An Assessment of the Macroinvertebrate Communities of the Indian Creek Watershed, Tazewell County, Virginia.

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Final

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Table of Contents

Acknowledgments

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1. Introduction

This survey was done as part of a multi-agency analysis of periphyton, fish and benthic macroinvertebrate communities and the effects of point and nonpoint sources in the Indian Creek watershed, in Tazewell County in southwestern Virginia. The completed multi-agency study will include collections or measurements of water quality parameters, the periphyton assemblage, the benthic macroinvertebrate assemblage, the fish assemblage, instream physical habitat, and the development of a Geographic Information System (GIS) database (Lingenfelser 2001). The USFWS is the lead agency on the study and is interested in developing a restoration plan for the endangered tan riffleshell mussel (*Epioblasma walkeri*), which lives in this watershed.

In February 2002, the USEPA Freshwater Biology Team and USFWS Staff collected benthic macroinvertebrate samples, measured some field physical/chemical parameters, and performed visual qualitative physical habitat surveys using the EPA's Rapid Bioassessment Protocol (RBP). The objective of the benthic macroinvertebrate survey is to provide data on the condition of the tributaries of Indian Creek and selected sites on the mainstem of Indian Creek. The sites were sampled once, within one week, in late February of 2002.

2. Monitoring Design and Site Locations

In April 2001, USEPA Wheeling staff accompanied USFWS staff and others on a reconnaissance trip to visit the candidate sites. The site locations in this study were chosen primarily by USFWS staff prior to the recon visit. These sites were chosen to provide information on the major tributaries and the main stem of Indian Creek. Staff knowledge of mining activity, point sources, and nonpoint sources was also important in selecting the sites. A list of the sites, their locations and the sampling dates are provided in Map 1 and Table 1 (Appendix A).

3. Monitoring Parameters, Methods and Their Frequency of Collection

Benthic macroinvertebrate samples, physical/chemical field parameters and visual qualitative stream habitat evaluations were collected once at each site during the week of February 26, 2002. The benthic macroinvertebrate samples were collected using the USEPA RBP single habitat protocol, with slight modifications. Four 0.25 m^2 sections of riffle were sampled using a 0.5 meter wide, 600 um mesh rectangular dip net. These 4 samples were composited for a total of one m^2 sampled. In the laboratory, a standard proportion (1/8th) of the sample was subsampled and picked. For calculation of taxa richness measures, the resulting data were rarefied to a 200 organism fixed count subsample.

The stream habitat evaluations were conducted using the EPA RBP riffle/run protocol for high gradient streams. The field chemical/physical parameters were measured using a Corning Checkmate 90 field meter, which was calibrated according to the manufacturer's instructions every day. The range of velocities in the sampled reach were measured using a Marsh McBirney velocity meter.

4. The Virginia Stream Condition Index

For this study, we used the Virginia Stream Condition Index (VSCI) and its component metrics to assess the macroinvertebrate assemblage data. The VSCI was developed by Tetra Tech Inc., using the Virginia Department of Environmental Quality (VA DEQ) macroinvertebrate database (Burton and Gerritsen 2003). The VSCI is a family-level index.

Eight metrics make up the VSCI: Total Taxa, EPT Taxa, % Ephemeroptera (% E), % Plecoptera plus Trichoptera less Hydropsychidae (%P + T - H), % Scrapers, % Chironomidae, % 2 Dominant Families (% 2 Dom Fam), and a family level HBI. These metrics were chosen in a rigorous process so that 1) the metrics could discriminate clearly between a priori most-disturbed (impaired) and least-disturbed (reference) sites, 2) the metrics represent several different aspects of the biotic community (e.g. composition, richness, diversity, tolerance, trophic groups), and 3) the metrics chosen minimize redundancy among component metrics.

The eight metrics were aggregated into an index by calculating the 5th percentile (% Chironomidae, % 2 Dom Taxa, HBI) or the 95th percentile (Total Taxa, EPT Taxa, % E, %P + T - H, % Scrapers) for all 1671 non-coastal plain samples in the VA DEQ 1994- 2002 database. These values were considered the standard "best" values. These values were then assigned a score of 100. Values of a metric between the minimum possible value (or in some cases the maximum possible value) and the standard best score were then scored proportionally from 0 ("worst") to 100 ("best"). The standard best values developed using the VA DEQ dataset are similar to those developed for West Virginia using a similar process but WV DEP's database (Gerritsen et al. 2000).

By standardizing the metric values to a common 100-point scale, each of the metrics contributes to the combined index with equal weighting, and all of the metric scores represent increasingly "better" site conditions as scores increase toward 100. Once all metric values for sites were converted to scores on the 100-point scale, a single multi-metric index value was calculated by simply averaging the individual metric scores for the site. See table 2 for a list of the metrics, the standard (best values) and the standardization equations.

Richness metrics have been shown to be positively correlated with abundance (Gerritsen et al 2000). VADEQ's sampling methods vary slightly across the state, but their subsample organism counts usually vary from 100 to 200 organisms. We used a standard proportion (1/8th) of the total sample as our subsample. This procedure standardizes the subsample by proportion, so the number of organisms in the subsample can vary quite widely depending on the productivity of the sampled streams. More productive streams will have much higher counts in the subsample than less productive streams. In this study, for samples with greater than 200 organisms, we rarified our proportion subsample data to 200 organisms and calculated richness measures on the fixed count subsample in order to score our samples using the VSCI richness best standard values. Seventeen (17) of the 24 subsamples were rarefied. The remaining seven proportional subsamples had between 100 and 200 organisms. Rarefaction is a statistical procedure which lets you directly compare the number of taxa found in samples when the sampling or subsampling effort differed. Rarefaction uses the data from the original sample to answer the questions "how many taxa would have been found in a smaller sample?". Rarefaction takes hypothetical subsamples of a fixed number of organisms from the original sample, and calculates the richness metrics for each hypothetical subsample (Krebs 1998). Our rarefaction procedure took 200 hypothetical subsamples of 200 organisms from the original subsample, and calculated average total taxa richness and EPT richness metric values for those 200 subsamples for each site. These average richness metrics were used in scoring the metric for the VSCI calculation.

The descriptive statistics and distribution of VSCI scores at the a priori reference site samples were used to establish a threshold for determining whether test sites are comparable to the reference condition (shown in table 3). In the final VSCI report, the 10^{th} % was recommended as a threshold to determine impairment (Burton and Gerritsen 2003). The 10^{th} % VSCI score of the reference site samples was 61.3. We used the VSCI scores to determine impairment and to rank the sites. We also pointed out the sites where we believe the genus-level taxa lists indicate a change in condition, but the family-level VSCI does not fully reflect those assemblage changes.

5. Macroinvertebrate Results

The macroinvertebrate component metrics and VSCI scores for the sites are shown in table 4. Note that for three sites, there are duplicate samples. These duplicate samples are used to estimate sampling method precision. Data generated from the first sample collected that day was displayed on map 2 (VSCI scores), map 3 (total taxa), and map 4 (EPT taxa). The taxonomic lists are shown in table 5. All total taxa and EPT (Ephemeroptera - mayflies, Plecoptera - stoneflies and Trichoptera - caddisflies) taxa values discussed are at the family level for the rarefied 200 fixed count subsamples, so many of these values, since they are averages, are not integers.

Figures 1, 2 and 3 indicate the VSCI scores, the total taxa values and the EPT taxa values for the 200 fixed count subsamples. The mainstem, tributary and limestone sites are grouped in separate bar graphs. The sites are listed from upstream to downstream order on each graph.

Most of the sites are located in the Cumberland Mountains area of the Central Appalachians (see Map 2). Some of the sites are located in the Southern Limestone/Dolomite Valleys and Rolling Hills of the Ridge and Valley Ecoregion. It should be noted that the VSCI study indicated that historical VADEQ reference sites in the Central Appalachians had lower VSCI scores as a group than reference sites located in other non-coastal ecoregions of Virginia. The interquartile range of VSCI scores for the Central Appalachians ecoregions was approximately 55 to 70. The interquartile range of all noncoastal reference sites was approximately 68 to 78. It is not clear at this point whether a separate (lower) threshold of impairment is needed for the Central Appalachians, or if the historical database in the Central Appalachians was biased to more impaired sites, and more sampling needs to be done to identify candidate reference sites in that region.

Many of the sites (12 of 21) in this study passed the state-wide noncoastal VSCI impairment threshold of 61.3. Three (3) sites scored less than the state-wide threshold but still within the interquartile range of the Central Appalachians reference sites (less than 61.3 but greater than 55). Six (6) sites had VSCI scores lower than the interquartile range of the Central Appalachians reference sites (less than 55). These six sites were site 1 (Indian Creek behind the trailer park), site 2 (Lowe Branch), site 4 (unnamed tributary that drains McGuire Valley), site 15 (South Branch of Indian Creek), site 19 (Coal Branch), and site 21 (Indian Creek at Cedar Bluff).

Mainstem Indian Creek Sites

There are 8 sites on the mainstem of Indian Creek. Starting at the upstream end, site 13 (upstream of Jackson Fork) was sampled in duplicate. The first sample scored 72.5 using the VSCI. The second sample had a VSCI score of 70.1. The taxa lists for both samples indicate good richness and evenness. There were 24.7 and 22.0 total taxa and 17.5 and 15.0 EPT taxa in the two samples. The site had a large number of EPT taxa, and many sensitive taxa (e.g. *Dolophilodes, Glossosoma, Rhyacophila, Neophylax, Diploperla, Acroneuria, Paracapnia, Pteronarcys, Ephemera, Epeorus, etc.).* The dominant taxon was midge, but midge only accounted for about 23% of the total organisms in both samples. The taxa lists for the two sites were very similar. Site 13 is clearly in good condition.

Site 16, located downstream of Jackson Fork, had a VSCI score of 61.8. The VSCI score dropped from that found at site 13 due to an increase in the number of Chironomidae collected at site 16. Chironomidae accounted for 45% of the organisms in the sample collected at this site. However, the number of total taxa (20.5) and the number of EPT taxa (13.4) were still high at site 16. We collected a good number of more sensitive taxa (*Dolophilodes, Neophylax, Goera, Acroneuria, Diploperla, Strophopteryx, Paracapnia, Epeorus, Ephemera, etc.).* The taxa list suggests Site 16 is in good condition, although the VSCI score is slightly less than the statewide threshold recommended for determining impairment.

Site 11, in Harmon, had a VSCI score of 72.2. This site was also sampled in duplicate and the second sample scored 67.1. Although the VSCI score indicates site 11 is in good condition overall, the taxa lists from both samples indicate loss of some more sensitive taxa. Taxa richness values were lower in both samples (15 and 19) and EPT taxa values were lower in both samples (9 and 10) than what was collected at upstream sites. (The taxa losses are particularly noticeable in the genus-level data. When the data are collapsed to family, the differences between sites are smaller.) The numbers of EPT organisms also decreased from upstream sites. We believe there is a change in condition at site 11 in Harmon.

Site 8, upstream of Panther Branch, looks similar to site 11. The VSCI score at this site was 69.7. However, this site also had fewer total taxa (17) and EPT taxa (9) than the sites upstream of Harmon. The abundance of these organisms dropped as well. Many of the more sensitive taxa found upstream of Harmon were not found in the sample collected at site 8.

Site 18, downstream of the railroad trestle in Bandy, had a VSCI score of 58.9. More sensitive taxa were again collected at this site, but the sample was dominated by blackflies and midge. This shift in composition to a predominance of more tolerant organisms drove the VSCI score lower. Midge made up 22.2% of the sample at this site. There were 18.1 total taxa and 8.4 EPT taxa in the sample. Some of the more sensitive taxa collected upstream of Harmon were also collected at site 18 (*Glossosoma, Goera)*. The abundance of EPT organisms also increased.

Site 5, upstream of the rail road trestle on rt. 630, had a VSCI score of 79. This site had good total taxa richness (23.1) and evenness, and had a good number of EPT taxa (13). The dominant taxon at this site was midge, although they were not overly abundant (only 24.7%).

Site 1, behind the trailer park, had a VSCI score of 43.3. This site has lower total taxa richness than the nearest upstream site (16) , and the taxa list indicates a loss of EPT taxa (7). The relative abundance of sensitive taxa decreased at this site. The sample was dominated by midge (56.4% of the sample). Overall abundance of other organisms at this site was low.

Site 21, at Cedar Bluff, had a VSCI score of 47.7. The VSCI score was driven down by an abundance of midge in the sample (53.6%). However, the sample still contained a good number of total taxa (17.8) and a fair number of EPT taxa (8.1), with some more sensitive taxa collected (*Brachycentrus, Helicopsyche, Allocapnia, Serratella)* . The abundance of all organisms at site 21 was much higher than the abundance at site 1.

In summary, we believe that the samples we collected at 3 sites on the mainstem indicate some degradation compared to other sites in the watershed: sites 11 and 8 downstream of Harmon, and site 1, in the trailer park. At all of these sites, there was a loss of some of the more sensitive taxa and low overall abundance. Site 21 shows an overabundance of midge, but still has good taxa richness. The VSCI does not appear to be very sensitive to the loss of rare taxa. (By rare, we mean more sensitive taxa that are not found in large numbers.) The VSCI is a family level index and some of the taxa losses that are present at the genus level are not present when the data are collapsed to family. The rest of the mainstem sites look to be in good condition, although midge or blackflies were abundant or dominant at some of the sites (sites 16, 18 and 21), as indicated by the lower VSCI scores.

Tributary Sites

There were ten tributary sites including the North and South Branches of Indian Creek. Most of the tributary sites are located in the Cumberland Mountains region (subecoregion 69d). The North and South Branches of Indian Creek both had considerable beaver activity and many beaver ponds midstream. These ponds made it difficult to find good sampling habitat. Site 15, on the South Branch, was located in a short reach between a beaver pond and a culvert upstream and an impounded area downstream, at the confluence with the North Branch. The bad weather and poor road conditions made it impossible to look further upstream for a more suitable site. The VSCI score at site 15 was only 40, but we are not convinced that this score is representative of the true condition of the South Branch. We did not collect a great number of total taxa (15) or EPT taxa (8) at this site. The habitat was clearly degraded instream, with some embeddedness and sediment deposition. Midge was the dominant taxon collected at this site (59.4 %).

Site 23, on the North Branch of Indian Creek, was added to the site list since we could not sample two of the original sites in the project plan (sites 14 and 22) due to beaver pond activity and lack of access due to bad road conditions. Site 23 was added and was located between sites 14 and 22. We collected a good number of total taxa (21.9) and EPT taxa (13.4) at this site. Midge dominated the sample (45.3%), and the VSCI score was 58.4.

Site 12 was located on Jackson Fork, which enters Indian Creek from the northeast of the watershed. Although the topographic map indicates substantial historical mining in this tributary's watershed, several total taxa (22.9) and EPT taxa (14.5) were collected, including some more sensitive taxa (*Glossosoma, Dolophilodes, Diplectrona, Rhyacophila, Paracapnia, Acroneuria, Pteronarcys, Epeorus, Baetisca, Ephemera, etc.*). In addition, the sample portrayed an even composition, with midge accounting for only 12.6% of the sample. The VSCI score was 71.8.

Greasy Creek is the next tributary downstream and enters Indian Creek from the west. Site 9 is located upstream on a Consol Coal Company property. Although the habitat at this site was clearly degraded, we collected several EPT taxa (12), including several more sensitive taxa (*Hydatophylax, Neophylax, Pycnopsyche, Clioperla, Baetisca, Ephemera, Ameletus, etc.*). Although we did not collect many organisms, the sample was well balanced, and midge only accounted for 24.6% of the sample. The VSCI score was 72.3.

The downstream site on Greasy Creek (site 10) was also in good condition. The habitat was much better at this site, and a few more EPT taxa were collected (13.6). The sample was also well balanced and midge accounted for only 19.6% of the sample. The VSCI score was 78.9.

Panther Branch is the next tributary downstream, and also enters Indian Creek from the west. Site 17 was located right next to the road, and the habitat was not optimal, but the sample collected from Panther Branch indicates a good variety of total taxa (21.4) and EPT taxa (12.3), with a fairly balanced assemblage. Although midge were the dominant taxon, they were not present in extreme numbers and made up only 25.2 % of the sample. The VSCI score for site 17 was 71.9.

Site 19 was located on Coal Branch, upstream of the railroad trestle. The VSCI score was 49, reflecting the large number of midge and tolerant Hydropsychidae caddisflies in the sample. Midge accounted for 34% of the sample. There were fewer total taxa (15.8) and EPT taxa (5.8) in the sample and they were collected in low numbers. Only one Plecoptera individual was in the sample.

Two sites were located on Laurel Fork. Site 6, the downstream site, had some habitat degradation due to the road and mowed lawns, but we still collected a good number of total taxa (18.1) and EPT taxa (11.2), including several more sensitive taxa (*Neophylax, Goera, Clioperla, Baetisca, Ephemera, Epeorus, etc.*). A tolerant caddisfly (*Cheumatopsyche)* dominated the sample. Midge accounted for only 16.5% of the sample. The VSCI score at this site was 67.9.

The upstream site on Laurel Fork was located upstream of the Rt. 626 bridge. Site 7 was sampled in duplicate and the two samples had VSCI scores of 73.4 and 69.7. Both samples indicate a good number of total taxa ((20 and 20.9) and EPT taxa (13 and 12.8). Midge were the dominant taxon in both samples (23.8 and 30.3%), but the taxa lists indicate that overall, the community was fairly well balanced among all the major insect groups.

The most downstream tributary was Raven's Nest Branch (site 20). This tributary also enters from the west, and was sampled upstream of the railroad tunnel, in a pasture. Although the habitat was not optimal in the sampled reach, we still collected several total taxa (19.8) and EPT taxa (12), and in good numbers. The community was well balanced among the major insect groups, and midge accounted for only 10.4% of the sample. The dominant taxon was the stonefly *Amphinemura*. The VSCI score was 82.9. This site had the highest VSCI score in the study.

In summary, we believe the South and North Branch samples may not be representative of the true condition of these tributaries. We had a difficult time finding areas to sample and in both cases had to settle for suboptimal or even marginal habitats. These tributaries may be in better condition than our data indicate. The nearest downstream station on the main stem, which receives the major part of its flow from these two tributaries was in very good condition. We believe that Coal Branch may have some impairment, since it is lacking many of the sensitive taxa found in the other tributaries. The habitat at the Coal Branch sampling site was also suboptimal and may have contributed to the result.

Limestone Sites

The Indian Creek watershed is a geologically diverse watershed. Three of the sites (site 2, site 3 and site 4) lie within limestone valleys (subecoregion 67f after Woods et al, 1999). These sites are different from the other sites due to the limestone influence and their naturally high conductivity. Site 3, the upstream site on Lowe Branch represents a typical limestone stream. The taxa list indicates high abundance with fair taxa richness (14.5) and a fair number of EPT taxa (7.2). There were also good numbers of organisms in the more sensitive EPT orders. The dominant taxon at this site was an *Ephemerella* mayfly. The VSCI score for this site was 61.

Site 2, the downstream site on Lowe Branch, had a VSCI score of only 25.7. The taxa list for this site indicates a loss of sensitive taxa, including the loss of all stoneflies and a sharp reduction in mayflies. The sample contained only 9.3 total taxa and 1.7 EPT taxa. The taxa list also indicates increases in tolerant taxa including a caddis fly (Hydropsychidae) and midge (Chironomidae). The dominant taxon was midge which accounted for 66.3 % of the organisms.

Site 4 is located on an unnamed tributary that drains McGuire Valley. This site scored 46.1 using the VSCI. Site 4 had a good number of total taxa (16.8) and a fair number of EPT taxa (7.3), but very few stoneflies and reduced numbers of mayflies compared to site 3. The site was dominated by tolerant midge and blackflies.

6. Qualitative Habitat and Field Chemistry Results

Physical and chemical characteristics of the sampled sites including mean stream width, mean velocity, temperature, conductivity, dissolved oxygen and pH are shown in table 6. None of the field physical and chemical results indicate any water quality problems. It should be noted that we sampled in February 2002. Parameters such as pH, temperature and dissolved oxygen typically reach critical levels in the summer and early fall when temperatures are elevated and primary productivity and respiration are at their peaks.

The Rapid Bioassessment Protocol component habitat parameters and total habitat scores are shown in table 7. The Rapid Bioassessment Protocol has specific criteria and descriptions for each parameter in ranges of optimal, suboptimal, marginal and poor. In general, optimal conditions provide high quality habitat and have the potential to sustain diverse natural assemblages of aquatic life. Suboptimal conditions provide adequate habitat for maintenance of aquatic life. Marginal conditions provide habitat that is less than desirable and in poor conditions, the physical habitat is obviously inadequate or absent. Optimal and suboptimal habitat are both considered sufficient to support macroinvertebrate assemblages. For example, state and federal agencies often require reference sites that are used to develop biological reference conditions to attain at least suboptimal scores. In table 7, individual parameters that scored less than Suboptimal (<11) are highlighted in red. The red parameters are in the marginal or poor range.

Total habitat scores at a site are usually compared to the range of scores of a collection of reference sites (a reference condition). For the development of the VSCI, a candidate site had to have a total habitat score of at least 120 to be considered as a reference site. The VSCI is composed of 461 macroinvertebrate samples from 116 reference sites. The 444 reference samples which had RBP habitat assessments had a range of scores from 122 to 231. The 25th%, median and 50th% scores of the reference samples were 173, 188 and 204.

The habitat results indicate a few habitat impairments at some of the sites. In terms of overall score, only two sites show habitat problems in several components of instream, bank and riparian habitat. Site 9 (the upstream site on Greasy Creek) only scored a total of 107, and scored only marginally in epifaunal substrate/available cover, embeddedness, sediment deposition, frequency of riffles and riparian zone width. Despite these low habitat scores, the benthos sample for the Creek indicates good water quality.

Site 15, the South Branch of Indian Creek scored only 96 on the visual habitat assessment. This site scored marginally on embeddedness, velocity depth regimes and sediment deposition. This site scored in the poor range for riparian zone width. As we stated earlier, we were confined to a very short reach between a beaver pond and a culvert at site 15. We believe the marginal instream habitat at this site may have impacted the benthos sample, which indicates some impairment.

Several of the sites scored less than suboptimal on the velocity depth regimes parameter. This is common for small streams, which often lack deep water, defined as greater than 0.5 meters. This does not impact our benthos samples since we target riffles. Several of the sites scored less than suboptimal on the bank vegetation and riparian zone width scores. These two parameters reflect habitat condition outside of the immediate stream channel, and do note appear to impact the benthos samples as much as the instream parameters (epifaunal substrate, embeddedness, sediment deposition).

Figure 4 shows a scatter plot of VSCI scores and total habitat scores. Figure 5 shows a scatter plot of VSCI scores and conductivity. Neither graph indicates a strong correlation between the VSCI scores and the physical or chemical parameter.

Figure 1. VSCI Scores at the Mainstem, Tributary and Limestone Sites from Upstream to Downstream

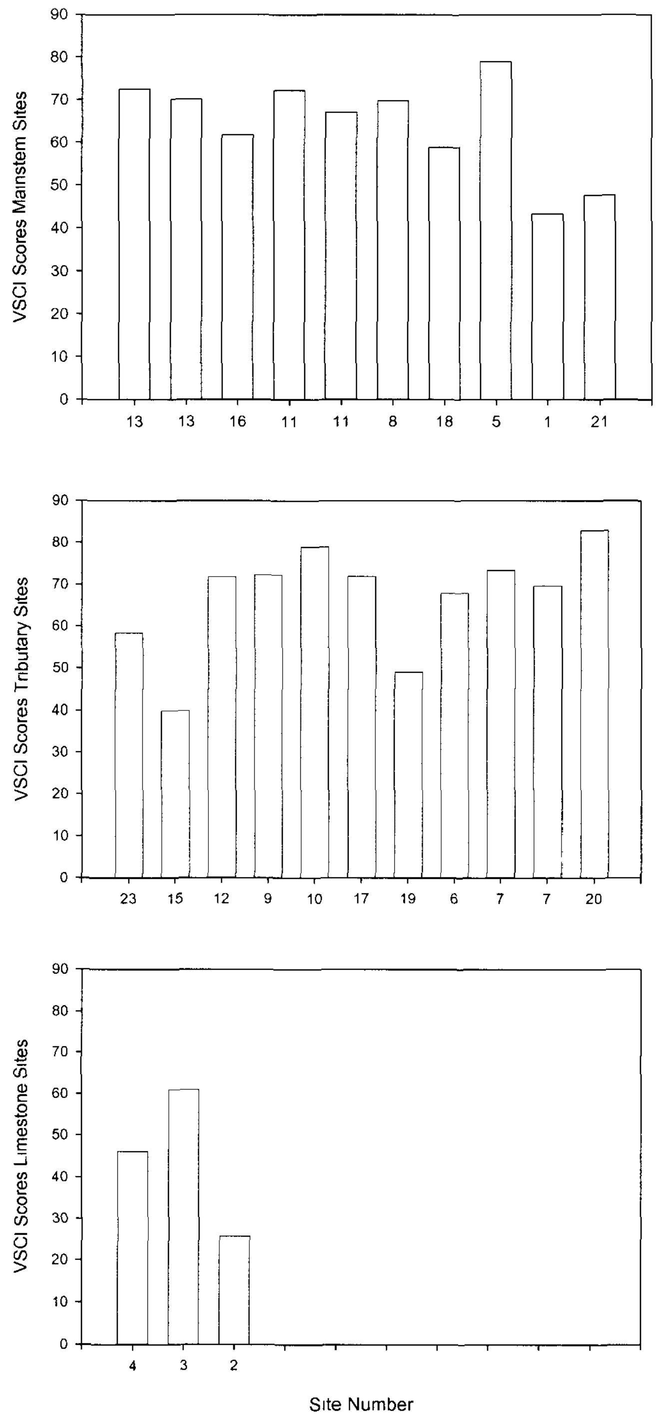

Figure 2. Total Taxa Metric Values at the Mainstem, Tributary and Limestone Sites from Upstream to Downstream. (Total Taxa Values are family-level and rarefied to a 200 count subsample.)

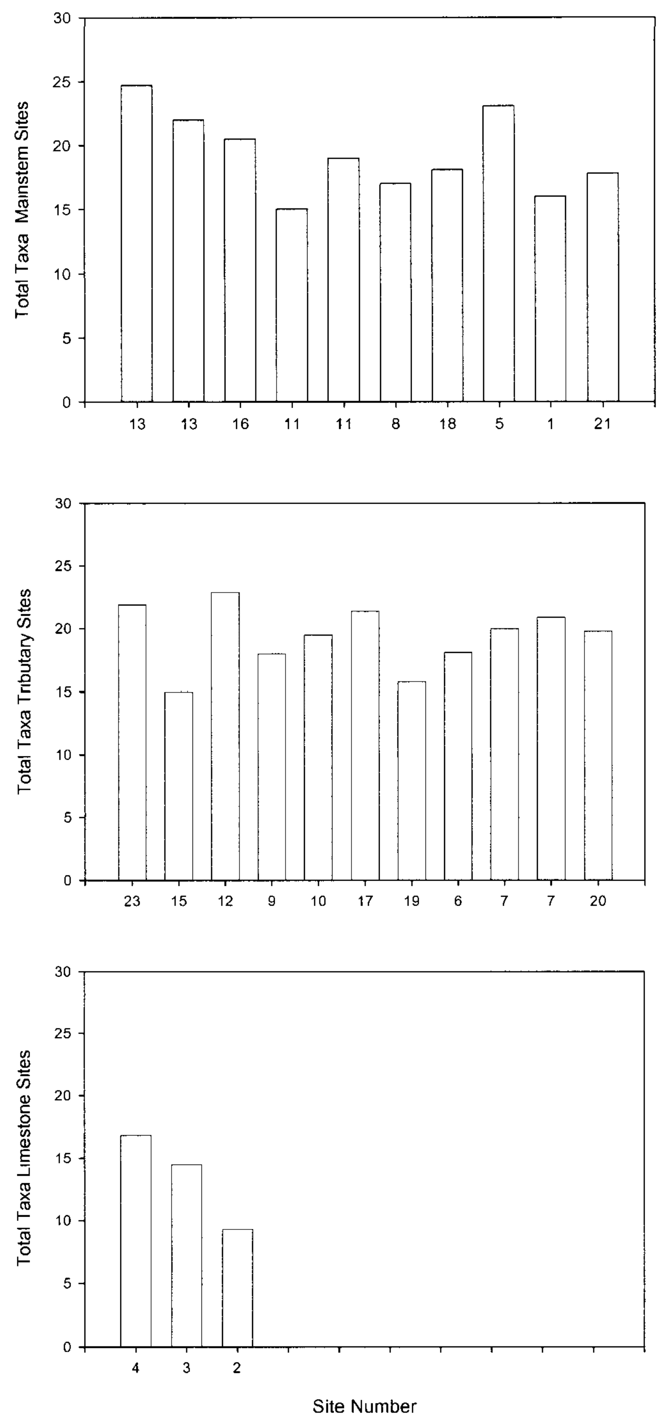

Figure 3. EPT Taxa Metric Values at the Mainstem, Tributary and Limestone Sites from Upstream to Downstream. (EPT Taxa values are family-level and rarefied to a 200 count subsample.)

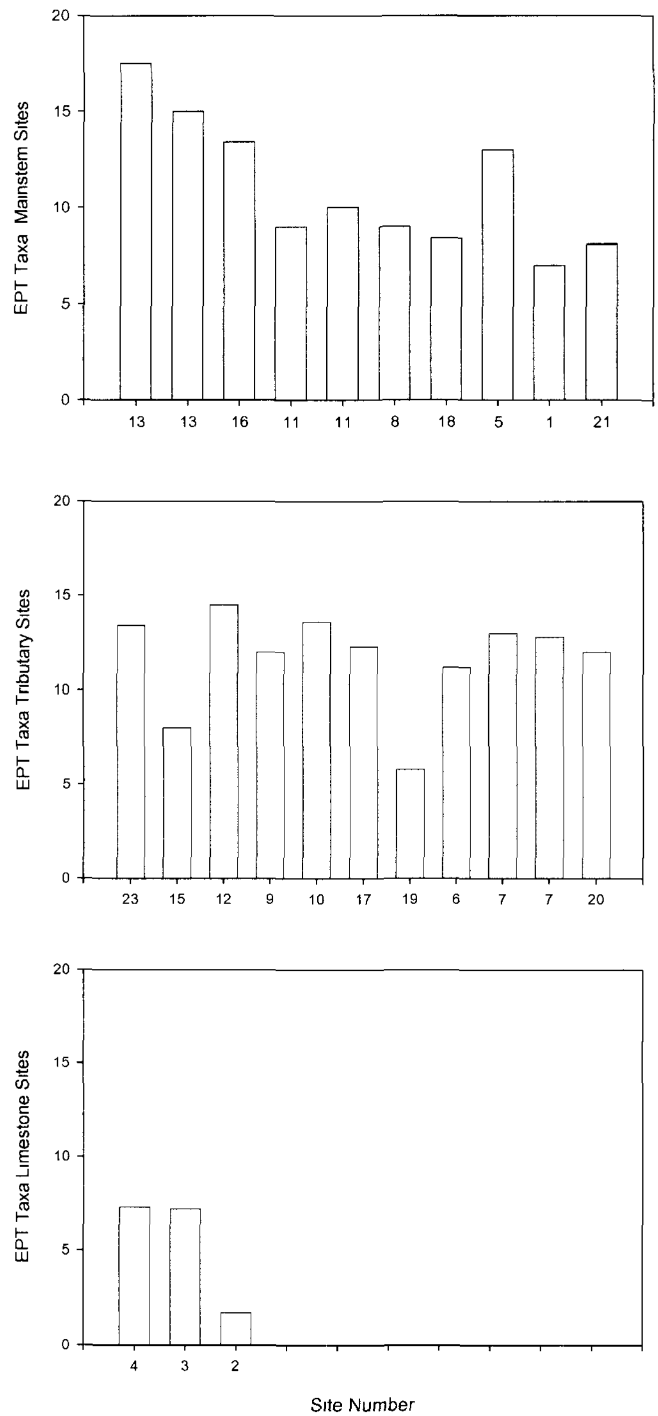

Figure 4. VSCI scores and Total Habitat Scores. Note that plot symbols are the site numbers, red sites are mainstem sites, green sites are tributary sites and blue sites are limestone sites. Duplicate samples are not shown.

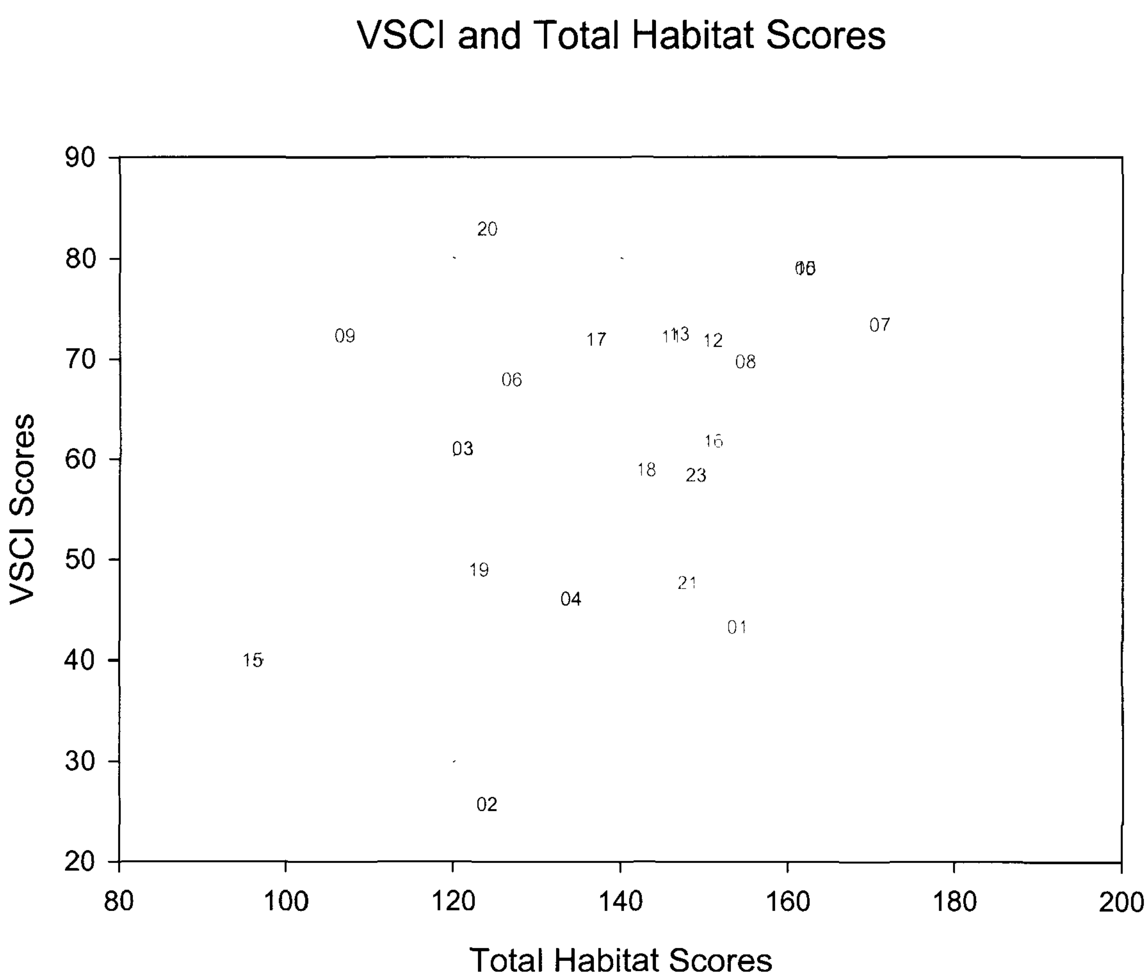

Figure 5. VSCI Scores and Conductivity. Note that plot symbols are the site numbers, red sites are mainstem sites, green sites are tributary sites and blue sites are limestone sites. Duplicate samples are not shown.

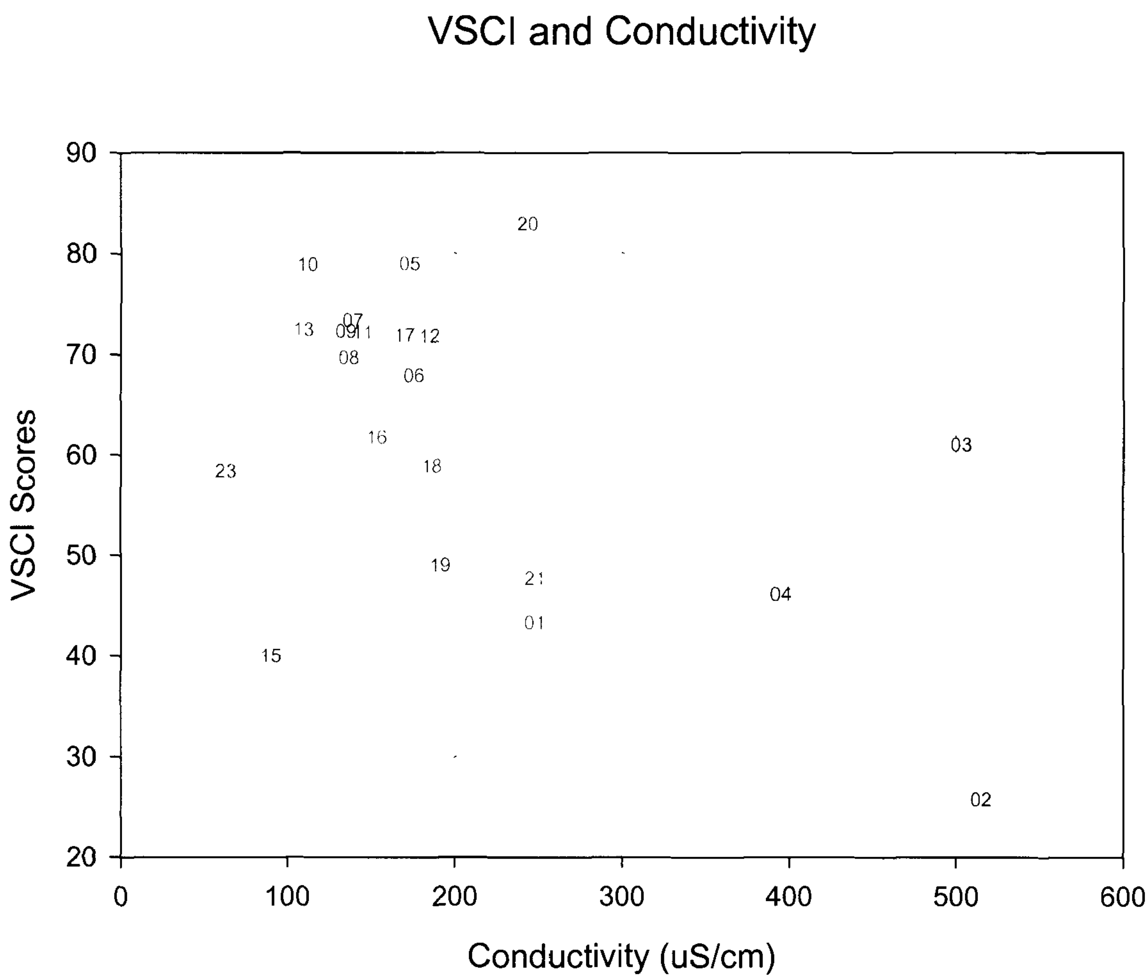

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Table 1. Indian Creek Site Locations

Station ID	Stream Name	Description of Location	Latitude Longitude	Sampling Date
1	Indian Creek	Behind the trailer park off 631.	37 05 26.88 81 44 38.44	02.25.02
2	Lowe Branch	Downstream of the old gas station in Busthead.	37 06 28.66 81 41 58.44	02.26.02
3	Lowe Branch	On property of Mary Barnett.	37 06 29.71 81 41 06.67	02.26.02
4	NNT to Lowe Branch (from McGuire Valley)	Approximately 0.5 miles northwest of 636/627 intersection on 627.	37 06 58.43 81 42 12.73	02.26.02
5	Indian Creek	Downstream of confluence with Lowe Branch, upstream of RR trestle on dirt road.	37 06 51.24 81 43 05.18	02.26.02
6	Laurel Fork	Upstream of first bridge on downstream end of Laurel Fork.	37 07 14.67 81 42 49.40	02.26.02
7	Laurel Fork	Upstream of the bridge off of 626, on Bandy Sportsmen's Club property.	37 07 50.03 81 43 02.09	02.26.02
8	Indian Creek	Past Bandy, upstream of Panther Branch, upstream of the 627 bridge.	37 08 54.92 81 42 09.92	02.27.02
9	Greasy Creek	On Consolidation Coal Co. property off Rt 612.	37 10 41.89 81 44 10.47	02.27.02
10	Greasy Creek	Further downstream than station 9, on Consol property.	37 09 38.04 81 42 53.58	02.27.02
11	Indian Creek	In Harman.	37 09 32.12 81 42 28.51	02.27.02

Table 1. Indian Creek Site Locations				
Station ID	**Stream Name**	**Description of Location**	**Latitude Longitude**	**Sampling Date**
12	Jackson Fork	Upstream of the 627 bridge.	37 10 48.82 81 42 20.30	02.27.02
13	Indian Creek	Upstream of Jackson Fork.	37 11 06.36 81 42 49.91	02.28.02
14	North Branch of Indian Creek	On Knox Creek Coal property.	37 11 58.00 81 42 58.51	This station could not be sampled due to beaver ponds.
15	South Branch of Indian Creek	On AT Massey property.	37 11 51.47 81 43 05.26	02.28.02
16	Indian Creek	Downstream of Jackson Fork, and upstream of Harman.	37 10 26.59 81 42 37.25	02.28.02
17	Panther Branch	Approximately 20 meters upstream of confluence with Indian Creek.	37 08 43.94 81 42 11.28	02.27.02
18	Indian Creek	South of Bandy, downstream of the RR bridge.	37 07 45.67 81 41 58.34	02.26.02
19	Coal Branch	Upstream of RR tunnel.	37 07 56.17 81 41 54.71	02.26.02
20	Raven Nest Branch	Upstream of RR tunnel.	37 06 06.59 81 44 08.16	02.28.02
21	Indian Creek	At Cedar Bluff, along 631.	37 05 17.37 81 45 19.67	02.26.02
22	North Branch of Indian Creek	Upstream of site 14, near gas well.	37 12 41.56 81 43 07.73	This station could not be sampled - dangerous road conditions - no other access.
23	North Branch of Indian Creek	Between sites 14 and 22.	37 12 10.86 81 42 53.81	02.28.02

Table 1. Indian Creek Site Locations				
Station ID	**Stream Name**	**Description of Location**	**Latitude Longitude**	**Sampling Date**
Watershed and sites are located on the Amonate, Jewell Ridge, Pounding Mill and Richlands VA 7.5 minute USGS topographic maps.				

Table 2. Metrics for Virginia non-coastal benthic multimetric index (VSCI). Standard values and standardization equations.			
Metrics that decrease with stress	**Standard (best value) X_{95}**	**X_{min}**	**Standardization equation X = metric value at test site.**
Total taxa	22	0	score = 100 x (X/22)
EPT taxa	11	0	score = 100 x (X/11)
% Ephemeroptera	61.3	0	score = 100 x (X/58.9)
% Plecoptera + Trichoptera - Hydropsychidae	35.6	0	score = 100 x (X/34.8)
% Scrapers	51.6	0	score = 100 x (X/58.9)
Metrics that increase with stress	**Standard (best value) X_5**	**X_5**	**Standardization equation X = metric value at test site**
% Chironomidae	0	100	score = 100 x [(100-X)/(100-0)]
% Top 2 Dominant	30.8	100	score = 100 x [(100-X)/100-29.5)]
HBI (family level)	3.2	10	score = 100 x [(10-X)/(10-3.2)]
Final Index score for a site is determined by averaging the site's 8 unitless standardized metric scores, using a maximum metric score of 100 for any metric whose individual score at a site exceeded 100.			

Table 3. Percentile distribution of index (VSCI) values in the Virginia DEQ 1994-2002 reference samples.	
N	461
maximum possible	100.0
maximum in data	88.9
95^{th}	84.1
90^{th}	81.7
75^{th}	77.8
50^{th} (median)	73.1
25^{th}	67.7
10^{th}	61.3
5^{th}	56.3
minimum	25.3
standard deviation	8.4
mean	72.1

Table 4. Component Metrics and VSCI scores

Station #	Duplicate #	Collection Date	Total Individuals	Total Taxa Family	Total Taxa Family R 200	EPT Taxa Family	EPT Taxa Family R 200	% Chiro	%2Dom Fam	VA HBI Fam	%Ephem	% P+T-H	%Scraper	VSCI Score
01	1	2/25/2002	172	16.0	16.0	7.0	7.0	56.4	70.3	5.3	8.1	5.2	14.0	43.3
02	1	2/26/2002	816	17.0	9.3	4.0	1.7	66.3	83.6	5.7	0.2	0.1	13.7	25.7
03	1	2/26/2002	2188	21.0	14.5	10.0	7.2	3.9	42.3	4.8	30.6	3.2	21.6	61.0
04	1	2/26/2002	450	22.0	16.8	9.0	7.3	43.6	66.9	5.5	11.6	2.0	16.0	46.1
05	1	2/26/2002	247	25.0	23.1	14.0	13.0	24.7	38.9	4.5	24.7	18.6	49.0	79.0
06	1	2/26/2002	491	22.0	18.1	13.0	11.2	16.5	50.7	4.9	18.5	18.3	25.7	67.9
07	1	2/26/2002	193	20.0	20.0	13.0	13.0	23.8	37.8	4.1	14.5	26.4	23.3	73.4
07	2	2/26/2002	396	25.0	20.9	15.0	12.8	30.3	40.7	4.4	21.2	16.2	23.5	69.7
08	1	2/27/2002	134	17.0	17.0	9.0	9.0	26.1	57.5	4.6	35.8	11.2	48.5	69.7
09	1	2/27/2002	138	18.0	18.0	12.0	12.0	24.6	40.6	4.0	39.1	23.2	9.4	72.3
10	1	2/27/2002	245	20.0	19.5	14.0	13.6	19.6	49.0	4.1	40.8	20.8	39.6	78.9
11	2	2/27/2002	170	19.0	19.0	10.0	10.0	24.7	45.3	4.5	10.6	21.2	24.7	67.1
11	1	2/27/2002	135	15.0	15.0	9.0	9.0	20.7	41.5	3.9	25.2	21.5	37.8	72.2
12	1	2/27/2002	333	26.0	22.9	17.0	14.5	12.6	44.1	4.4	15.6	15.6	28.2	71.8
13	1	2/28/2002	252	27.0	24.7	19.0	17.5	23.4	41.3	4.5	30.2	15.5	23.0	72.5
13	2	2/28/2002	201	22.0	22.0	15.0	15.0	23.4	59.2	4.3	21.4	21.4	23.9	70.1
15	1	2/28/2002	138	15.0	15.0	8.0	8.0	59.4	75.4	5.5	8.7	6.5	2.2	40.0
16	1	2/28/2002	685	28.0	20.5	19.0	13.4	44.7	52.8	4.8	19.1	14.0	16.2	61.8
17	1	2/27/2001	270	23.0	21.4	13.0	12.3	25.2	38.9	4.4	9.3	22.2	28.1	71.9
18	1	2/26/2002	559	24.0	18.1	11.0	8.4	22.2	59.0	5.1	17.9	4.7	31.7	58.9
19	1	2/26/2002	571	23.0	15.8	9.0	5.8	34.0	59.9	5.0	6.3	1.4	29.1	49.0
20	1	2/28/2002	299	22.0	19.8	13.0	12.0	10.4	31.1	3.6	41.5	26.8	24.1	82.9
21	1	2/25/2002	459	25.0	17.8	11.0	8.1	53.6	67.5	5.2	6.1	3.3	22.9	47.7
23	1	2/28/2002	234	23.0	21.9	14.0	13.4	45.3	69.2	4.5	28.6	9.0	7.7	58.4

Table 5 . Taxonomic list used to calculate component metrics and VSCI scores

Family	FinalID	01	02	03	4	5	06	07	07 R2	08	09	10	11	11 R2	12	13	13 R2	15	16	17	18	19	20	21	23
Athericidae	Atherix																				3				
Blephariceridae	Blephariceria								1												1				
Ceratopogonidae	Bezzia							1	2		1					1	1	1	1	1		4			9
Ceratopogonidae	Ceratopogon																					1			
Ceratopogonidae	Ceratopogonidae																							1	
Chironomidae	Chironomidae	97	541	85	196	61	81	46	120	35	34	48	28	42	42	59	47	82	306	68	124	194	31	246	106
Empididae	Chelifera		1			1									1	1		3	2						1
Empididae	Hemerodromia	2	3	4	1	1	2			4				1	3		1		2	2	2	12	1	1	
Psychodidae	Psychoda				1																				
Psychodidae	Psychodidae			1																					
Simuliidae	Simuliidae	24	4	41	105	15		6	30	1				35	13	1	3	1	53	5	206	1	11	52	11
Tipulidae	Antocha	3	1		4	1	2	8	10	2		6	1	1	10	5	13	4	6		1	1		16	
Tipulidae	Dicranota							3	1																
Tipulidae	Limonia				1																				
Tipulidae	Molophilus							1																	1
Tipulidae	Pedicia																					1			
Tipulidae	Pseudolimnophila				1						2				1					1		35			
Tipulidae	Tipula		4						1		2	1	1							2	3	2			
Brachycentridae	Brachycentrus																							3	
Glossosomatidae	Glossosoma					1									1	1	3				3				
Helicopsychidae	Helicopsyche	1																						5	
Hydropsychidae	Cheumatopsyche	2	54	233	12	4	130	18	9	10	1	12	8	1	54	30	15	1	19	23	6	89	11	1	
Hydropsychidae	Diplectrona							8	15						6					3		8	13		
Hydropsychidae	Hydropsyche		87	139			38	1	11			7	1		32	15	13	1	11	2	1	4	1	2	
Hydroptilidae	*Hydroptila*		1																						
Leptoceridae	Oecetis																							1	
Limnephilidae	Goera					1	1												1	1	2				
Limnephilidae	Hydatophylax							1			3														
Limnephilidae	Pycnopsyche							1			1									6					
Philopotamidae	Chimarra			25	3	1	12			1		6				7			9	1	2	4			
Philopotamidae	Dolophilodes							1	1			2		2	3	4	1		24		2				
Phryganeidae	Oligostomis																								1

Table 5 . Taxonomic list used to calculate component metrics and VSCI scores

Family	FinalID	01	02	03	4	5	06	07	07 R2	08	09	10	11	11 R2	12	13	13 R2	15	16	17	18	19	20	21	23
Phryganeidae	Ptilostomis										1														
Polycentropodidae	Neureclipsis			1																					
Polycentropodidae	Polycentropus								1			1			1	1			1				1		1
Psychomyiidae	Psychomyia					1				1		2				5	9		19						
Rhyacophilidae	Rhyacophila							8	8						3	1	1			2					1
Uenoidae	Neophylax				2	32	27	6	8	7	1	12	18	6	4	5	12		3	12	7	3	5		3
Capniidae	Allocapnia					1																	25	1	
Capniidae	Capniidae					1																			
Capniidae	Paracapnia														9		1		3						5
Chloroperlidae	Chloroperlidae			2	4																		3		
Chloroperlidae	Suwallia															1									
Chloroperlidae	Sweltsa																						1		
Leuctridae	Leuctra							9	16						3			4							4
Leuctridae	Leuctridae			1								4			3	1	2		4	3			3		
Nemouridae	Amphinemura	1		41				14	13			4		1	20	2	1		5	5	1		41	2	
Nemouridae	Nemouridae						7								1	2	2	1	6						3
Nemouridae	Prostoia	7				1		7	13	3	12	7	5	21					13	25	8			2	
Perlidae	Acroneuria							3	2			5	2	1	1	3	7		4	3					
Perlodidae	Clioperla						4				3														3
Perlodidae	Diploperla															1			2						
Perlodidae	Isoperla					7	39	1	2		10					4	4	4				1	1		
Perlodidae	Perlodidae														1										
Pteronarcyidae	Pteronarcys														2	1									
Taeniopterygidae	Oemopteryx																				1				
Taeniopterygidae	Strophopteryx									3	1	8	4	5					2	2					
Taeniopterygidae	Taeniopteryx																							1	
Ameletidae	Ameletus							1	2		6	4	16	5		4	1	4	2	16	1	1	1		1
Baetidae	Baetidae			51																			4		3
Baetidae	Baetis			40					8										1						
Baetidae	Pseudocloeon																						7		
Baetiscidae	Baetisca						2				1	1			1	1				1					

Table 5. Taxonomic list used to calculate component metrics and VSCI scores

Family	FinalID	01	02	03	4	5	06	07	07 R2	08	09	10	11	11 R2	12	13	13 R2	15	16	17	18	19	20	21	23
Caenidae	Caenidae																							1	
Caenidae	Caenis				30		1																		
Ephemerellidae	Attenella																				3				
Ephemerellidae	Drunella							1				1													
Ephemerellidae	Ephemerella			443		13	2	2		2	4	16	13	7	7	30	27	1	45	4					2
Ephemerellidae	Ephemerellidae								16																
Ephemerellidae	Eurylophella	1	1		1		3				18	2	1	1		2						1		1	
Ephemerellidae	Serratella	1					3	3	2															3	
Ephemeridae	Ephemera	1				2	8		1		19	4	1	1	2	3			2			1			2
Heptageniidae	Epeorus						5	5	15			6	2		15	5			10		2		8		
Heptageniidae	Heptageniidae					7		1	7							7	4	1					17	3	
Heptageniidae	Leucrocuta																						6		
Heptageniidae	Stenacron				1		1					1			4						1				
Heptageniidae	Stenonema	5	1	27	16	28	56	13	19	42	6	65	1	4	10	19	9		46	4	88	4	21	14	3
Isonychiidae	Isonychia	6			2	8	4			4									4		5		26	6	
Leptophlebiidae	Leptophlebiidae			109	2	3	6	2	7						8	5	2	5	18			28	28		40
Leptophlebiidae	Paraleptophlebia								7						5			1	3			1	6		16
Aeshnidae	Boyeria																			1		1			
Calopterygidae	Hetaerina		1																						
Coenagrionidae	Coenagrionidae				1																			1	
Coenagrionidae	Enallagma				1																				
Gomphidae	Gomphidae																							1	
Gomphidae	Stylogomphus				2			1	1		2	5			4	1					3		1	2	
Dryopidae	Helichus					1								1											
Elmidae	Dubiraphia		6	2			3				1	2									2	6		2	
Elmidae	Elmidae	1							2										5			21			
Elmidae	Gonielmis			1																				1	
Elmidae	Microcylloepus				3																				
Elmidae	Optioservus	7	80	376	30	31	22	7	15	8		9	27	24	7	17	12		36	37	61	80	5	13	
Elmidae	Oulimnius						1	13	22	1	5		1	1	48	4	8	2	4			18			12
Elmidae	Promoresia	1	1		1																			4	
Elmidae	Stenelmis	5	8	19	11	2	3															23		44	

Table 5 . Taxonomic list used to calculate component metrics and VSCI scores

Family	FinalID	01	02	03	4	5	06	07	07 R2	08	09	10	11	11 R2	12	13	13 R2	15	16	17	18	19	20	21	23
Psephenidae	Ectopria		1	4	6				1											3					
Psephenidae	Psephenus	4		21		16	7		3	7		2	2	7	5				7	20	10	6	10	22	
Corydalidae	Nigronia								1				1		2	3	2		3		1		1	1	3
Sialidae	Sialis													1											
Pyralidae	Petrophila					1																			
Pyralidae	Pyralidae																			1					
Cambaridae	Cambaridae			2			3	1		1					1						3				
Asellidae	Lirceus			13																			8		
Gammaridae	Gammarus		1	482																					
Ancylidae	Ancylidae																				2				
Ancylidae	Ferrissia				1	3																1			
Lymnaeidae	Fossaria																					1			
Physidae	Physa		5				1															3			
Pleuroceridae	Goniobasis	1	10	22	1	1																		1	
Valvatidae	Valvata																							1	
Corbiculidae	Corbicula	1	1			2																1		1	
Oligochaeta	Oligochaeta	1	3	3	10		16		3	2	4	2	2	2				22	3	16	4	11	2	3	2
Turbellaria	Turbellaria		1		1		1															3			1

Note that the following taxa were excluded from the table: Organisms that could only be identified to Order level, Collembola, Copepoda, Hydracarina, Nematoda, and Nemertea.

Table 6. Physical/Chemical Characteristics of Stream Reach							
Station ID	Stream Name	Mean Stream Width (m)	Mean Velocity (ft/sec)	Temp (C)	Conduct-ivity (uS/cm)	Dissolved Oxygen (mg/l)	pH
1	Indian Creek	6.9	1.43	8.8	248	13.4	8.57
2	Lowe Branch	1.3	1.12	8.9	515	11.6	7.97
3	Lowe Branch	1.7	0.88	8.1	503	10.6	7.67
4	NNT to Lowe Branch	3.5	0.24 *	7.7	395	12.3	7.69
5	Indian Creek	5.5	1.56	5.9	173	14.2	8.02
6	Laurel Fork	1.1	0.96	9.0	176	9.5	7.44
7	Laurel Fork	2.7	0.38	6.6	139	11.4	6.95
8	Indian Creek	6.9	1.25	1.3	137	12.2	7.16
9	Greasy Creek	2.7	1.13	2.4	135	10.2	7.35
10	Greasy Creek	4.5	0.75	0.8	112	11.1	6.7
11	Indian Creek	4.4	0.94	1.8	145	11.1	6.64
12	Jackson Fork	3.3	0.93	0.4	185	11.4	6.77
13	Indian Creek	3.4	0.80	1.0	110	12.6	6.10
15	South Branch of Indian Creek	2.8	1.35	6.9	90	9.0	6.57
16	Indian Creek	4.0	0.77	1.9	153	12.2	6.32

Table 6. Physical/Chemical Characteristics of Stream Reach							
Station ID	**Stream Name**	**Mean Stream Width (m)**	**Mean Velocity (ft/sec)**	**Temp (C)**	**Conduct-ivity (uS/cm)**	**Dissolved Oxygen (mg/l)**	**pH**
17	Panther Branch	1.8	0.72	4.4	170	10.4	7.06
18	Indian Creek	6.4	1.04	9.0	186	12.4	7.06
19	Coal Branch	1.2	0.42	8.6	191	13.8	8.2
20	Raven Nest Branch	2.4	0.62	1.9	244	13.0	6.45
21	Indian Creek	9.6	0.91	8.2	248	13.0	8.32
23	North Branch of Indian Creek	4.0	0.56	1.7	63	11.9	7.09
* Difficult to obtain accurate velocity reading due to large substrate.							

Table 7. Habitat Assessment Scores
(Individual parameter scores that are marginal or poor are highlighted in red. Habitat parameters are listed at end of table)

Station ID	Stream Name	1	2	3	4	5	6	7	8	9	10	Total
1	Indian Creek	15	18	14	16	16	16	16	9 9	9 6	8 2	154
2	Lowe Branch	15	14	10	13	16	13	17	6 6	5 5	2 2	124
3	Lowe Branch	15	14	10	15	16	8	17	9 9	2 3	2 1	121
4	NNT to Lowe Branch	10	16	11	16	16	16	16	6 6	5 5	2 9	134
5	Indian Creek	17	16	10	18	16	16	18	9 9	10 9	9 5	162
6	Laurel Fork	13	18	10	17	16	13	16	9 6	4 2	1 2	127
7	Laurel Fork	17	18	10	19	16	18	18	10 10	10 9	10 6	171
8	Indian Creek	18	19	15	19	16	15	18	9 9	6 3	6 2	155
9	Greasy Creek	6	6	14	6	16	15	9	8 8	6 6	3 4	107
10	Greasy Creek	17	13	10	18	16	18	18	9 9	9 9	7 9	162
11	Indian Creek	14	16	10	17	16	15	17	8 8	6 9	2 8	146
12	Jackson Fork	16	15	10	18	16	14	18	9 9	9 6	9 2	151
13	Indian Creek	15	15	10	18	16	11	18	9 9	6 9	2 9	147
15	South Branch of Indian Creek	11	8	10	6	16	11	6	7 5	6 6	2 2	96
16	Indian Creek	19	15	10	18	16	15	18	9 9	9 6	3 4	151

Table 7. Habitat Assessment Scores
(Individual parameter scores that are marginal or poor are highlighted in red. Habitat parameters are listed at end of table)

Station ID	Stream Name	1	2	3	4	5	6	7	8	9	10	Total
17	Panther Branch	16	13	10	11	16	13	18	9 7	6 9	1 8	137
18	Indian Creek	15	17	10	16	16	14	17	9 6	9 4	9 1	143
19	Coal Branch	11	11	10	11	16	17	11	6 7	3 9	2 9	123
20	Raven Nest Branch	13	13	10	14	16	16	17	7 5	2 2	6 3	124
21	Indian Creek	15	16	10	15	16	15	18	9 9	9 6	8 2	148
23	North Branch of Indian Creek	16	14	10	12	16	15	16	7 7	9 9	10 8	149

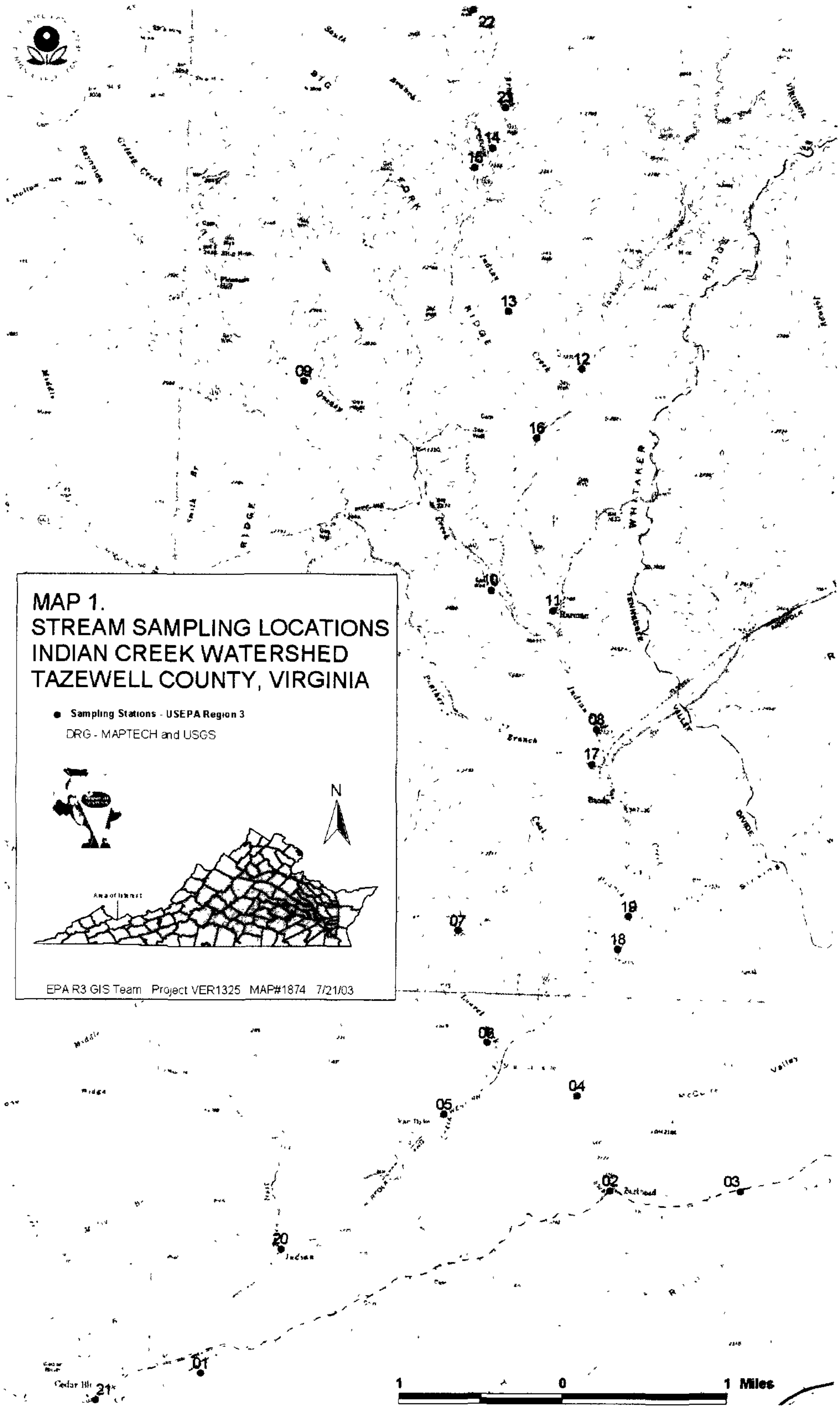
Habitat Parameters:

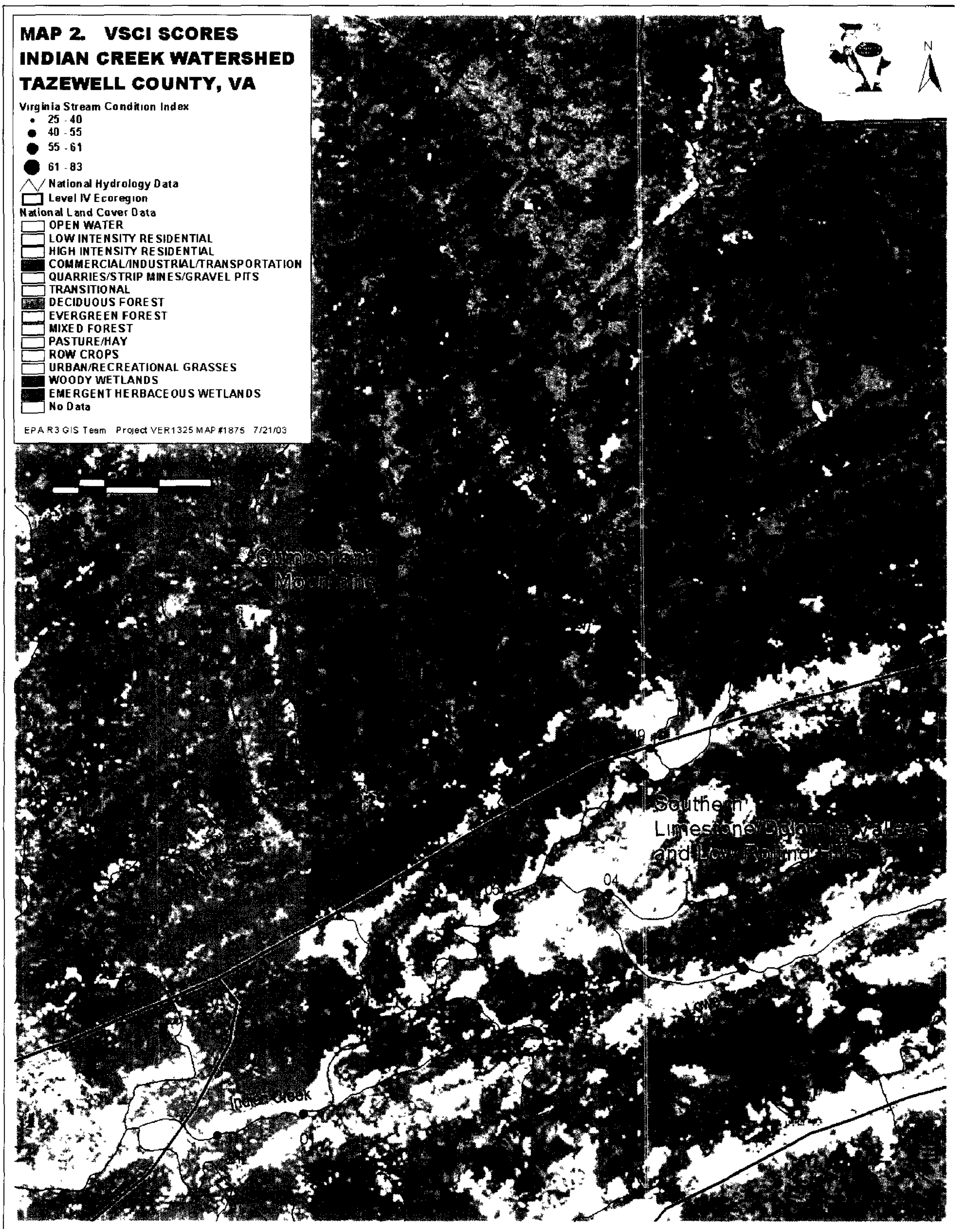
1. Epifaunal Substrate/Available Cover
2. Embeddedness
3. Velocity/Depth Regime
4. Sediment Deposition
5. Channel Flow Status
6. Channel Alteration
7. Frequency of Riffles (or bends)
8. Bank Stability (score both left and right banks)
9. Vegetative Protection (score both left and right banks)
10. Riparian Vegetative Width Zones (score both left and right bank riparian zones)

Total = sum of parameters 1-10 (the highest possible score is 200).

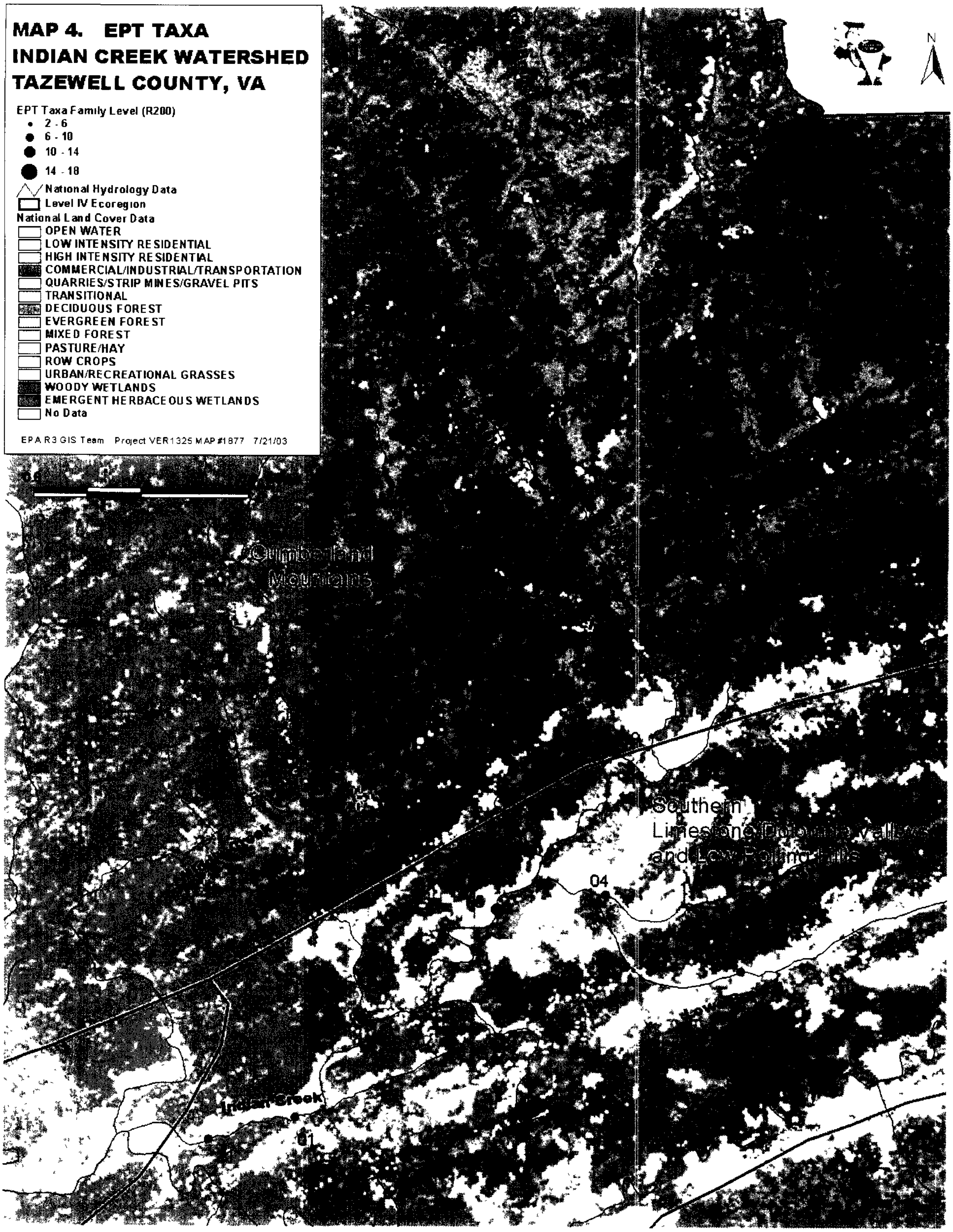
Note that the individual ranges for the scores are as follows:

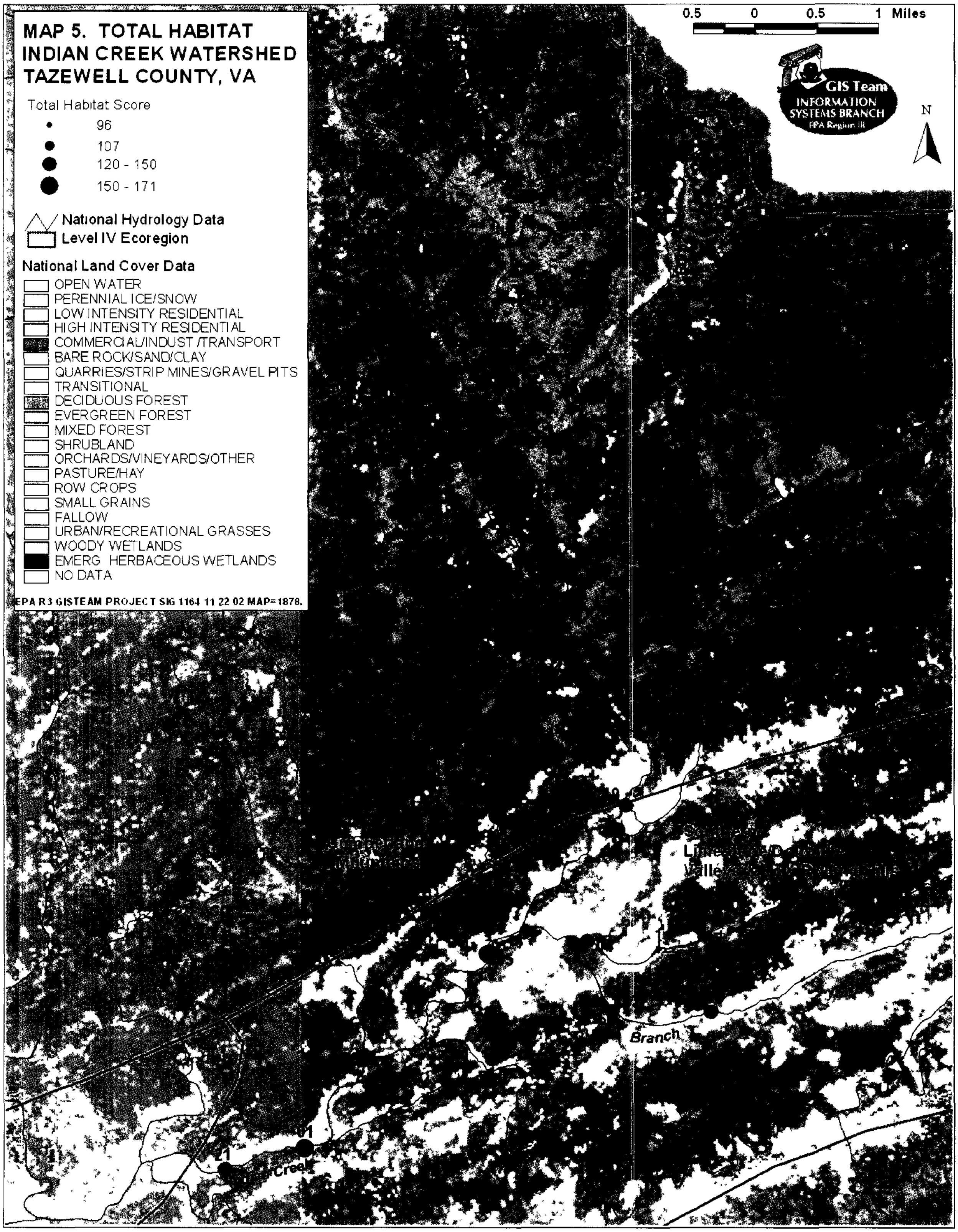
20-16 Optimal
15-11 Suboptimal
10-6 Marginal
5-0 Poor

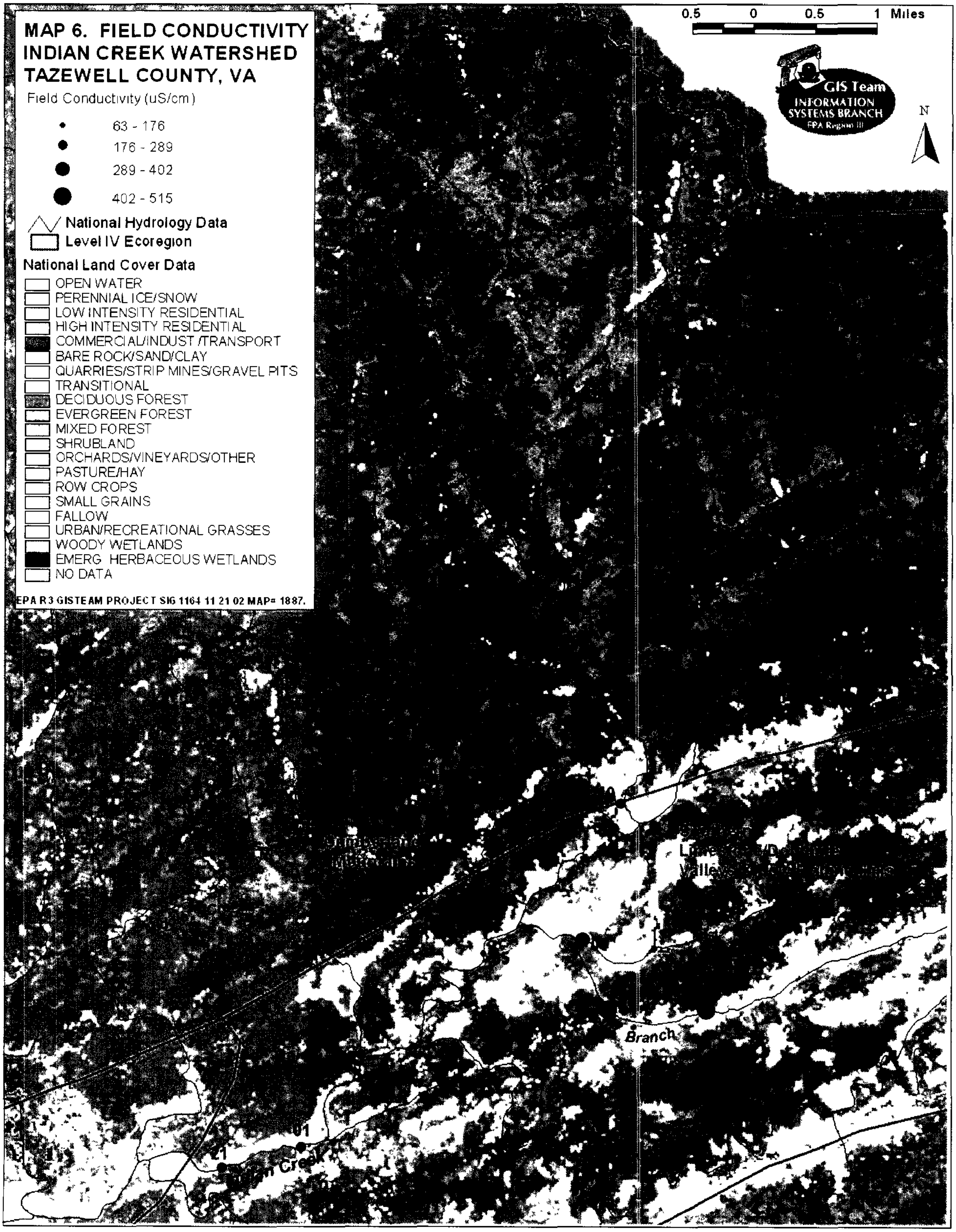

MAP 1.
STREAM SAMPLING LOCATIONS
INDIAN CREEK WATERSHED
TAZEWELL COUNTY, VIRGINIA
Sampling Stations - USEPA Region 3
DRG - MAPTECH and USGS
N
EPA R3 GIS Team Project VER1325 MAP#1874 7/21/03
22
14
13
12
09
16
10
11
08
17
19
18
07
06
04
05
02
03
20
01
21
WHITAKER
RIDGE
1
0
1 Miles


MAP 2. VSCI SCORES
INDIAN CREEK WATERSHED
TAZEWELL COUNTY, VA
Virginia Stream Condition Index
25 - 40
40 - 55
55 - 61
61 - 83
National Hydrology Data
Level IV Ecoregion
National Land Cover Data
OPEN WATER
LOW INTENSITY RESIDENTIAL
HIGH INTENSITY RESIDENTIAL
COMMERCIAL/INDUSTRIAL/TRANSPORTATION
QUARRIES/STRIP MINES/GRAVEL PITS
TRANSITIONAL
DECIDUOUS FOREST
EVERGREEN FOREST
MIXED FOREST
PASTURE/HAY
ROW CROPS
URBAN/RECREATIONAL GRASSES
WOODY WETLANDS
EMERGENT HERBACEOUS WETLANDS
No Data
EPA R3 GIS Team Project VER1325 MAP #1875 7/21/03
N
04


MAP 3. TOTAL TAXA
INDIAN CREEK WATERSHED
TAZEWELL COUNTY, VA
Total Taxa Family Level (R200)
9 - 13
13 - 17
17 - 21
21 - 25
National Hydrology Data
Level IV Ecoregion
National Land Cover Data
OPEN WATER
LOW INTENSITY RESIDENTIAL
HIGH INTENSITY RESIDENTIAL
COMMERCIAL/INDUSTRIAL/TRANSPORTATION
QUARRIES/STRIP MINES/GRAVEL PITS
TRANSITIONAL
DECIDUOUS FOREST
EVERGREEN FOREST
MIXED FOREST
PASTURE/HAY
ROW CROPS
URBAN/RECREATIONAL GRASSES
WOODY WETLANDS
EMERGENT HERBACEOUS WETLANDS
No Data
EPA R3 GIS Team Project VER1325 MAP #1876 7/21/03
N


MAP 4. EPT TAXA
INDIAN CREEK WATERSHED
TAZEWELL COUNTY, VA
EPT Taxa Family Level (R200)
2 - 6
6 - 10
10 - 14
14 - 18
National Hydrology Data
Level IV Ecoregion
National Land Cover Data
OPEN WATER
LOW INTENSITY RESIDENTIAL
HIGH INTENSITY RESIDENTIAL
COMMERCIAL/INDUSTRIAL/TRANSPORTATION
QUARRIES/STRIP MINES/GRAVEL PITS
TRANSITIONAL
DECIDUOUS FOREST
EVERGREEN FOREST
MIXED FOREST
PASTURE/HAY
ROW CROPS
URBAN/RECREATIONAL GRASSES
WOODY WETLANDS
EMERGENT HERBACEOUS WETLANDS
No Data
EPA R3 GIS Team Project VER1325 MAP #1877 7/21/03
N
Cumberland Mountains
Southern
04
Indian Creek
01


MAP 5. TOTAL HABITAT
INDIAN CREEK WATERSHED
TAZEWELL COUNTY, VA
Total Habitat Score
96
107
120 - 150
150 - 171
National Hydrology Data
Level IV Ecoregion
National Land Cover Data
OPEN WATER
PERENNIAL ICE/SNOW
LOW INTENSITY RESIDENTIAL
HIGH INTENSITY RESIDENTIAL
COMMERCIAL/INDUST /TRANSPORT
BARE ROCK/SAND/CLAY
QUARRIES/STRIP MINES/GRAVEL PITS
TRANSITIONAL
DECIDUOUS FOREST
EVERGREEN FOREST
MIXED FOREST
SHRUBLAND
ORCHARDS/VINEYARDS/OTHER
PASTURE/HAY
ROW CROPS
SMALL GRAINS
FALLOW
URBAN/RECREATIONAL GRASSES
WOODY WETLANDS
EMERG HERBACEOUS WETLANDS
NO DATA
EPA R3 GISTEAM PROJECT SIG 1164 11 22 02 MAP=1878.
0.5 0 0.5 1 Miles
GIS Team
INFORMATION
SYSTEMS BRANCH
EPA Region III
N
Branch
Creek


MAP 6. FIELD CONDUCTIVITY
INDIAN CREEK WATERSHED
TAZEWELL COUNTY, VA
Field Conductivity (uS/cm)
63 - 176
176 - 289
289 - 402
402 - 515
National Hydrology Data
Level IV Ecoregion
National Land Cover Data
OPEN WATER
PERENNIAL ICE/SNOW
LOW INTENSITY RESIDENTIAL
HIGH INTENSITY RESIDENTIAL
COMMERCIAL/INDUST/TRANSPORT
BARE ROCK/SAND/CLAY
QUARRIES/STRIP MINES/GRAVEL PITS
TRANSITIONAL
DECIDUOUS FOREST
EVERGREEN FOREST
MIXED FOREST
SHRUBLAND
ORCHARDS/VINEYARDS/OTHER
PASTURE/HAY
ROW CROPS
SMALL GRAINS
FALLOW
URBAN/RECREATIONAL GRASSES
WOODY WETLANDS
EMERG HERBACEOUS WETLANDS
NO DATA
EPA R3 GISTEAM PROJECT SIG 1164 11 21 02 MAP= 1887.
0.5 0 0.5 1 Miles
GIS Team
INFORMATION SYSTEMS BRANCH
N
Branch
01
21