5A	17	18	15	10	18	15	19	16	12	14	19	19	192
WVKE-98-C-11	18	18	15	11	17	14	16	15	7	8	9	11	159
WVKE-98-C-11-C	17	15	13	15	14	10	9	16	15	11	17	15	167
WVKE-98-C-14-{1.4}	17	16	16	15	16	16	17	10	15	16	18	15	187
WVKE-98-C-15-{1.0}	14	12	14	10	18	11	14	8	14	15	18	15	163
WVKE-98-C-2	15	15	15	9	12	9	16	15	7	5	6	2	126
WVKE-98-C-2-D	18	15	11	10	19	9	17	10	18	10	19	19	175
WVKE-98-C-5	18	17	16	10	19	14	20	17	15	16	12	8	182
WVKE-98-C-6	15	18	16	8	17	15	19	18	16	16	5	4	167
WVKE-9-B-1	6	17	10	8	13	10	16	16	10	10	9	1	126
WVKE-9-C-{0.6}	15	16	8	16	17	14	13	13	12	13	13	6	156
WVKE-9-E	12	18	12	14	15	10	19	19	2	5	3	1	130
WVKE-9-G	11	18	15	10	16	14	18	14	10	13	10	5	154
WVKE-9-I-1-A	18	19	16	15	14	18	18	18	10	10	11	0	167
WVKE-9-J	5	19	9	9	8	3	18	13	8	4	9	2	107

Categories scored 0-20, total possible score =

cover = instream
substrate = epifaunal
embed = embeddedness
veloc = # of velocity/depth regimes (i.e.
alteration = channel
sediment = sediment deposition

riffle freq. = frequency of
flow = channel flow (relative to season)
bank stab. = erosional condition of banks
bank veg = bank vegetative protection
grazing = grazing or other disruptive
rip veg = riparian vegetation zone width (least buffered)

Appendix B. 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, that are large enough to be collected with a 595 micron mesh screen. Examples include insects, snails, and worms.

benthic organisms, or benthos - organisms that live on or near the substrate (bottom) of a water body, e.g., algae, mayfly larvae, 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 5 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 (DO) - the amount of molecular oxygen dissolved in water, normally expressed in mg/l.

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 (specifically macrobenthos).

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 1 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.

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 (see Appendix B).

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 1 describes the strongest acid, 14 represents the strongest base, and 7 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.

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 (Appedix D).

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 form 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, 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. Environmental Protection Agency, US Geological Survey) and state (e.g., Division of Environemental Protection, Soil Conservation Agency) 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 coaliton of federal, state, multi-state, and non-governmental groups cooperating to support local watershed associations.