# BIOLOGICAL BASELINE CONDITIONS IN THE LITTLE RIVER WATERSHED (2003)

## **Final Project Report**

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#### from

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#### **Executive Summary**

- 1) Nutrients, pathogens and siltation continue to be serious impairments of the mainstem and tributaries of the Little River, located in the Lower Cumberland drainage basin in western Kentucky. Non-point sources of nutrients, pathogens, and siltation result from agriculture and other crop-related inputs. Urban-suburban runoff from the Hopkinsville area also contributes non-point pollutants. The Little River has been identified as a "first priority" river for future TMDL development (KWRRI 1999).
- 2) The main objective of this study was to assess the biological integrity of the Little River by achieving the following.
  - a) An assessment of habitat, fish, macroinvertebrate, and algal data using biological metric criteria provided by KDOW for the Little River and it's tributaries,
  - b) Identification of biological indicators that are sensitive to, and/or specific for, nonpoint source pollution, and
  - c) Comparison of biological data collected and habitat assessments conducted in 2003 with a previous survey carried out in 2000 at the same sites by the Center for Reservoir Research (Murray State University), and with other similar KDOW historical data (1988) for the Little River.
- 3. Ten study sites were sampled on the Little River (including North and South Forks), three on Casey/Skinner Creek, and three on Sinking Fork during May and September of 2003. (Fig. 1).
- 4. Physical and chemical data, algae, macroinvertebrates and fish were collected, visual habitat assessments were carried out, and a photographic log of all sites was established.

- 5. Multimetric scoring systems were used to integrate biological data (algae, macroinvertebrates, fish) in order to identify sites in the Little River basin impacted by non-point source pollution.
- 6. Algae and macroinvertebrates were collected in May and September of 2003; fish were collected in July and September. For May, 156 diatom taxa, and 144 macroinvertebrate taxa were identified; 35 fish taxa were identified for July. For September, 198 diatom taxa, 116 macroinvertebrate taxa, and 38 fish taxa were identified.
- 7. Casey/Skinner Creeks (CRR200014 and CRR 200015) were rated as Good and Excellent for diatoms and Fair for fish, but Poor for macroinvertebrates. The uppermost sites on Sinking Fork (CRR200010 and CRR200011) were rated as Good or Fair for diatoms and fish, but Poor for macroinvertebrates. Use-support based on habitat assessments rated only three sites as Partially Supporting of aquatic life (South Fork sites CRR200001 and CRR200002, Casey Creek site CRR200014). All other sites in the Little River were rated as Non-Supporting of aquatic life (Table 15).
- 8. Diatom Bioassessment Indices (DBIs) in 2003 were generally more complementary of Little River habitats than either the Macroinvertebrate Biotic Indices (MBIs) or Fish Index of Biotic Integrity (IBIs), resulting in several Good ratings of sites (19/32 sites or 59%). This is probably attributable to the changes in which metrics were used and how they were weighted in the DBI calculation. Improved methods in DBI calculations have emphasized such metrics as the highly silt tolerant % Navicula+Nitzschia+Surirella group and % Cymbella Total Richness, rather than previously used metrics such as % Sensitive Species and 'non-diatom taxa' presence. The improvement brings the DBIs more in line with other biological indices when assessing overall stream health.

- 9. MBIs classified only three sites as Fair (CRR200001, CRR20002 and CRR200011) during either May or September, 2003; all other sites during both sampling times were deemed as Poor. No Excellents occurred at any sites for macroinvertebrates.
- 10. IBIs (KIBIs) classified three Little River sites (CRR200001, CRR200002 and CRR 200005) and two upper Sinking Fork sites (CRR200010 and CRR200011) as Good in 2003.Other sites were either Fair or Poor for fish. No Excellents occurred at any sites.
- 11. The most common disturbances encountered at sites in the Little River basin in 2003 continue to be lack of habitat for aquatic organisms, deep, highly eroded and channelized streambeds, limited riparian zone area and vegetation, and agricultural runoff.
- 12. Overall comparisons of indices and assessments from this study to previous studies carried out in 1988 and 2000 were mixed depending on the index. In some cases, some sites seemed to be improving while others showed continued degradation of water quality (Tables 19-11). The best scores were found in Casey/Skinner Creeks while the worst were consistently found along the mid-reaches of the Little River and at some North and South Fork sites.
- 13. Based on the 2003 study and comparisons with previous studies of 1988 and 2000 using improved methods for calculating DBIs, MBIs and IBIs, the Little River remains a highly impaired habitat for aquatic biota due to nonpoint source inputs and disturbances characteristic of agricultural activity, riparian destruction, and in-stream disturbances.

#### Introduction

This study was conducted by the Center for Reservoir Research (CRR, Murray State University) in agreement with the Kentucky Division of Water (KDOW). The agreement laid the basis for the implementation of the Kentucky Nonpoint Source Management Program, as required by Section 319 of the Federal Clean Water Act Amendments of 1987.

The Little River basin, located in the Lower Cumberland drainage basin in western Kentucky, has been identified as a "first priority" river for future TMDL development (KWRRI 1999). Nutrients, pathogens and siltation continue to be serious impairments of the mainstem of the Little River. Non-point sources of nutrients, pathogens, and siltation result from agriculture and other crop-related inputs. The North Fork of the Little River, although considered a non-priority for future TMDL development (KWRRI 1999), is considered to be highly impaired by siltation and pathogens, but only slightly impaired by nutrients.

Agriculture, resource extraction, urban runoff and storm sewers are major non-point sources contributing to impairment. Nutrients and siltation also contribute to serious impairment of the South Fork of the Little River, although the South Fork is a "non-priority" for future TMDL development. Agriculture as the most important non-point source of pollutants; industrial point sources make a moderate contribution to impairment (KWRRI 1999).

The main objectives of the above-stated agreement with KDOW included

- (1) comparing resulting fish, macroinvertebrate, and algal data using biological metric criteria provided by KDOW for the Little River and it's tributaries,
- (2) identifying biological indicators that are sensitive to, and/or specific for, non-point source pollution, and

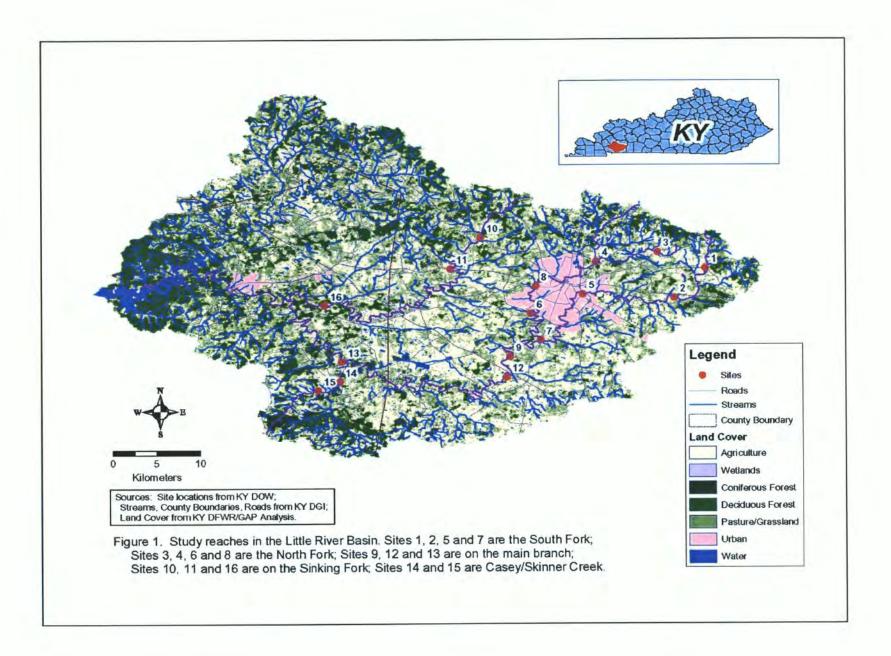
(3) comparing May and September, 2003, biological data collected from the Little River sites with the previous CRR/HBS survey carried out in 2000 at the same sites and with other similar KDOW historical data (1988) for the Little River.

The goal was to assess and identify streams in western Kentucky impacted by nonpoint source pollution (e.g., runoff from fields, impermeable urban surfaces). Algae, fish, and macroinvertebrates were collected and identified to assess the biological integrity of each stream. Habitat assessments were conducted to supplement biological data. The protocols used for collection and metrics were established and detailed in KDOW (1993). The KDOW methods were modified from those developed by the United States Environmental Protection Agency (US EPA) and are detailed in Barbour et al. (1999). Historical reference data collected from the least disturbed streams in the region were used as a foundation with which to compare our data.

#### **Site Selection**

The general area of each site was pre-selected by personnel at KY Division of Water and was approximately at the same locations as in a previous KDOW investigation (KDOW 1996). The land uses indicated the potential for non-point source pollution, predominantly from agriculture fields (corn, soybeans, cattle). Detailed maps (7.5 minute USGS Topographical Maps) were used to locate the sampling sites. Locations were recorded using a Global Positioning System (Trimble Navigator Pro X R GPS unit) and entered into a Geographic Information System (GIS, Fig. 1).

A total of 16 sites were sampled within the Little River or its tributaries in the Lower Cumberland River basin. Based on USGS maps, GPS and GIS information, the 16 sites



included three on Sinking Fork creek, one on Casey Creek, one on Skinner Creek (renamed as such from the Casey Creek of 2000) and the remaining eleven on the Little River. All sites were sampled in May, 2003, during high base flow, and again in September 2003, during low base flow.

#### **Ecoregions**

All sites within the Little River basin are in the Interior Plateau ecoregion also known as the Pennyroyal Bioregion – Interior Plateau (Fig. 2, Omernik (1987)). The Interior Plateau ecoregion is the largest region in western Kentucky with the most complete reference data for biological assessments. The geology consists of limestone, sand stone, and shale. Because of the solubility of limestone, many springs, caves, and sinks are present (McGrain, 1983). The plentiful springs produce a more constant base flow throughout the year; surface water temperatures in the summer tend to be variable yet cool for the spring-summer season (range 8-22 °C), and the high alkalinities are reflected in potentially higher biological productivity. The stream substrates are normally dominated by gravel, sand, bedrock, and silt; however, we found much variability in substrate from one study site to the next. The land use is mostly for row cropping (corn, soybeans) and pasture/grazing. Very little riparian corridor is left in the Little River Drainage (KYGAP 2001).

#### Materials and Methods

Physicochemical measurements were recorded, algae and macroinvertebrates collected, and the habitat was assessed at each site during May and September, 2003. Fish were sampled independently, during July and September, 2003.

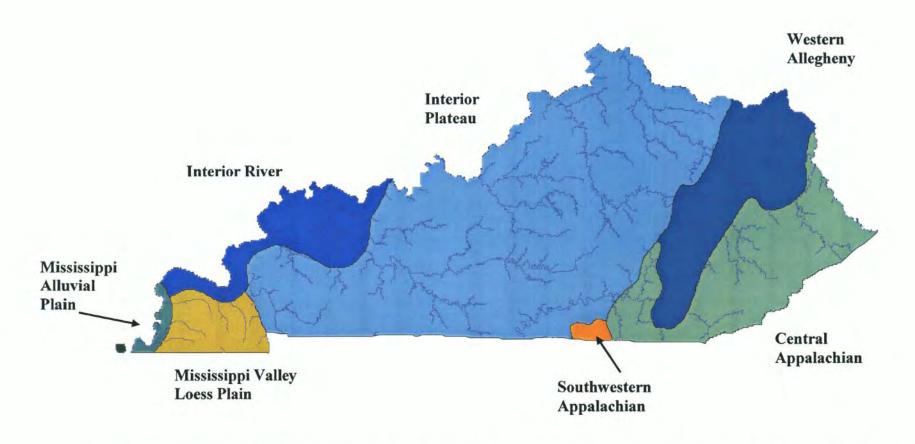


Figure 2. Ecoregions of Kentucky. CRR study sites were located within the far western portion of the Interior Plateau ecoregion.

Physicochemical measurements. Physiochemical measurements (dissolved oxygen, turbidity, pH, temperature, specific conductivity, and oxidation-reduction potential) were recorded at each site using a YSI 6820 Multi-Parameter Water Quality Monitor. Stream channel cross-sections were divided into at least four smaller cross-sections, depths were recorded at the center of each section, and water velocity was measured at 0.6 of the depth in each section using a Marsh McBirney 201 D PWCM flow meter. Discharge was calculated using the following equation: Q = WDU for each cross section of stream where

 $Q = \text{stream discharge (m}^3/\text{sec});$ 

W = width of cross section (m);

D = average depth of cross section (m);

U = velocity (m/sec).

A roughness factor of 0.9 was multiplied with Q to account for friction from a rockybottomed substrate. All cross sections were summed for total discharge (Q).

Habitat Assessment. Stream habitat and the riparian area for aquatic organisms were visually assessed at each site. The assessment protocol followed the US EPA's "Rapid Bioassessment Protocols (RBP) for Use in Wadeable Streams and Rivers" (Barbour et al. 1999). The Little River habitats at sites 1-16 were a mix of high and low gradient habitats (Mike Compton, KDOW, pers. comm. 2005); however low gradient habitat assessment sheets were used in this study. Table 1 shows the habitat parameters and scoring for each site. Each parameter is described by Barbour et al. (1999).

Table 1. Habitat assessment variables for high and low gradient streams.

High	Low
1 = Epifaunal Substrate/Available Cover	Same
2 = Embeddedness	Pool substrate characterization
3 = Velocity/Depth Combinations	Pool variability
4 = Sediment Deposition	Same
5 = Channel Flow Status	Same
6 = Channel Alteration	Same
7 = Frequency of Riffles	Channel sinuosity
8a = Bank Stability - Left Bank	Same
8b = Bank Stability – Right Bank	Same
9a = Vegetative Protection – Left Bank	Same
9b = Vegetative Protection – Right Bank	Same
10a = Riparian Width - Left Bank	Same
10b = Riparian Width - Right Bank	Same

A Nonpoint Source data sheet was used for assessing habitat quality, surrounding land use, weather conditions at the time of sampling, percentage substrate components, and other instream features similar to the above assessment form. Variables were assigned scores that were summed to arrive at a Metric Score for each site. Metric Scores provided a "classification" of Habitat Support Criteria by which each site was rated (Table 2).

Table 2. Habitat Support Criteria for Habitat Assessment Values for sites in the Little River Basin and its Tributaries (Pennyroyal Bioregion–Interior Plateau).

Metric Score  ≥ 122	Classification
≥ 122	Fully Supporting
121-110	Partially Supporting
< 110	Not Supporting

#### **Biological Assessment**

Algae. Composite, qualitative algal samples were collected at all sites. Standard collection and identification methods are described in KDOW (1998). All sampling occurred on natural substrate when stream flow was normal to low. Algae were sampled with a microspatula for scraping substrates and a turkey baster for sucking material from substrates. All major habitat and substrate types were sampled including riffles, pools, runs, rock, sand and woody debris. Algae were placed in a 60 ml Nalgene™ bottle as composite samples, preserved in 2% gluteraldehyde and refrigerated until processed.

The non-diatom (soft-bodied) algae were removed from the preserved sample, mounted on pre-cleaned microscope slides, identified to the lowest possible taxon and counted. Diatom frustules were cleared of organic and intercellular material using the Burn-Mount Method (Van Der Werff 1955). This method required placing about 5-10 ml of sample in a 1,000 ml beaker and oxidizing the solution with 100 ml of 30% peroxide (H<sub>2</sub>O<sub>2</sub>) for 24 hours. A micro-spatula of potassium dichromate (K<sub>2</sub>Cr<sub>2</sub>O) was then added to the mixture causing a violent exothermic reaction that oxidizes all organic matter in 5 to 10 minutes leaving only the diatom frustules. The mixture was allowed to settle for 4 hours, decanted, filled with distilled water and allowed to settle again. The decanting process was repeated at least four times. The remaining diatoms were mounted in Zrax (W.P. Dailey, University of Pennsylvania, dailey@sas.upenn.edu) dissolved in toluene on a precleaned slide, identified, and enumerated. A minimum of 3 slides was created for each sample. The criteria for determining a representative sample of diatoms included at least 600 valves with 10 valves of 10 species and/or 100 new species that had not been observed consecutively

(USEPA 1999). Fixed slides, bench sheets and field shields are archived at Hancock Biological Station.

Genus and species of diatoms and numbers of individuals found at each site were entered into the Ecological Data Application System (EDAS vKY3.0.mdb of 5/31/00). KDOW used streams that were shown to be the most representative and least disturbed as reference reaches to determine the most pollutant sensitive metrics for each ecoregion (Table 3). Five of the eleven metrics calculated by EDAS and specific to the diatoms were used to calculate the Diatom Bioassessment Index (DBI). The DBI was calculated by entering the five metrics in Table 3 into the most recent Excel spreadsheet program provided by KDOW (John Brumley, pers. comm.). The DBIs were then rated according to the scoring classification (Table 4). Each metric is described in detail in (KDOW, 1995).

Table 3: Diatom metrics used to calculate the Diatom Bioassessment Index (DBI). [Note: This Excel program includes a sixth metric (*Fragilaria* Richness) which this version of EDAS does not compute; thus it was excluded from the DBI calculation.] (KDOW 1995)

**Diatom Metrics:** 

Taxa Richness (TR)

Diatom Diversity (H)

Pollution Tolerance Index (PTI)

Percent Navicula+Nitzschia+Surirella (%NNS)

Cymbella Group Richness (TR)

Table 4. Diatom Bioassessment Index rating criteria for sites in the Little River Basin and tributaries. (Pennyroyal Bioregion-Interior Plateau). [Note: Soft-bodied (non-diatom) algae are not included in the metric scoring process, but are reported in Table 11.)]

Metric Score	Classification
≥ 67	Excellent
55-66	Good
50-54	Fair (Partially Supporting)
≤49	Poor (Not Supporting)

Non-diatom (soft-bodied) algae give further insight into the quality of the stream but are not a component of the DBI. Non-diatom species are listed separately.

Macroinvertebrates. Benthic macroinvertebrates were sampled using two collection methods that varied with stream morphology. All streams with riffles were sampled with a one-meter kick-net in the riffles, and with a D-frame net in the remainder of habitats (undercut banks, woody debris, vegetation, etc). This Multi-habitat sampling method is semi-quantitative (KDOW 1993). In streams where riffles were a significant feature, 2 half-meter kick net samples were taken in the riffle areas, as well as sampling the remainder of the habitat. Available habitat was weighed on a percentage basis, so all sites received comparable sampling effort.

The second sampling type was specific to low gradient, slow flowing, sandy-gravelly bottomed streams. This method, referred to as the Mid-Atlantic Coastal Plain Sampling Method (MACS), was developed by several southeastern states, and is summarized in Barbour et al. (1999) and recently has been adopted by KDOW for use in the Coastal Plain area. It is a semi-quantitative, multi-habitat sampling method using a D-frame net.

Approximately 20 one-meter sweeps of all the major habitats are collected based on the percent habitat available.

Macroinvertebrate genera and number of individuals found at each site were entered into EDAS (vKY3.0.mdb of 5/31/00). Of the 17 metrics calculated by EDAS, either 7 or 8 were used to calculate the Macroinvertebrate Bioassessment Index (MBI) for Wadeable or Headwater streams, respectively. The appropriate metrics for either stream type (Table 5) were determined by the KDOW based on the most sensitive pollution indicators and were entered into the most recent Excel spreadsheet provided by KDOW (Randall Payne, pers. comm.). The metric scores were based on analyses of data from all streams sampled, both reference and impacted (our data and KDOW's), in the Interior Plateau ecoregion.

Table 5: Macroinvertebrate metrics used to calculate the Macroinvertebrate Bioassessment Index (MBI).

#### **Metrics for Wadeable Streams**

Total Number of Genera (G-TR)

Total Number of Ephemeroptera, Plecoptera, and Trichoptera Genera (G-EPT)

Modified Hilsenhoff Biotic Index (mHBI)

Modified % Ephemeroptera Plecoptera and Trichoptera (m%EPT)

%Chironomidae+Oligochaetes (%Chiro)

% Clingers (%Cling)

Total Number of Individuals (TNI)

#### **Metrics for Headwater Streams**

All of the above

% Ephemeroptera (%Ephem)

All of the metric scores are based on the 50<sup>th</sup> and 5<sup>th</sup> percentile calculated for each metric by compiling reference and study site data by KDOW (Randall Payne, pers. comm.). These percentiles result in a ranking of all streams together, including the reference data, so that comparisons could be made among similar streams (based in part on USEPA, 1999) and so that outliers would not adversely affect study site scores. The Macroinvertebrate Bioassessment Index (MBI) is the average of the 7 or 8 metric scores (wadeable or headwater) entered into the most recent KDOW Excel spreadsheet (Randall Payne, pers. comm.). The scoring classifications were assigned according to Table 6.

Table 6. Macroinvertebrate Bioassessment Index Rating Criteria for Headwater and Wadeable Sites (50<sup>th</sup> and 5<sup>th</sup> %iles) in the Little River Basin and its Tributaries (Pennyroyal Bioregion–Interior Plateau).

	Metric Score	Classification	
Wadeable	≥ 81	Excellent	
	72-80	Good	
	49-71	Fair	
	25-48	Poor	
	0-24	Very Poor	
Headwater	≥ 72	Excellent	
	65-71	Good	
	43-64	Fair	
	22-42	Poor	
	0-21	Very Poor	

Fish. Fish were sampled at each site using a seine and a portable backpack electroshocker. A selected 100-meter reach was intensively shocked and seined for approximately 60 minutes. Fish samples were preserved in the field using 10% CaCO<sub>3</sub> buffered formalin. Large specimens were identified in the field, recorded, and released.

Small, easily identifiable fish captured in abundance also were recorded and released.

Representative fish samples were taken back to the laboratory, fixed in formalin, rinsed with water, and preserved in 40% isopropanol. Specimens were identified, enumerated, and recorded.

EDAS (vKY3.0.mbd of 5/31/00). EDAS calculated 16 metrics of which 8 were entered into the most recent KDOW Excel spreadsheet (Mike Compton, pers. comm.) to calculate the Index of Biotic Integrity (IBI, Karr 1981). Because our version of EDAS does not calculate a % Facultative Headwater Individuals (%FHW) metric we adapted the EDAS species classification codes by applying codes for % Headwater to % Pioneers and then recalculated the metric (Mike Compton, pers. comm.). The new % Pioneer metric was substituted for the % Facultative Headwater Individuals in the most recent Excel spreadsheet for calculating the IBI. The IBI uses equally weighted metrics to detect impacted fish populations. Different metrics have been used for different ichthyoregions, as determined by KDOW's analyses of reference data (Compton et al. 2003). In order to compare our study data with the reference data, the 95th percentile for all reference data within each ichthyoregion was calculated. The method normalizes the data so that sites with particularly high values were not weighted as heavily. Unusually high values could have caused the remaining study sites to be rated too low.

Table 7. Metrics Used to Calculate Fish Index of Biotic Integrity (IBI).

Pennyroyal Ichthyoregion - Interior Plateau Metrics

Total Number of Individuals (TNI) Native Species Richness Darter+Madtom+Sculpin
Intolerant Richness
Simple Lithophil Richness
Percent Insectivores excluding Tolerants
Percent Tolerants
Percent Facultative Headwater (calculated from recoded EDAS species classification under percent pioneers)

(Fish metrics assemblages are from KDOW (1997) and Compton et al. (2003).

The resulting IBIs (=KIBIs) were rated according to the criteria established for the Pennyroyal (PR) – Interior Plateau Ichthyoregion (Table 8, Compton et al. 2003).

Table 8. Ichthyoregion Criteria for Index of Biotic Integrity in the Little River Basin and its Tributaries (Pennyroyal Bioregion-Interior Plateau).

Metric Score	Rating	
≥ 67	Excellent	
53-66	Good	
35-52	Fair	
17-34	Poor	
0-16	Very Poor	

Data Storage. Biological and habitat data were entered into the state's Ecological Database System (EDAS), and will be returned to the state for distribution to all participating organizations). Original specimens, slides, datasheets, and bench sheets are archived at the Hancock Biological Station, Murray State University.

#### Results

**Habitat Assessment**. The overall average (May + September) habitat assessment score was  $85 \pm 18$ , ranging from 37 to 119 (Table 9). The average habitat assessments for all sites

during May and September were  $89 \pm 15$  and  $82 \pm 21$ , respectively, and were not significantly different (t = 1.403, p = 0.181, df = 15). There were no sites assessed as Fully Supporting of aquatic organisms during either May or September. In May, two sites on the South Fork of the Little River were Partially Supporting (CRR200001 and CRR200002) with the remaining 14 sites deemed as Not Supporting. In September, only one site was Partially Supporting of aquatic biota (Casey Creek, CRR200014) while the rest were Not Supporting. In most cases, low habitat assessment scores were the result of channelized streambeds, unstable banks, little vegetative protection, limited riparian corridor, and pool variability.

Habitat quality did not vary significantly between the two sampling dates for most sites. All of the sampling sites were still wet by September with the exception of one site, CRR200011 (Sinking Fork). Although Sinking Fork site, CRR2000010, showed a marked decrease in flow by September, the channel remained wet.

Water chemistry: Total annual rainfall for 2003 at the nearest NADP site (LBL-Mulberry Flats operated by Hancock Biological Station) was approximately 48 inches (115 cm). Approximately 36% of the total annual precipitation fell during the months of April, May and June, 17.4 inches (41.9 cm). Stream discharge was normally higher in the spring than in the fall throughout the basin (Table 10, Figure 3). Water temperatures were significantly lower during May (16.1 °C) than during September (18.9 °C) throughout the basin (t stat = -4.474; p < 0.001). Dissolved oxygen concentrations were significantly higher during May (10.56 mg L<sup>-1</sup>) than during September (8.34 mg L<sup>-1</sup>) throughout the basin (t stat = 3.00; p < 0.01). Other parameters, pH, conductivity, turbidity and oxidation-reduction potential, were not significantly different between May and September (p values = 0.402– 0.788). Turbidity was noteworthy in its basin-wide variability ranging from 6 – 60 NTU

Table 9. Habitat assessment values for study sites in the Little River drainage basin (Interior Plateau Ecoregion). Two assessments were carried out for each site, May and September 2003. PS = Partially Supporting aquatic organisms, FS = Fully Supporting, and NS = Not Supporting. See Tables 1 and 2 in text, for explanations of scoring and use-support criteria.

Station Code	Stanon Nome	Stream Gradient	Data	1	•	•	_			_	0-	OL	0-	٥L	10-	104	Todal	Use-
Station Code	Stream Name	Gradient	Date	1		3	4		6	7	8a	8b	9a	9b	IVa	10b	<u>Total</u>	Support
CRR200001	South Fork	High	5/14/03	14	10	9	8	19	13	7	7	7	7	7	1	1	110	PS
CRR200001	South Fork	High	9/05/03	17	1	4	13	19	13	6	7	7	8	8	3	3	99	NS
CRR200002	South Fork	High	5/14/03	9	11	14	7	19	12	8	7	7	7	7	1	1	110	PS
CRR200002	South Fork	High	9/05/03	7	14	12	14	14	13	7	5	3	4	3	0	0	96	NS
CRR200003	Lower Branch NF	High	5/14/03	8	8	11	7	17	12	8	7	7	7	7	1	1	101	NS
CRR200003	Lower Branch NF	High	9/05/03	3	3	3	16	18	13	6	9	9	9	9	0	0	98	NS
CRR200004	Upper Branch NF	High	5/13/03	7	6	8	4	18	14	7	3	3	6	6	3	3	88	NS
CRR200004	Upper Branch NF	High	9/05/03	6	8	0	13	18	13	8	6	3	6	3	2	2	88	NS
CRR200005	South Fork	High	5/13/03	4	11	13	13	19	13	3	4	1	8	3	2	2	86	NS
CRR200005	South Fork	High	9/05/03	4	11	15	9	19	8	6	8	2	9	3	0	0	94	NS
CRR200006	North Fork	High	5/15/03	10	8	14	9	19	13	6	3	3	3	3	4	4	99	NS
CRR200006	North Fork	High	9/06/03	10	6	0	0	15	11	3	2	2	5	5	2	2	63	NS
CRR200007	North Fork	High	5/15/03	8	11	14	8	19	15	5	8	4	3	1	1	1	99	NS
CRR200007	North Fork	High	9/06/03	6	10	0	13	7	13	2	3	1	1	1	0	0	58	NS
CRR200008	North Fork	High	5/20/03	2	6	1	2	19	9	4	1	1	1	1	0	0	47	NS
CRR200008	North Fork	High	9/06/03	0	6	0	0	10	13	2	1	1	1	1	1	1	37	NS
CRR200009	Little River	High	5/15/03	7	9	15	9	19	14	4	3	1	2	2	3	3	91	NS
CRR200009	Little River	High	9/06/03	8	14	2	7	11	9	5	9	2	8	4	1	2	82	NS
CRR200010	Sinking Fork	High	5/20/03	8	7	8	10	18	12	6	2	2	2	2	1	1	79	NS
CRR200010	Sinking Fork	High	9/05/03	3	16	0	10	13	10	3	2	3	2	3	2	2	69	NS
CRR200011	Sinking Fork	High	5/20/03	6	7	7	11	10	18	8	7	0	3	0	3	3	83	NS
CRR200011	Sinking Fork	High	9/06/03	8	6	8	5	15	13	9	5	0	2	2	2	3	78	NS
CRR200012	Little River	High	5/15/03	9	11	13	9	19	14	7	4	4	4	4	1	3	102	NS
CRR200012	Little River	High	9/06/03	11	16	0	14	14	11	6	5	5	5	5	3	1	96	NS
CRR200013	Little River	High	5/16/03	8	10	14	10	19	11	7	1	1	1	1	1	0	84	NS
CRR200013	Little River	High	9/07/03	16	16	16	6	6	11	8	2	2	3	3	5	1	95	NS
CRR200014	Casey Creek	High	5/16/03	7	11	12	7	13	13	8	2	3	2	7	1	1	87	NS
CRR200014	Casey Creek	High	9/07/03	13	10	18	10	11	15	8	7	4	7	4	3	8	119	PS
CRR200015	Skinner Creek	High	5/16/03	8	9	7	10	13	13	7	3	3	2	2	0	0	77	NS
CRR200015	Skinner Creek	High	9/07/03	15	10	10	13	13	11	5	5	4	5	4	1	1	92	NS
CRR200016	Sinking Fork	High	5/16/03	6	7	14	7	19	12	6	3	3	0	0	0	0	77	NS
CRR200016	Sinking Fork	High	9/06/03	8	13	2	8	8	11	2	0	0	0	0	1	1	54	NS

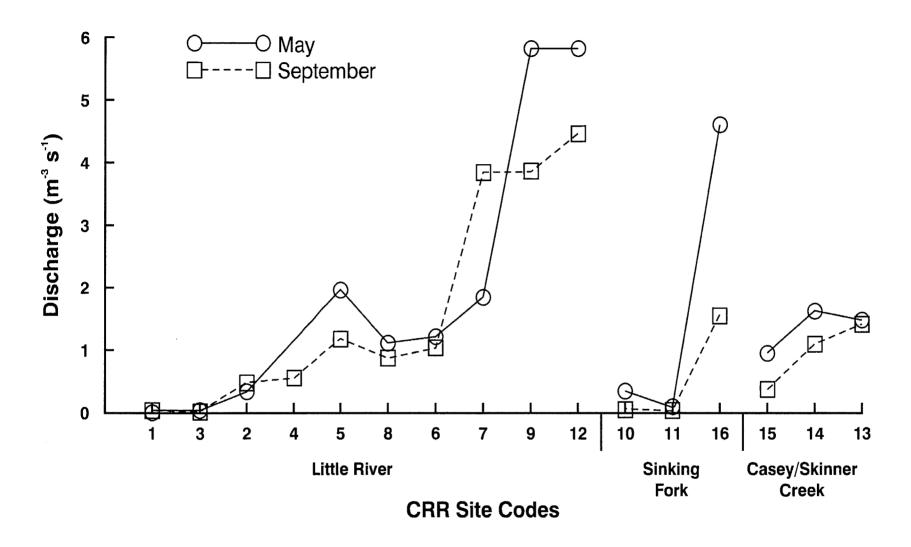


Figure 3. Little River basin stream discharge for study reaches in the Little River (North and South Forks), Sinking Fork and Casey/Skinner Creek. Sites were numbered and ordered in a downstream direction. Station codes are CRR2000 plus the site number (e.g., CRR200001....CRR200016).

Table 10. Field physicochemical data collected from sites in the Little River Drainage Basin during May and September, 2003. NM = Not Measured, NMF = No Measurable Flow.

Station Code	Stream Name	Date	Temp (°C)	D.O. (mg/L)	рН	Turb (NTU)	Cond (mS/cm)	ORP (mv)	Channel Width(m)	Discharge (m³/sec)
CRR200001	South Fork	5/14/03	17.5	10.55	8.01	60.3	325	419.2	7.0	0.032
CRR200001	South Fork	9/05/03	19.6	9.15	8.15	23.9	321	405.2	7.0	0.056
CRR200002	South Fork	5/14/03	16.3	9.95	7.95	10.2	362	439.9	8.2	0.368
CRR200002	South Fork	9/05/03	18.5	9.56	8.11	17.4	326	430.4	8.6	0.507
CRR200003	Lower Branch NF	5/14/03	17.6	8.83	7.72	24.9	383	434.1	5.5	0.061
CRR200003	Lower Branch NF	9/05/03	21.6	9.99	8.12	22.4	327	394.5	4.5	0.037
CRR200004	Upper Branch NF	5/13/03	NM	NM	NM	NM	NM	NM	NM	NM
CRR200004	Upper Branch NF	9/05/03	22.8	4.94	7.93	9.6	154	365.2	6.0	0.575
CRR200005	South Fork	5/13/03	15.2	10.00	7.3	NM	402	NM	9.9	1.981
CRR200005	South Fork	9/05/03	19.9	8.26	7.8	41.8	316	451.4	8.35	1.191
CRR200006	North Fork	5/15/03	1 <b>7.9</b>	8.05	7.42	12.0	358	460.5	12.4	1.236
CRR200006	North Fork	9/06/03	19.6	7.00	7.94	26.3	337	378.7	13.0	0.876
CRR200007	North Fork	5/15/03	17.2	9.01	7.57	11.8	388	436.3	10.5	1.859
CRR200007	North Fork	9/06/03	19.5	7.67	7.81	45.5	353	383.1	10.0	1.053
CRR200008	North Fork	5/20/03	19.6	8.48	9.1	NM	247	62.4	13.0	1.143
CRR200008	North Fork	9/06/03	20.3	6.72	7.72	<b>17.7</b>	312	379.4	9.8	0.893
CRR200009	Little River	5/15/03	<b>16.6</b>	11.50	7.8	14.5	390	410.2	20.5	5.827
CRR200009	Little River	9/06/03	19.7	8.23	7.0	17.8	328	303.7	18.0	3.865
CRR200010	Sinking Fork	5/20/03	18.2	19.96	8.0	NM	245	65.1	8.3	0.253
CRR200010	Sinking Fork	9/05/03	20.6	8.95	7.97	44.4	236	374.5	6.0	0.036
CRR200011	Sinking Fork	5/20/03	8.1	9.32	7.83	NM	246	66.0	4.0	0.020
CRR200011	Sinking Fork	9/06/03	<b>17.9</b>	5.33	7.45	11.4	391	388.0	NMF	0.000
CRR200012	Little River	5/15/03	17.1	9.91	7.72	13.8	382	431.0	22.0	5.831
CRR200012	Little River	9/06/03	19.6	9.03	7.9	21.0	354	304.5	13.0	4.472
CRR200013	Little River	5/16/03	15.2	10.69	7.78	10.2	246	415.7	14.0	1.717
CRR200013	Little River	9/07/03	15.4	9.30	8.53	16.7	202	304.5	9.3	1.413
CRR200014	Casey Creek	5/16/03	14.8	9.50	7.38	9.8	237	432.8	9.5	1.858
CRR200014	Casey Creek	9/07/03	15.5	9.20	8.04	8.3	199	405.9	8.0	1.394
CRR200015	Skinner Creek	5/16/03	13.9	11.44	7.32	6.0	234	469.1	9.4	0.821
CRR200015	Skinner Creek	9/07/03	14.8	9.60	7.9	9.3	202	399.0	8.0	0.557
CRR200016	Sinking Fork	5/16/03	16.4	11.26	7.53	30.1	318	436.1	11.6	4.704
CRR200016	Sinking Fork	9/06/03	19.4	8.50	7.94	22.7	287	301.3	11.0	1.758

during the spring and from 8 – 45 NTU during the fall.

Algae: One hundred seventy eight (178) algae taxa were collected basin-wide during May, 2003. Of the total, 156 taxa were diatoms (Bacillariophyta), 8 taxa were Chlorophyta, 12 taxa were Cyanophyta, and 2 were Rhodophyta (Table 11; diatom taxa in Appendix B). The most abundant diatom taxa during May included Achnanthes lanceolata, A. minutissima, Gomphonema minutum, Nitzschia dissipata, N. frustulum, Melosira italica, M. varians, Surirella ovalis, Rhoicosphenia curvata, and several species of Navicula including N. cryptotonella. Many of the taxa above are known to be pollution tolerant. The most abundant non-diatom taxa during May included Cladophora sp., Rhizoclonium hookeri, Oscillatoria agardhii, O. nigra, and O. subbrevis.

One hundred ninety eight (198) algae taxa were collected basin-wide in September, 2003. Of the total, 177 taxa were diatoms, 10 taxa were chlorophytes, 10 taxa were cyanophytes and 1 taxon was a red alga (Table 11; diatoms in Appendix B). The most abundant diatom taxa during September included Cocconeis peduculus, C. placentula var. euglypta, Melosira varians, Nitzschia pelea, Navicula schroeterii, N. minima, N. contenta, N. crypotonella, and Stephanocylus meneghiniana. Some of the above taxa are known to be organic pollution tolerant. The most abundant non-diatom taxa during September included Rhizoclonium hieroglyphicum, Spirogyra sp. and Oscillatoria articulate. The lowest number of diatom taxa collected was 22 at CRR200008 (North Fork) during May while the highest number of diatom taxa collected was 68 at CRR200005 (South Fork) during September (Table 12). The basin-wide average DBI for combined sampling periods was 55.7. The average DBI for September was not significantly different (58) than the average DBI for May

Table 11. Distribution of soft-bodied algae from 16 Little River sites, (May/September), 2003. A = abundant; C = common; R = rare; (-) denotes absent for either May or September.

Taxa		Little River Sites 2003														
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Chlorophyta											- 18.8°	**************************************	241.			
Ankistrodesmus facatus var. mirabilis				-/R												
Cladophora sp.	A/R	<b>A</b> /–														
Closterium moniliferum				-/R												
Cylindrocapsa conferta			-/R													
Dichotomosiphon tuberosus										C/-						
Hydrodictyon reticulatum				-/C												
Mougeotia sp.			-/R													
Oedogonium sp.		C/-	C/C	C/-						-/R	R/R		C/-	R/-	<b>R</b> /–	
Rhizoclonium crassipelitum																<b>R</b> /–
R. hieroglyphicum			-/A	/R						-/R	C/-		<b>R</b> /–	R/	-/C	
R. hookeri			<b>A</b> /–	<b>A</b> /		<b>A</b> /	<b>C</b> /–									
Scenedesmus quadricauda						<b>R</b> /-										
Spirogyra sp.	<b>C</b> /–		C/	- <b>/A</b>												
Stigeoclonium sp.			/R													
Unidentified green filament															-/C	-/ <b>R</b>
Cyanophyta																
Anabaena sp.			R/-	R/-												
Calothrix sp.			10-	10-						-/R						
Chroococcus sp.										–/R –/R						
Coelosphaerum sp.						-/R				-/ K						
Dactylococcopsis acicularis	R/-	<b>R</b> /_				/10										
Lyngbya diguetii		C/-	<b>R</b> /–					<b>R</b> /								
L. limnetica		-					<b>R</b> /_	10								
L. nana	R/						10									
Oscillatoria agardhii									A/-				<b>R</b> /–	<b>R</b> /–		
O. amoena						-/R			10 -				N-	<b>N</b> -	-/R	
O. articulate					/A										-/K	
O. limnetica	-/ <b>R</b>									C/-						

Table 11. (Soft-bodied algae continued).

	01	02	03	04	05	06	07	Little 1	River Site	es 2003 10	11	12	13	14	15	16
O. nigra		4				-/C	R/-				<b>A</b> /–	R/A		-/C	C/-	
O. rubescens			<b>R</b> /–	<b>R</b> /	<b>R</b> /	<b>R</b> /										
O. splendida										<b>R</b> /–						
O. subbrevis			C/C	C/-	R/C	<b>C</b> /–	A/R	R/R	A/A	R/C		-/C	-/ <b>R</b>	R/C	C/	<b>R</b> /–
O. tenuis		<b>R</b> /–	C/C		R/C			<b>R</b> /–		<b>A</b> /–	-/C					
O. terebriformis											-/R					
Unidentified BG filaments							-/A	-/R								
Rhodophyta																
Lemanea sp.	<b>R</b> /–		<b>R</b> /–		<b>R</b> /–				<b>R</b> /–							
Rhodochorton sp.		<b>R</b> /–			<b>R</b> /		R/R		R/-				4			

Table 12. Diatom Bioassessment Index (DBI) scores for the Little River Basin (Pennyroyal Bioregion – Interior Plateau Ecoregion). \*Excel spreadsheet program (KDOW; per John Brumley).

Station Code	Stream Name	Date	DTR	s	DIV	S	%NNS	s	PTI	s	CymbTR	s	*DBI	Overall Score
CRR200001	South Fork	5/14/03	50	49	1.46	102.1	57.9	43.2	2.17	62.7	6	46.2	60.1	Good
CRR200001	South Fork	9/05/03	52	51	1.40	97.9	48.5	52.9	2.35	67.9	5	38.5	61.6	Good
CRR200002	South Fork	5/14/03	40	39	1.42	99.3	72.6	28.1	2.16	62.4	3	23.1	50.4	Fair
CRR200002	South Fork	9/05/03	42	41	1.38	96.5	49.5	51.8	2.14	61.8	8	61.5	62.6	Good
CRR200003	Lower Branch NF	5/14/03	40	39	1.05	73.4	26.5	75.3	2.15	62.1	5	38.5	57.7	Good
CRR200003	Lower Branch NF	9/05/03	41	40	1.29	90.2	40.0	61.6	2.27	65.6	7	53.8	62.3	Good
CRR200004	Upper Branch NF	5/13/03	44	43	1.26	88.1	24.6	77.4	2.59	74.9	0	0.0	56.7	Good
CRR200004	Upper Branch NF	9/05/03	48	47	1.30	90.9	47.5	53.9	2.11	61.0	1	7.7	52.1	Fair
CRR200005	South Fork	5/13/03	48	47	1.48	103.5	69.7	31.1	2.25	65.0	4	30.8	55.5	Good
CRR200005	South Fork	9/05/03	68	67	1.62	113.3	69.2	31.6	2.50	72.2	4	30.8	62.9	Good
CRR200006	North Fork	5/15/03	47	46	1.35	94.4	75.2	25.4	2.34	67.6	4	30.8	52.9	Fair
CRR200006	North Fork	9/05/03	38	37	1.35	94.4	90.1	10.1	1.95	56.4	2	15.4	42.7	Poor
CRR200007	North Fork	5/15/03	47	46	1.48	103.5	52.8	48.5	2.51	72.5	2	15.4	57.2	Good
CRR200007	North Fork	9/06/03	50	49	1.29	90.2	80.1	20.4	2.23	64.4	3	23.1	49.4	Poor/Fair
CRR200008	North Fork	5/20/03	22	21	0.88	61.5	72.0	28.7	2.39	69.1	0	0.0	36.2	Poor
CRR200008	North Fork	9/06/03	64	62	1.59	111.2	67.5	33.4	2.31	66.8	3	23.1	59.4	Good
CRR200009	Little River	5/15/03	37	36	1.19	83.2	48.4	53.0	2.38	68.8	4	30.8	54.4	Fair
CRR200009	Little River	9/06/03	59	58	1.55	108.4	74.6	26.0	2.18	63.0	5	38.5	58.7	Good
CRR200010	Sinking Fork	5/20/03	33	32	1.14	<b>79.7</b>	23.6	78.4	2.40	69.4	5	38.5	59.7	Good
CRR200010	Sinking Fork	9/05/03	36	35	1.24	86.7	25.3	76.7	2.77	80.1	6	46.2	65.0	Good
CRR200011	Sinking Fork	5/20/03	34	33	1.17	81.8	48.8	52.5	2.76	<b>79.8</b>	2	15.4	52.6	Fair
CRR200011	Sinking Fork	9/06/03	44	43	1.33	93.0	74.4	26.3	2.26	65.3	3	23.1	50.2	Fair
CRR200012	Little River	5/15/03	52	51	1.47	102.8	53.6	47.6	2.87	83.0	1	7.7	58.4	Good
CRR200012	Little River	9/06/03	43	42	1.46	102.1	52.4	48.8	2.60	<b>75.</b> 1	1	7.7	55.2	Good
CRR200013	Little River	5/16/03	27	26	1.12	78.3	<b>75.1</b>	25.6	1.83	52.9	4	30.8	42.8	Poor
CRR200013	Little River	9/07/03	48	47	1.45	101.4	55.6	45.5	2.03	58.7	8	61.5	62.8	Good
CRR200014	Casey Creek	5/16/03	31	30	1.20	83.9	62.5	38.5	2.17	62.7	6	46.1	52.3	Fair
CRR200014	Casey Creek	9/07/03	39	38	1.40	97.9	39.6	62.0	2.15	62.1	6	46.1	61.3	Good
CRR200015	Skinner Creek	5/16/03	41	40	1.32	92.3	44.4	57.0	2.33	67.3	5	38.5	59.1	Good
CRR200015	Skinner Creek	9/07/03	48	47	1.47	102.8	36.4	65.3	2.39	69.1	7	53.8	67.6	Excellent
CRR200016	Sinking Fork	5/16/03	38	37	1.37	95.8	67.3	33.6	2.06	59.5	i	7.7	46.8	Poor
CRR200016	Sinking Fork	9/06/03	49	48	1.39	97.2	76.2	24.4	2.00	57.8	6	46.2	54.7	Fair/Good

DTR = Diatom taxa richness

S = Metric Score following each metric value

DIV = Diatom Diversity (H)

**DBI** = **Diatom Bioassessment Index** 

%NNS = Percent Navicula+Nitzschia+Surirella

PTI = Pollution Tolerance Index (Diatoms)

CymTR = Cymbella Group Richness

(53.3) (*t* stat = -2.056, p = 0.06). The DBI scores rated 3 sites as Poor during May (CRR200008, CRR200013 and CRR200016), and 5 sites as Fair during May (CRR200002, CRR200006, CRR200009, CRR200011, and CRR200014). In September, DBI scores rated 2 sites as Poor (CRR200006 and CRR200007) and 3 sites as Fair (CRR200004, CRR200011 and CRR200016). All other sites during both seasons were rated as Good with one Excellent rating occurring in September at CRR200015 (Table 7). Paradoxically, one of the Poor sites has the lowest number of taxa collected (22 at CRR200008), while another Poor/Fair site has one of the highest number of taxa collected (50 at CRR200007). The site with the highest number of taxa collected (68 at CRR200005) resulted in only a modest Good rating. The Poor sites were characterized by the highest silt tolerant diatom composition (% *Nitzschia+Navicula+Surirella*: 75%—90%).

DBI scores were regressed against habitat assessment values to determine any DBI predictive power from the relationship (Figure 4a). Habitat assessment (HA) was only a weak predictor of DBI as there was much unexplained variation around the best fit regression line (DBI = 0.154HA + 42.5;  $r^2 = 0.138$ , F ratio = 5.983, p = 0.021). Because the DBI scores did not fully support the potential indicated by the habitat assessments, some factor other than stream habitat was influencing diatom diversity in the Little River. Other studies have found that where periphyton diversity is low and habitat disturbance is only weakly related to periphyton community structure, periphyton metrics in general may be of limited use in biomonitoring (Mazor and Resh 2005). Thus, DBIs alone may not be a useful tool in assessing water and habitat quality of the Little River system.

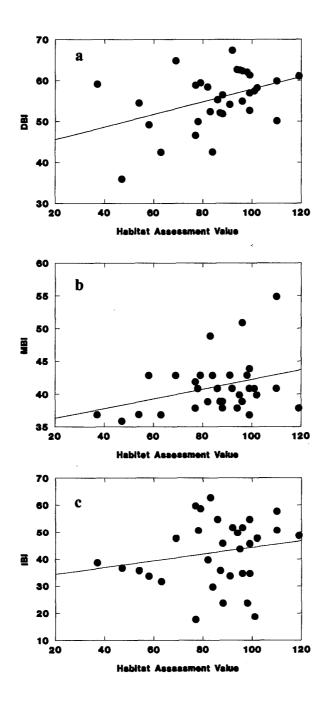


Figure 4. DBI (a), MBI (b), and IBI (c) regressions on Habitat Assessment Values for all sites on the Little River, 2003. See text for regression statistics.

Non-diatom taxa were only qualitatively determined as abundant, common or rare (Table 11). Basinwide, the Chlorophyta were represented by 14 taxa; the Cyanophyta were represented by 18 taxa; and the Rhodophyta by 2 taxa.

Macroinvertebrates: One hundred forty four (144) taxa of aquatic insects, oligochaetes, mollusks, decapods, isopods, and amphipods were identified in the Little River system in May, 2003. Abundant taxa collected basinwide were *Polypedium convictum*, *Chironomus*, *Elimia*, *Caecidotea*, *Stenelmis*, *Gammarus* and *Physella*. These are all moderate to highly tolerant of organic pollution (Lenat 1993). In September, 116 taxa were identified with the most abundant being *Polypedium*, *Elimia*, *Chironomus*, *Stenelmis*, and *Gammarus*, but the others were replaced by *Baetis*, *Stenonema* and *Cheumatopsyche* (Appendix B).

Genus richness ranged from a low of 22 at CRR200005 (South Fork) to a maximum of 68 at CRR200001 (South Fork – Headwater) upstream. MBIs ranged from 36 at CRR200008 to a high of 55 at CRR200001 in May. Only four Macroinvertebrate Biotic Indices (MBI) out of 32 resulted in a Fair rating for the sites. All other sites and dates rated as Poor (Table 13) and, therefore, non-supporting of macroinvertebrate communities. Two of the four MBIs resulting in Fair were due to the combination of high Genus Total Richness (GTR) and Genus Ephemeroptera/Plecoptera/Trichoptera (GEPT) metrics.

MBI scores were regressed against habitat assessment scores in order to examine the strength of the relationship between the two and assess the potential predictive power of habitat assessment for MBIs (Fig. 4b). Habitat assessment value was not a significant predictor of MBI as too much variation was not explained by the best fit regression (MBI = 0.074HA + 34.85;  $r^2 = 0.078$ , F value = 3.627, p = 0.066). The lack of a significant

Table 13. Macroinvertebrate Biotic Index (MBI), overall quality rating, and metrics used to calculate MBI in the Little River Drainage Basin (Interior Plateau Ecoregion). Sites CRR20001, CRR20003 and CRR20015 are Headwater streams; all others are Wadeable. [%C+O = %C output from EDAS vKY3.0.mbd]

Station Code	Stream Name	Date	G-TR	G-EPT	mHBI	m%EPT	%C+O	%Cling	TNI	*MBI	*Rating
CRR200001	South Fork	5/14/03	68	13	6.014	10.41	65.51	17.84	3889	55	Fair
CRR200001	South Fork	9/05/03	36	8	6.592	25.29	1.66	32.63	1388	44	Fair
CRR200002	South Fork	5/14/03	46	5	6.437	1.73	39.28	26.66	2138	41	Poor
CRR200002	South Fork	9/05/03	27	7	5.537	59.11	2.72	23.32	626	51	Fair
CRR200003	Lower Branch NF	5/14/03	47	5	7.037	2.79	59.93	18.67	1253	41	Poor
CRR200003	Lower Branch NF	9/05/03	40	10	6.496	11.84	4.40	47.54	591	43	Poor
CRR200004	Upper Branch NF	5/13/03	49	2	7.016	0.09	52.56	9.83	2279	39	Poor
CRR200004	Upper Branch NF	9/05/03	30	6	6.147	3.76	12.35	3.76	372	38	Poor
CRR200005	South Fork	5/13/03	40	5	6.499	2.97	49.72	6.86	539	41	Poor
CRR200005	South Fork	9/05/03	22	3	5.274	12.20	2.44	18.29	246	38	Poor
CRR200006	North Fork	5/15/03	35	4	6.445	1.28	17.09	15.17	1404	37	Poor
CRR200006	North Fork	9/05/03	29	5	6.119	4,22	1.71	43.34	759	37	Poor
CRR200007	North Fork	5/15/03	41	8	6.450	5.53	15.00	36.31	760	41	Poor
CRR200007	North Fork	9/06/03	36	9	6.187	<b>16.21</b>	2.39	40.69	543	43	Poor
CRR200008	North Fork	5/20/03	35	4	6.922	2.30	16.01	5.20	999	36	Poor
CRR200008	North Fork	9/06/03	27	5	6.372	12.42	3.10	17.59	483	37	Poor
CRR200009	Little River	5/15/03	43	8	6.158	6.73	21.31	36.04	788	43	Poor
CRR200009	Little River	9/06/03	30	5	5.593	6.80	2.27	34.50	397	39	Poor
CRR200010	Sinking Fork	5/20/03	30	7	6.058	9.56	35.10	26.95	638	43	Poor
CRR200010	Sinking Fork	9/05/03	33	7	5.975	20.23	0.49	46.32	613	43	Poor
CRR200011	Sinking Fork	5/20/03	51	11	5.966	12.38	31.70	40.50	1817	49	Fair
CRR200011	Sinking Fork	9/06/03	32	5	6.278	22.88	0.65	28.10	765	41	Poor
CRR200012	Little River	5/15/03	45	6	6.391	3.40	3.60	4.90	1000	40	Poor
CRR200012	Little River	9/06/03	29	7	5.438	1.19	9.63	5.42	3116	39	Poor
CRR200013	Little River	5/16/03	40	8	6.080	3.57	39.74	5.60	785	43	Poor
CRR200013	Little River	9/07/03	30	7	5.512	7.86	5.16	13.14	852	40	Poor
CRR200014	Casey Creek	5/16/03	36	6	5.726	1.11	6.47	5.08	1809	39	Poor
CRR200014	Casey Creek	9/07/03	28	3	5.336	3.39	<b>15.71</b>	35.71	560	38	Poor
CRR200015	Skinner Creek	5/16/03	42	8	6.150	2.15	29.24	2.89	2599	42	Poor
CRR200015	Skinner Creek	9/07/03	34	7	5.622	4.95	24.05	13.67	848	41	Poor
CRR200016	Sinking Fork	5/16/03	30	5	6.092	1.88	36.84	14.47	532	38	Poor
CRR200016	Sinking Fork	9/06/03	26	5	5.724	5.56	0.79	16.37	629	37	Poor

G-TR = Genus-Total Richness

%C+O = Percent Chironomidae+Oligochaetes (%Chronomidae)

G-EPT = Genus-Ephemeroptera/Plecoptera/Trichoptera Index

mHBI = Modified Hilsenhoff Biotic Index

m%EPT = Modified Percent EPT

<sup>\*</sup>Excel program (KDOW; per Randall Payne, 2005)

<sup>%</sup>Cling = Percent Clingers

TNI = Total number of individuals

MBI = Macroinvertebrate Biotic Index

relationship between MBI and habitat assessment suggested that factors other than habitat were affecting MBIs such as siltation, habitat loss and nutrient enrichment.

Fish: Thirty five taxa of fish were collected in July, and 38 taxa were collected in September, 2003. Dominant taxa in July included rosefin shiner, striped shiner, stone roller, bluntnose minnow, and longear sunfish. In September, the banded sculpin and fringed darter replaced stone rollers and striped shiners in the above list. The average IBI score for wadeable streams was 43.5 for both sampling periods; the average IBI score for headwater streams was 42.2 for both sampling periods. For all sites, the average IBI for July was 42 with a range of 18-63, while the average IBI for September was 42.9 ranging from 24-55 and were not significantly different (t stat = -0.303, p = 0.766).

IBIs resulted in Good ratings in only two headwater streams (CRR200001 - South Fork) in September and CRR200015 (Skinner Creek) in July (Table 14a). The Lower Branch of the North Fork (CRR200003) was rated Poor during both sampling periods. Poor ratings were a result of low numbers of individuals collected at those sites. IBIs resulted in four Good ratings at wadeable streams (CRR200002 and CRR200005 at South Fork and CRR200010 and CRR200011 at Sinking Fork), all during July (Table 14b). IBIs resulted in several ratings of Poor (CRR200004, CRR200006, CRR200007, CRR200013, and CRR200016) during either July or September and were mostly a result of low numbers of individuals caught at those sites. The remaining sites were rated Fair. There were no Excellent ratings based on IBIs anywhere in the Little River basin in 2003.

IBIs were regressed against habitat assessment scores in order to test for the strength of the relationship between the two and assess the potential predictive power of habitat assessment for IBIs (Fig. 4c). Habitat assessment was not a significant predictor of IBI as too

Table 14a. Index of Biotic Integrity (IBI) for fish samples within the Headwater streams (catchment <10 mi²) in the Pennyroyal Bioregion (Interior Plateau Ichthyoregion) of western Kentucky.

Stream Code	Stream Name	Date	Catchment Area (mi²)	TNI	NAT	(Raw ) DMS	Metric INT	Values SL	from EDAS) %INSCT	%TOL	%FHW	KIBI	Classif.
CRR200001	South Fork	7/03	4.20	192	14	1	1	2	61.46	36.45	95.31	51	Fair
CRR200001	South Fork	9/03	4.20	107	15	3	2	4	39.25	42.05	88.78	55	Good
CRR200003	Lower Branch NF	7/03	2.95	24	6	0	0	0	66.67	25.00	100.00	19	Poor
CRR200003	Lower Branch NF	9/03	2.95	33	9	1	1	1	30.30	66.67	96.96	24	Poor
CRR200015	Skinner Creek	7/03	8.25	176	7	2	1	3	75.57	22.15	87.50	60	Good
CRR200015	Skinner Creek	7/03	8.25	90	10	3	2	3	62.22	22.22	40.00	52	Fair

TNI = Total # individuals

NAT = Native Species Richness

DMS = Darter+Madtom+Sculpin

INT = Intolerant Richness

SL = Simple Lithophil Richness %INSCT = % Insectivores excluding Tolerants

%FHW = % Facultative Headwater

KIBI = Kentucky Index of Biotic Integrity

Table 14b. Index of Biotic Integrity (IBI) for fish samples within the Wadeable streams (catchments > 10mi<sup>2</sup>) in the Pennyroyal Bioregion (Interior Plateau Ichthyoregion) of western Kentucky.

						(Raw)	Metric	Values	from EDAS	)			
Stream Code	Stream Name	Date	Catchment Area (mi <sup>2</sup> )	TNI	NAT	DMS	INT	SL	%INSCT	%TOL	%FHW	KIBI	Classif
CRR200002	South Fork	7/03	23.29	191	15	3	4	3	68.06	23.03	94.76	58	Good
CRR200002	South Fork	9/03	23.29	255	13	4	4	3	48.24	39.60	70.58	52	Fair
CRR200004	Upper Branch NF	7/03	16.29	17	9	2	3	0	41.18	47.05	88.23	24	Poor
CRR200004	Upper Branch NF	9/03	16.29	94	13	3	3	1	53.19	44.68	89.36	46	Fair
CRR200005	South Fork	7/03	45.39	200	14	5	4	4	74.00	22.50	96.00	55	Good
CRR200005	South Fork	9/03	45.39	116	10	4	4	2	74.14	13.79	75.86	50	Fair
CRR200006	North Fork	7/03	52.40	238	12	2	3	2	83.61	13.02	91.17	46	Fair
CRR200006	North Fork	9/03	52.40	94	12	2	3	1	79.79	17.02	95.74	32	Poor
CRR200007	North Fork	7/03	58.54	194	4	1	1	1	94.33	5.67	97.42	35	Fair
CRR200007	North Fork	9/03	58.54	65	11	3	3	2	67.69	13.84	55.38	34	Poor
CRR200008	North Fork	7/03	46.16	149	8	0	0	2	88.59	11.40	98.65	37	Fair
CRR200008	North Fork	9/03	46.16	117	12	1	1	2	80.34	18.80	98.29	39	Fair
CRR200009	Little River	7/03	126.64	92	14	3	4	5	71.74	25.00	92.39	34	Poor
CRR200009	Little River	9/03	126.64	110	13	4	5	5	58.18	31.81	77.27	40	Fair
CRR200010	Sinking Fork	7/03	16.64	409	13	3	3	3	72.86	25.42	92.66	59	Good
CRR200010	Sinking Fork	9/03	16.64	193	16	2	2	3	46.11	48.70	61.13	48	Fair
CRR200011	Sinking Fork	7/03	30.14	335	13	5	5	4	77.91	20.59	94.92	63	Good
CRR200011	Sinking Fork	9/03	30.14	322	15	3	3	2	71.74	27.63	85.71	51	Fair
CRR200012	Little River	7/03	129.64	109	9	4	5	4	94.50	3.67	93.57	48	Fair
CRR200012	Little River	9/03	129.64	108	11	3	5	3	59.26	30.55	69.44	35	Fair
CRR200013	Little River	7/03	243.72	163	11	4	5	6	34.97	25.14	95.09	30	Poor
CRR200013	Little River	9/03	243.72	133	14	7	5	7	59.40	24.81	60.90	44	Fair
CRR200014	Casey Creek	7/03	30.72	52	6	3	2	3	82.69	17.30	48.07	36	Fair
CRR200014	Casey Creek	9/03	30.72	85	13	3	5	5	67.06	21.17	55.29	49	Fair
CRR200016	Sinking Fork	7/03	106.93	54	7	1	1	2	61.11	38.88	66.66	18	Poor
CRR200016	Sinking Fork	9/03	106.93	133	8	2	2	2	93.23	6.01	42.10	36	Fair

(see Table 9a for column definitions)

much variation around the best fit regression line was unexplained (IBI = 0.124HA + 31.89;  $r^2 = 0.004$ , F ratio = 1.117, p = 0.299). Of the three regressions (Figure 4a-c), IBI versus habitat assessment was the weakest. Other variables such as nutrient enrichment or siltation were influencing the fish community and species richness.

Sites scores resulting from all biological indices and habitat assessments in the Little River Basin during both sampling periods in 2003 are summarized in Table 15. Particularly noteworthy are the DBI classifications in that they resulted in the most numerous Good classifications. The Macroinvertebrate indices resulted in predominately Poor ratings for most of the Little River basin followed by the IBIs with mostly Poor or Fair ratings; these generally agreed with the habitat assessment classifications (Non-Supporting) for the Little River. A multiple rating system combining biological and habitat assessments is essential in assessing overall stream health particularly where non-point source pollution is a predominating influence.

# Comparison of 2003 with 1988 and 2000 Little River Studies

# **Habitat and Biological Assessments**

Table 16 summarizes all taxa information for 1988 (KDOW 1996), 2000 and 2003 from the Little River drainage. A maximum of 224 alga taxa, 177 macroinvertebrate taxa and 31 fish taxa were reported in 1988 (KDOW 1996). An average maximum of 248 alga taxa, 168 macroinvertebrate taxa and 42 fish taxa were collected in 2000. An average maximum of 188 alga taxa, 130 macroinvertebrate taxa and 36 fish taxa were collected in 2003. The general decrease in biological taxa from 1988 to 2003 is in agreement with the mostly Not

Table 15. Summary of assessments resulting in use-support and overall ratings (scores, classifications) of habitat, DBIs, MBIs and IBIs for sixteen Little River sites in 2003. PS = Partially Supporting, NS = Not Supporting.

Station			Use-	DBI	MBI	IBI
Code	Stream Name	Date	Support	Classif.	Classif.	Classif.
		,				
CRR200001	South Fork	5/03	PS	Good	Fair	Fair
CRR200001	South Fork	9/03	NS	Good	Fair	Good
CRR200002	South Fork	5/03	PS	Fair	Poor	Good
CRR200002	South Fork	9/03	NS	Good	Fair	Fair
CRR200003	Lower Branch NF	5/03	NS	Good	Poor	Poor
CRR200003	Lower Branch NF	9/03	NS	Good	Poor	Poor
CRR200004	Upper Branch NF	5/03	NS	Good	Poor	Poor
CRR200004	Upper Branch NF	9/03	NS	Fair	Poor	Fair
CRR200005	South Fork	5/03	NS	Good	Poor	Good
CRR200005	South Fork	9/03	NS	Good	Poor	Fair
CRR200006	North Fork	5/03	NS	Fair	Poor	Fair
CRR200006	North Fork	9/03	NS	Poor	Poor	Poor
CRR200007	North Fork	5/03	NS	Good	Poor	Fair
CRR200007	North Fork	9/03	NS	Fair/Poor	Poor	Poor
CRR200008	North Fork	5/03	NS	Poor	Poor	Fair
CRR200008	North Fork	9/03	NS	Good	Poor	Fair
CRR200009	Little River	5/03	NS	Fair	Poor	Poor
CRR200009	Little River	9/03	NS	Good	Poor	Fair
CRR200010	Sinking Fork	5/03	NS	Good	Poor	Good
CRR200010	Sinking Fork	9/03	NS	Good	Poor	Fair
CRR200011	Sinking Fork	5/03	NS	Fair	Fair	Good
CRR200011	Sinking Fork	9/03	NS	Fair	Poor	Fair
CRR200012	Little River	5/03	NS	Good	Poor	Fair
CRR200012	Little River	9/03	NS	Good	Poor	Fair
CRR200013	Little River	5/03	NS	Poor	Poor	Poor
CRR200013	Little River	9/03	NS	Good	Poor	Fair
CRR200014	Casey Creek	5/03	NS	Fair	Poor	Fair
CRR200014	Casey Creek	9/03	PS	Good	Poor	Fair
CRR200015	Skinner Creek	5/03	NS	Good	Poor	Fair
CRR200015	Skinner Creek	9/03	NS	Excellent	Poor	Fair
CRR200016	Sinking Fork	5/03	NS	Poor	Poor	Poor
CRR200016	Sinking Fork	9/03	NS	Good/Fair	Poor	Fair

Table 16. Comparison of number of taxa identified from the Little River basin: 1988 (KDOW 1996), CRR 2000 and CRR 2003 reports.

	Number of Taxa					
	1988	20	00	20	03	
	(Total)	(Jul)	(Sep)	(May)	(Sep)	
Algae Phyla					-	
Bacillariophyta (diatoms)	182	185	203	156	177	
Chlorophyta (green algae)	24	42	14	8	10	
Cyanophyta (blue-green algae)	11	22	21	12	10	
Rhodophyta (red algae)	2	0	2	2	1	
Euglenophyta (euglenoids)	3	3	0	0	0	
Chrysophyta (yellow-green algae)	2	2	0	0	0	
Cryptophyta (cryptomonads)	0	0_	1	0	0	
Total Algae Taxa	224	254	241	178	198	
Macroinvertebrates	177	162	173	144	116	
Fish	31	30	55	*35	38	

<sup>\*</sup> fish collected in July

Table 17. Comparison of classifications based on habitat assessments for three studies (KDOW 1988, CRR 2000 and CRR 2003) in the Little River Basin. The KDOW sites of 1996 were chosen from sites most proximate to the CRR sites for comparisons.

Station Codes	Hal	bitat Assessn	nent Classific	ations		
KDOW/CRR	*1988	**20	000	**2003		
		J	S	M	S	
14-4/200001	F	PS	PS	PS	NS	
14-3/200002	G	NS	NS	PS	NS	
13-4/200003	P/F	PS	PS	NS	NS	
13-3/200004	P/F	PS	PS	NS	NS	
14-2/200005	P	NS	NS	NS	NS	
13-1/200006	P	FS	FS	NS	NS	
14-1/200007	F	NS	NS	NS	NS	
13-2/200008	P/F	NS	NS	NS	NS	
12-2/200009		PS	PS	NS	NS	
10-12/200010	F	FS	FS	NS	NS	
10-9/200011		PS	PS	NS	NS	
12-1,10-6/200012	F	FS	FS	NS	NS	
10-4/200013	F	PS	PS	NS	NS	
10-13/200014	F	PS	FS	NS	PS	
10-14/200015	F	PS	FS	NS	NS	
10-3,10-8/200016	F	FS	FS	NS	NS	

<sup>\*</sup> Based on Biotic Assessment Index (BAI; see KDOW 1996).

<sup>\*\*</sup> Based on KDOW Habitat Evaluation Sheet Metrics.

J = June/July, M = May, S = September, (--) not determined.

FS = Fully Supporting, PS = Partially Supporting, NS = Not Supporting.

Supporting classifications based on habitat assessments (Table 17). Specific comparisons among sampling years follow below.

Habitat Assessements: In order to compare habitat classifications for the three studies, both KDOW and CRR station codes were identified as roughly proximate to one another as possible and classifications summarized in Table 17. Because the 1988 study was conducted differently from the 2000 and 2003 studies, only a superficial comparison could be made and caution must be taken in this regard when evaluating overall stream health. Further, the classifications of the 1988 study were based on a biotic assessment index (BAI) which was different from the 2000 and 2003 studies but roughly comparable. All sites in 1988 except for one were evaluated as Poor or Fair. Three sites during both seasons in 2000 were evaluated as Fully Supporting; all others were Partially Supporting or Not Supporting. No sites in 2003 were evaluated as Fully Supporting; all except one were Not Supporting. Thus, although metrics and terminology have changed, the Little River sites, based on habitat assessments, either remain in a degraded state or have regressed into a further degraded state since the first study in 1988.

Algae: In order to give a better comparison among the three sampling years and because the Excel spreadsheet program has changed since the 2000 sampling, the 2000 EDAS output was reentered and DBIs were recalculated (Table 18) with ratings (classifications) summarized in Table 19. The 1988 DBIs were scaled from 1-5 and therefore are not directly comparable, but the classifications resulting from the DBIs are comparable among years (Table 19). Upon examination of 2000 and 2003 data in Table 18, all DBIs from 2000 are significantly higher (60.7) than DBIs from 2003 (55.7) (t stat = -2.589; p = 0.015).

Table 18. Comparison of DBIs, MBIs and IBIs for two studies (CRR 2000 and CRR 2003) in the Little River Basin. J = June/July, M = May, S = September, O = October. (--) not calculated. EDAS metrics from 2000 were recalculated using the most recent Excel spreadsheets from KDOW. Indices have been rounded to the nearest 1.

Station Codes		D	BI			MB	I			IBI		
KDOW/CRR	20	00	2003	3	200	00	200	)3	20	00	200	13
	J	S	M	S	J	S	M	S	J	S/O	M	S
*CRR200001	57		60	62			55	44	37		51	55
CRR200002	60	62	50	63	51	41	41	51	48	42	58	52
*CRR200003	73	70	58	62	31	17	41	43	24	39	19	24
CRR200004	61	62	57	52	38	45	39	38	14	16	24	46
CRR200005	64	67	55	63	40	28	41	38	1	6	55	50
CRR200006	51	58	53	43	41	44	37	37	21	23	46	32
CRR200007	62	60	57	49	38	35	41	43	17	31	35	34
CRR200008	57	62	36	59	35	42	36	37	2	6	37	39
CRR200009	47	43	54	59	43	55	43	39			34	40
CRR200010	56	65	60	65	39	47	43	43	23	55	59	48
CRR200011	56	56	53	50	35	46	49	41	39	31	63	61
CRR200012	57	68	58	55	49	42	40	39			48	35
CRR200013	52	55	43	63	38	51	43	40	23		30	44
CRR200014	67	61	52	61	41	49	39	38	53	17	36	49
*CRR200015	70	75	59	68	29	31	42	41	46	43	60	52
CRR200016	65	54	47	55	40	38	38	37	0	2	18	36

<sup>\*</sup> Headwater streams based on catchment areas <10 sq. mi.

Table 19. Comparison of classifications based on Diatom Biotic Indices from three studies (KDOW 1988, CRR 2000 and CRR 2003) in the Little River Basin. The 1988 KDOW sites were selected from sites most proximate to the CRR sites for comparisons.

Station Codes KDOW/CRR	*1988	DBI Cla **2	ssifications 000	20	003
		J	<u>S</u>	M	S
14-4/200001	P/F	G		G	G
14-3/200002	F/G	G	G	F	G
13-4/200003	P/F	E	Е	G	G
13-3/200004	F	G	G	G	F
14-2/200005	G	G	E	G	G
13-1/200006	P	F	G	F	P
14-1/200007	F	G	G	G	P
13-2/200008	P	G	G	P	G
12-2/200009	No. ton	P	P	F	G
10-12/200010	F	G	G	G	G
10-9/200011		G	G	F	F
12-1,10-6/200012	P	G	E	G	G
10-4/200013	P/F	F	G	P	G
10-13/200014	F	E	G	F	G
10-14/200015	P/F	E	E	G	Е
10-3,10-8/200016	F	G	F/G	P	F/G

<sup>\*</sup> Based on DBI Classification Criteria of 1-5 for the Little River (see KDOW 1996).

<sup>\*\*</sup> Based on 2000 EDAS metrics and recalculated DBIs using most recent Excel spreadsheet program (John Brumley, KDOW, 2005).

J = June/July, M = May, S = September, (--) not determined.

E = Excellent, G = Good, F = Fair, P = Poor.

The classifications based on DBIs among sampling years (Table 19) are mixed and range from mostly Poor to Fair in 1988 followed by a mixed but general improvement to several Goods, with only one Excellent in 2003. The Poor sites in 2000 and 2003 were characterized by %NNS (% *Navicula+Nitzschia+Surirella* complex). These diatoms are highly silt tolerant.

**Macroinvertebrates:** The 1988 MBIs in general indicated a Good to Fair classification for Little River sites (Table 20). MBIs in 2000 showed mixed seasonal differences, some sites improved, but most became worse from July to September. However, in 2003, MBIs indicated Poor classifications almost entirely basinwide. No sites in any of the three studies resulted in Excellent classifications for macroinvertebrates. MBIs from 2000 are not significantly different from 2003 (Table 18; means for 2000 and 2003 = 41.1 and 39.9, respectively; t stat = 0.545; p = 0.59).

The Little River remains a severely degraded habitat for macroinvertebrates.

Fish: Historical studies (1977-1993) of fish found in the Little River which are intolerant of turbidity, siltation and low dissolved oxygen included smallmouth bass, longear sunfish, northern hog sucker, spotted sucker, and Johnny darter (Rister 1994). In Casey Creek, intolerant fish found in 1987 included longear sunfish, northern hog sucker, greenside darter, orangethroat darter, rockbass, rainbow trout (stocked) and banded sculpin. At Sinking Fork in 1993, intolerant fish found included all of the above plus blackside darter and slabrock darter. Although intolerant species were found, their low catch numbers also indicated impaired fish habitat. The number of intolerant species caught in 2000 and 2003, as indicated by such metrics as "darter+madtom+sculpin" and "intolerant richness" were all very low at all sites during both years (Table 14a, 14b).

Table 20. Comparison of classifications based on Macroinvertebrate Biotic Indices from three studies (KDOW 1988, CRR 2000 and CRR 2003) in the Little River Basin. The KDOW sites of 1996 were chosen from sites most proximate to the CRR sites for comparisons.

Station Codes KDOW/CRR	*1988	MBI Cla	assifications	2	.003
· · · · · · · · · · · · · · · · · · ·		J	S	M	S
14-4/200001	F/G	P	***	F	F
14-3/200002	G	F	F	P	F
13-4/200003		F	VP	P	P
13-3/200004		P	F	P	P
14-2/200005		P	VP	P	P
13-1/200006	P	F	G	P	P
14-1/200007	F	F	P	P	P
13-2/200008	P	P	F	P	P
12-2/200009		F	G	P	P
10-12/200010	G	F	G	P	P
10-9/200011		VP	G	F	P
12-1,10-6/200012	F	F	F	P	P
10-4/200013	F	F	G	P	P
10-13/200014	F	F	F	P	P
10-14/200015	F	F	P	P	P
10-3,10-8/200016	F	F	P	P	P

<sup>\*</sup> Classification based on KDOW 1-5 rating criteria (see KDOW 1996).

<sup>\*\*</sup> Based on 2000 EDAS metrics and recalculated MBIs using most recent (2005) Excel spreadsheet program to recalculate MBIs (Randall Payne, KDOW).

J = June/July, M = May, S = September, (--) not determined.

E = Excellent, G = Good, F = Fair, P = Poor, VP = Very Poor.

Table 21. Comparison of classifications based on Fish Indices of Biotic Integrity (IBIs) from three studies (KDOW 1988, CRR 2000 and CRR 2003) in the Little River Basin. The KDOW sites of 1996 were chosen from sites most proximate to the CRR sites for comparisons.

Station Codes		IBI Class	ifications		
KDOW/CRR	*1988	**20	000	20	03
		J	S	M	S
14-4/200001		F		F	G
14-3/200002	F	F/G	F	G	F
13-4/200003	P	F	F	P	P
13-3/200004	P	VP	VP	P	F
14-2/200005	P	VP	P/VP	G	F
13-1/200006	P	P/F	F	F	P
14-1/200007	P	P	G	F	P
13-2/200008	P/F	VP	P	F	F
12-2/200009				P	F
10-12/200010	P	P/F	G	G	$\mathbf{F}$
10-9/200011		P/F	P/F	G	F
12-1,10-6/200012	P/F	<b></b>		F	F
10-4/200013		F/G		P	F
10-13/200014	F	F	VP	F	F
10-14/200015	P	G	F	G	F
10-3,10-8/200016	P	VP	VP	P	F

<sup>\*</sup> Classification based on KDOW criteria ratings of 1-5 for the Little River (see KDOW 1996).

<sup>\*\*</sup> Based on 2000 EDAS metrics and recalculated IBIs using the most recent Excel spreadsheet program (Mike Compton, KDOW, 2005).

J = June/July, M = May, S = September, (--) not determined.

E = Excellent, G = Good, F = Fair, P = Poor, VP = Very Poor.

The 1988 IBIs indicated Poor to Fair habitat for fish (Table 21). By 2000, the IBI classifications degenerated to Poor and Very Poor for most sites. This can be attributed to low numbers of individuals caught and low taxa richness at several sites and possibly sampling method (electroshocking in 2000, electroshocking and seining in 2003). In 2003, the IBI classifications appeared to have improved slightly with some sites rating as Good during May but dropping again only to Fairs by September. All IBIs from 2000 were significantly lower than those in 2003 (Table 18; means for 2000 and 2003 = 25.3 and 42.5, respectively; t stat = 3.822; p = 0.001).

The Little River remains a highly impaired habitat for fish.

#### **Conclusions**

Upon examination of the results of three studies conducted on the Little River from 1988-2003, the overall conclusion is that the Little River remains a severely degraded habitat for aquatic biota. The total number of algae taxa found in the Little River has decreased by about 12% (Table 16) since 1988. The total number of macroinvertebrate taxa found has decreased as well by about 25%. However, total number of fish taxa has remained roughly the same in the Little River since 1988.

Of the sites that are comparable among the 1988, 2000 and 2003 studies (Table 17), habitat degradation in the Little River has continued. In 1988, of the habitat assessments of all comparable sites among three studies (14 sites), 5 or 36% rated Poor. If a "Poor" classification were the equivalent to the more recent "Not Supporting" classification, then in 2000, considering both sampling months, habitat assessments resulted in 8 of 32 sites or 25% as Not Supporting (=Poor). Continuing to 2003, 29 of 32 sites were Not Supporting (=Poor)

during both sampling months. Only CRR200001 and CRR200002 were determined as Partially Supporting in 2003 and only in May. CRR200014 was Partially Supporting, but only in September.

The Diatom Bioassessment Indices were calculated differently among the three studies from 1988-2003. For example, the 1988 DBIs were scaled from 1-5 while 2000 and 2003 DBIs were scaled from 1-100. Thus, only the 2000 and 2003 were numerically similar and only after 2000 data had been recalculated using the most recent procedures and spreadsheets provided by KDOW (per KDOW personnel, 2005). Once the recalculations were made based on identical metrics, DBIs became more comparable between years. Total number of diatom taxa, diversity, and the pollution tolerance index were held in common from 2000 to 2003; however, other metrics such as % *Navicula+Nitzschia+Surirella* (%NNS) rather than % Sensitive Species (%SS), and the *Cymbella* group richness (Cym GR) metric were used as well. "Total number of non-diatom divisions" and "total number of non-diatom species" were not used in the DBI (re)calculations for this comparison. Further, the version of EDAS used in these studies did not give a metric for "*Fragilaria* total richness" which therefore was not included in the DBI calculations.

Our evaluation of the DBIs among the three studies from 1988 through 2003 concluded that the most recent methods for calculating the DBI appear to be the most sensitive for assessing conditions in the Little River by weighting the %NNS and *Cymbella* GR more heavily than non-diatom taxa and %SS. DBIs from 1988 resulted in 7 of 14 sites (50%) rating as Poor; in 2000, only 2 Poors occurred in 32 sites, yet 7 of 32 sites (22%) were rated as Excellent; in 2003, only one Excellent site occurred and 5 of 32 were rated Poor (Table 19). Although methods for calculated DBIs have improved recently, comparing DBIs

from year to year among many methods continues to confound assessments of habitat over time. Although DBIs indicated that many of the Little River sites were classified as Good in both 2000 and 2003, studies of the relationships between DBIs and habitat assessment need to continue, especially in systems where this relationship is very weak or not well-defined. The Little River is a highly disturbed system having had the riparian canopy opened for agriculture along much of its course and having increased non-point source nutrient inputs which may account for several Good and Excellent classifications from DBIs. For example, the 1988 study revealed not only high nitrogen inputs during April and August, but also very high phosphorus loads (e.g., up to 0.63 mg L<sup>-1</sup> orthophosphate and 1.2 mg L<sup>-1</sup> total phosphorus in the North Fork and up to 1.58 mg L<sup>-1</sup> total phosphorus in the South Fork). [Note: The origin of phosphorus may be from the underlying karstic parent geology at some sites.] However, high nutrient loading at times and a higher amount of sunlight may stimulate diatom growth and diversity in certain river sections, thus confounding the DBI classifications for those sites.

Among comparable sites from 1988 to 2000 and 2003, the Macroinvertebrate Bioassessment Indices (MBIs) continue to show the Little River as highly impaired. Two sites (CRR200001 and CRR200002) were rated Fair in 2003, while mostly Poor classifications prevailed in 2003 (Table 20). Some Very Poor sites from 2000 (CRR200003, CRR200005 and CRR200011) improved to Poor in 2003. No Excellent classifications were found at any time on the Little River based on MBIs.

Fish IBIs among the three studies indicated a slight improvement in habitat classification from 1988 to 2003 (Table 21). From 1988 to 2000 there was a serious degradation of habitat for fish resulting in mostly Poor classifications in 1988 to mostly Poor

and Very Poor in 2000 (CRR200004), mostly attributed to low catch rates. This site also is deeply channelized, runs parallel to a highway with a automobile garage upstream, and contains very silty/clayey bottom, and very little habitat for aquatic biota. In 2003, fish habitat improved to several Fairs and Goods among comparable sites most likely due to higher catch rates (e.g., in 2003 both seining and electroshocking methods were used whereas only electroshocking was used in 2000). However, no Excellent classifications based on IBIs occurred during any of the three studies. By 2003, 80% of the sites were classified as either Poor or Fair.

Measures of Success. Based on habitat assessments and three biotic indices, we conclude that the Little River continues to be highly impaired by non-point source pollution and non-supportive of aquatic biota, with most of the impairment coming from agricultural sources of siltation, high turbidity, high nutrient loading and potentially low dissolved oxygen. Although DBI calculation methods continue to improve and to reflect the status of the diatom community in the Little River, habitat assessments, MBIs and IBIs are the best and most consistent indicators of the health of the biotic community.

One manuscript has been accepted for publication by the *Journal of the Kentucky Academy of Sciences*. [Hendricks, S.P., M.R. Luttenton, and S.W. Hunt. Benthic diatom species list and environmental conditions in the Little River basin, western Kentucky, USA.] A second manuscript is in preparation and will be submitted to the same journal. [Hendricks, S.P., M.R. Luttenton, D.S. White, and T. Timmons. Assessing biotic integrity of the Little River using diatom, macroinvertebrate, and fish biotic indices in conjunction with habitat evaluations.]

We suggest a follow-up survey be carried out in 2010 at the same sites on the Little River in order to compare subsequent habitat assessments, and multiple biotic inidices with present and past studies. One drawback of this study was that all habitat assessments were carried out using low gradient criteria. We have since decided that sites 9, 12, 14, and 16 are high gradient and, therefore, we suggest that high gradient habitats be assessed with appropriate high gradient criteria.

Habitat assessment forms used in this study are included in Appendix C. All data entered into EDAS are available to KDOW and other interested parties.

**Project Deliverables.** A brief account of each MSU milestone and its status is presented below and in Appendix A.

Milestone	End Date	<u>Status</u>
1. Submit all draft materials to the Cabinet for review and approval.	9/05	Draft Final Report submitted in October 2005 by MSU.
2. Submit advanced written notice on all workshops, demonstrations, and/or field days to the Cabinet.	4/03	All field training/demonstrations were completed in 4/03.
3. Provide assessment forms for reporting biological and habitat data (KDOW).	4/03	KDOW provided MSU with all biological and field assessment forms.
4. Conduct Spring sampling (MSU)	6/03	Completed by 6/03.
5. Conduct taxonomy and data analysis on Spring samples (MSU)	10/04	Completed 10/04.
6. Conduct Summer sampling (MSU).	9/03	Completed 9/03.
7. Conduct taxonomy and data analysis on Summer samples (MSU).	10/04	Completed 10/04.

8. Enter data into EDAS (MSU).	3/05	All data entered into EDAS by 3/05.
9. Make the EDAS Database available to agencies and Universities interested in this watershed (KDOW).	5/06	All data are available to interested parties.
10. Submit completed assessment forms to KDOW (MSU).	5/06	All Habitat assessment forms have been submitted with this report (Appendix).
11. Use the assessment forms to make use-support determinations for inclusion in the Kentucky 2004 305 (b) Report to Congress on Water Quality (KDOW)	5/06	MSU includes support determinations in this report.
12. Use the assessment forms to determine if further 303(d) listings are appropriate (KDOW).	5/06	MSU has provided all appropriate information to KDOW for this milestone.
13. Upon request of the KDOW, Submit Annual Report and/or parti- Cipate in the Cabinet sponsored Biennial NPS Conference (MSU).	9/05	MSU submitted a draft final report in 9/05.
14. Submit three copies of the final Report and submit three copies of all products produced by the project (MSU).	5/06	MSU submitted a Final Report in 5/06.

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# APPENDIX A.

# Milestones; Financial & Administrative Close-out

1. Project Milestones and Deliverables. A brief account of each MSU milestone and its status is presented below.

Milestone	End Date	<u>Status</u>
1. Submit all draft materials to the Cabinet for review and approval.	9/05	Draft Final Report submitted in October 2005 by MSU.
2. Submit advanced written notice on all workshops, demonstrations, and/or field days to the Cabinet.	4/03	All field training/demonstrations were completed in 4/03.
3. Provide assessment forms for reporting biological and habitat data (KDOW).	4/03	KDOW provided MSU with all biological and field assessment forms.
4. Conduct Spring sampling (MSU)	6/03	Completed by 6/03.
5. Conduct taxonomy and data analysis on Spring samples (MSU)	10/04	Completed 10/04.
6. Conduct Summer sampling (MSU).	9/03	Completed 9/03.
7. Conduct taxonomy and data analysis on Summer samples (MSU).	10/04	Completed 10/04.
8. Enter data into EDAS (MSU).	3/05	All data entered into EDAS by 3/05.
9. Make the EDAS Database available to agencies and Universities interested in this watershed (KDOW).	5/06	All data are available to interested parties.
10. Submit completed assessment forms to KDOW (MSU).	5/06	All Habitat assessment forms have been submitted with this report (Appendix).
11. Use the assessment forms to	5/06	MSU includes support determinations in

make use-support determinations for inclusion in the Kentucky 2004 305 (b) Report to Congress on Water Quality (KDOW)		this report.
12. Use the assessment forms to determine if further 303(d) listings are appropriate (KDOW).	5/06	MSU has provided all appropriate information to KDOW for this milestone.
13. Upon request of the KDOW, Submit Annual Report and/or parti- Cipate in the Cabinet sponsored Biennial NPS Conference (MSU).	9/05	MSU submitted a draft final report in 9/05.
14. Submit three copies of the final Report and submit three copies of all products produced by the project (MSU).	5/06	MSU submitted a Final Report in 5/06.

# 2. SUMMARIZATION OF ALL BUDGET EXPENDITURES, including matching funds. Recommendation how excess projects funds should be reallocated.

The original budget for the projects was \$120,000 of which \$72,000 was to come from Section 319(h) funds and \$48,000 from non-federal match. The actual non-federal match totaled \$48,000 with a \$16,435.64 over match that was comprised of release time for senior technical staff and data entry support. Grant expenses from Section 319(h) funds totaled \$72,000 and included \$5,419.05 in expendable supply costs and \$715.86 in travel for sample collection. Total expenditures including Section 319(h) and non-federal match were \$120,000 with a \$16,435.64 over match.

#### ORIGINAL BUDGET

<b>Budget Categories</b>	319 Grant	Murray State University Match	ch Total	
Personnel	48,530.00	34,259.00	82,789.00	
Supplies	3,452.00	0	3,452.00	
Equipment	0	0	0	
Travel	800.00	0	800.00	
Contractual	0	0	0	
Operating Costs Other	19,218.00	13,741.00	32,959.00	
Other				
TOTAL:	72,000.00	48,000.00	120,000.00	

# FINAL BUDGET\*

<b>Budget Categories</b>	319 Grant*	Murray State University Match	Total	
Personnel	46,991.16	47,327.76	94,318.92	
Supplies	5,419.05	0	5,419.05	
Equipment	0	0	0	
Travel	715.86	0	715.86	
Contractual	0	0	0	
Operating Costs	18,873.93	17,107.88	35,981.81	
Other (excess expenditur	res)	(16,435.64)	(16,435.64)	
TOTAL:	72,000.00	48,000.00	120,000.00	

<sup>\*</sup>The KY Division of Water approved changes in budget categories from the original 319 Grant.

There were no excess project funds to be reallocated.

<sup>2.</sup> Equipment: No equipment was purchased with project funds, and there was no equipment purchased with a fair market value exceeding \$5,000.

#### APPENDIX B

# Quality Assurance Project Plan for Biological Baseline Conditions in the Little River Watershed, 2002

Project officer: Dr. David S. White, 561 Emma Drive, Murray, KY 42071.

Phone: (270) 474-2272

Field sampling supervisor: Ms. Kelly W. Bush, 561 Emma Drive, Murray, KY 42071.

Phone: (270) 474-2272

Laboratory supervisor: Dr. Pinar Balci, 561 Emma Drive, Murray, KY 42071.

Phone: (270) 474-2272

Laboratory used: Hancock Biological Station, 561 Emma Drive, Murray, KY 42071

Waterbody name: Little River, Casey Creek (tributary), Sinking Fork Creek (tributary)

Stream locations: Christian and Trigg counties, Lower Cumberland River Basin

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A3: Distribution List	
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3. Kelly Bush Hancock Biological Station Murray State University (270) 474-2272 (270) 474-0120 (fax)	
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# A4: Project/Task organization

Name:	Project Title/ Responsibility	Telephone Number

Dr. David White Project QA Manager		(270) 474-2272
Ms. Kelly Bush	Field Sampling Supervisor	(270) 474-2272
Dr. Pinar Balci	Laboratory Supervisor	(270) 474-2272

#### A5: Problem Definition/Background

The Little River and its tributaries are located in Christian and Trigg counties in western Kentucky. Its watershed is comprised of agricultural land, several small urban areas, and one significant urban area, the city of Hopkinsville (population > 30,000). The Little River receives point source pollution from a wastewater treatment plant in eastern Hopkinsville, and nonpoint source pollution from agricultural and urban runoff.

The purpose of this project is to assess and identify streams in Western Kentucky that are impacted by nonpoint source pollution. Biological baseline conditions in the Little River have been documented in the past by KDOW (1996) and the Center for Reservoir Research (2001).

### A6: Project/Task description

The project will involve collection and identification of fish, algae, and macroinvertebrates from 16 sites in summer 2002, during high base flow, and again in fall 2002, during low base flow. Habitat assessments and physicochemical analyses will be conducted to supplement biological data. The 16 sites to be sampled include 9 sites along the Little River, four sites on Casey Creek, and three on Sinking Fork Creek. Casey Creek and Sinking Fork Creek are tributaries of Little River.

The biological data obtained will be used to calculate biological metrics, which will be supplemented by the habitat and physicochemical data. These metrics will be compared to a previous KDOW survey of the same sites. A final report will be submitted to KDOW within two years.

# A7: Quality Objectives and Criteria

All data will be gathered according to protocols outlined in the KDOW "Methods for Assessing Biological Integrity of Surface Water" (1993) manual and the "Quality Assurance Guidelines" (1986) manual. These internal Division of Water guidelines are a part of the EPA approved Department of Environmental Protection QA/QC Plan.

All of the macroinvertebrate metric scores will be based on a 95<sup>th</sup> percentile calculated for each metric by compiling reference and study site data (Greg Pond, Ecological Support, KDOW). The actual values of each metric will be divided by the calculated 95<sup>th</sup> percentile and multiplied by 100, ranking all streams together, including the reference data, so that comparisons can be made among similar streams (USEPA, 1999) and so that outliers will not adversely effect study site scores.

When calculating fish metrics, different metrics will be used for different ecoregions, as determined by KDOW's analyses of reference data. In order to compare our study data with the reference data, the 95<sup>th</sup> percentile for all reference data within each ecoregion will be calculated. This method will normalize the data so that sites with particularly high values are not weighted as heavily.

Four diatom metrics will be scored and averaged to give the Diatom Biotic Index (DBI) according to "Algal and habitat Assessments For Reference Reach Stations" (KDOW, 1995, p.120).

Biological and habitat data will be entered into the state's Ecological Database System (EDAS) and will be returned to the state for distribution to all participating organizations. Original specimens, slides, datasheets, and bench sheets will be archived at the Hancock Biological Station.

# A8: Special Training/Certification

All field personnel will be trained in fish, algal, and macroinvertebrate collection techniques according to KDOW sampling protocols. A training session for these sampling protocols was given by KDOW at the Hancock Biological Station in 2000. Personnel collecting fish have completed a course in Ichthyology and have experience with fish electroshocking and seining. Personnel collecting macroinvertebrates are lead by a Master's level stream ecologist with a background in entomolgy. Personnel collecting algae will be trained by a Ph.D. level phycologist and a Master's level stream ecologist who has attended KDOW training. Macroinvertebrates will be identified by a doctorate-level entomologist. Fish will be identified in the laboratory by a Ph.D. level fisheries biologist.

#### A9: Documents and Records

All data gathered in the field is written in a waterproof field book and entered into spreadsheets upon arrival to Hancock Biological Station. These data are saved on the computer's hard drive and on floppy disk. Information recorded on field data sheets will include: Site name, site description, names of field technicians, date, time, results of physicochemical measurements, numbers of containers of collected specimens, and notes on stream and riparian conditions. Habitat data sheets are kept in a waterproof container and are

stored at the Hancock Biological Station. Digital images of each site are downloaded and saved on computer hard drive and on compact disk (CD).

Upon completion of the biological metrics, biological and habitat data will be entered into the Kentucky's Ecological Database System (EDAS).

#### **B1: Sampling Process Design**

To reduce variability among stations resulting from sampling error, a maximum of four full-coverage (algae + macroinvertebrates + fish) stations are collected per day. The 16 sites to be sampled include 9 sites along the Little River, four sites on Casey Creek, and three on Sinking Fork Creek. Casey Creek and Sinking Fork Creek are tributaries of Little River. All sites are to be sampled once in summer during high base flow and again in fall during low base flow. Locations of the sites to be sampled are as follows:

Site Code	Stream Name	Latitude	Longitude
CRR200001	South Fork LR	36.88174	-87.34167
CRR200002	South Fork LR	36.84893	-87.37433
CRR200003	Lower Branch LR	36.89947	-87.39161
CRR200004	North Fork LR	36.88908	-87.45583
CRR200005	North Fork LR	36.85292	-87.46967
CRR200006	North Fork LR	36.841000	-87.53022
CRR200007	North Fork LR	36.80178	-87.51382
CRR200008	North Fork LR	36.86183	-87.51936
CRR200009	Little River	36.78336	-87.54604
CRR2000010	Sinking Fork	36.91603	-87.57668
CRR2000011	Sinking Fork	36.8812	-87.60839
CRR2000012	Little River	36.76038	-87.5501
CRR2000013	Little River	36.77781	-87.7223
CRR2000014	Casey Creek	36.75579	-87.72483

CRR2000015	Casey Creek	36.74586	-87.74755	
CRR2000016	Sinking fork	36.84078	-87.74045	

All site-specific data are recorded on field data sheets at the time of collections. Data include station name and number, date and time (start to finish) of sampling, type of collections made, location of station, name of person recording data, and names of all people sampling at that station. Copies of the data sheets to be used have been provided to MSU by KDOW.

Samples are labeled with station number and location, date and time of collection, name of collector, and type of preservative used.

All available habitat types are sampled during biological collections. Samples are representative of the entire community; therefore, effort is made to recognize and collect all possible habitats (e.g., pools, riffles, banks).

Sample equipment such as nets, seines, grabs, buckets, and artificial substrates are cleaned thoroughly and dried after each use.

All staff involved in collections receive specific training in collection techniques and in the use of computers for data analysis.

Biological samples are preserved at the time of collection using the following preservatives:

- 1. Algae (identification and counting) in 2% buffered glutaraldehyde.
- 2. Fish in 10% formalin buffered with CaCO<sub>3</sub>.
- 3. Macroinvertebrates in 70% ethanol.

All biological samples are recorded in the proper logbooks upon delivery to the Biological Station. The biological data obtained will be used to calculate biological metrics, which will be supplemented by the habitat and physicochemical data. These metrics will be compared to a previous KDOW survey of the same sites.

# **B2: Sampling Methods**

#### Algae

Algae sampling and analyses follow the Kentucky Division of Water's (KDOW) "Methods for Assessing Biological Integrity of Surface Waters in Kentucky" (2002). Qualitative samples are collected from all available substrates by selective hand picking/scraping. Microhabitats are sampled in roughly the proportion that they occur at each site. All sites are sampled only during low flow periods. In the field, the algal community is qualitatively ranked (1 = lowest, 5 = highest) and recorded based on the following criteria: 1, no algae visible or if present they are in the form of thick blue-green or green algal mats; 3, algae visible on substrates and may

include some *Cladophora* or small floating mats; and 5, algae on substrates appear diverse but not floating mats present.

Wet mount slides (a minimum of three) for non-diatom taxa are examined at 200x and 400x. Taxa present are recorded in a logbook along with estimated relative abundance (abundant, common, rare). In determining abundance, colonial, connubial, or filamentous forms are recorded as units rather than counting the individual cells present. Digital photographs of each taxon are taken and used to create a species archive. All identifications are verified by at least two people knowledgeable in algal identification.

Diatoms are examined using the hydrogen peroxide/potassium dichromate oxidation method for clearing. Cleared diatoms are mounted in Nephrax. A minimum of 300 to 500 valves is identified and the numbers of each taxon recorded on bench data sheets. Digital photographs of each taxon are taken and used to create a species archive. All identifications are verified by at least two people knowledgeable in algal identification.

#### **Fish**

Fish sampling and analyses follow the Kentucky Division of Water's (KDOW) "Methods for Assessing Biological Integrity of Surface Waters in Kentucky" (2002). All fish are collected using backpack electro-fishing techniques and/or seines depending on habitat type or bottom complexity. All field personnel are trained how to safely use electro-fishing equipment prior to use in the field.

All available habitats at each stream site are sampled. Sites are sampled for a minimum of 60 minutes active seining/electro-fishing effort.

Fish are identified to the lowest possible taxonomic unit and verified by at least two people knowledgeable in fish identification. All data are entered into field notebooks. Voucher specimens are saved and preserved in 10% formalin buffered with CaCO<sub>3</sub> and identifications are verified.

#### Macroinvertebrates

Macroinvertebrate sampling and analyses follow the Kentucky Division of Water's (KDOW) "Methods for Assessing Biological Integrity of Surface Waters in Kentucky" (2002). Collections from all methods listed below are composited into one or two wash buckets with No. 30 mesh screen bottoms. Wash buckets are set in shallow water during sampling and picking to keep organisms alive.

1. The 1-meter<sup>2</sup> Kicknet Sample: The kicknet is placed about mid-riffle, the lead-line is secured against the substrate, and the net is tilted back so that the maximum amount of surface area is in the water without the water flowing over the top of the net. About a square meter of substrate is disturbed directly in front of the net. Any large rocks are hand washed into a wash-bucket.

- 2. Sweep Sample: This method involves sampling a variety of habitats using a D-frame net. Each habitat is sampled in three replicates whenever possible.
  - i. Undercut Banks: The principal habitat in undercut banks is submerged roots. Note if undercut banks are present in both riffle and pool areas, each is sampled separately.
  - ii. Marginal Emergent Vegetation Sample (exclusive of *Justicia* beds): A triangular or D-frame kicknet is placed in the vegetation and about 1 meter is swept. Any sticks, leaves, and vegetation are thoroughly washed before discarding.
  - iii. Bedrock or Slabrock Sample: The edge of the D-frame or triangular kicknet is placed flush on the substrate and about 1/3 of a square meter of area in front of the kicknet is sampled.
  - iv. Justicia Beds Sample: Along the edge of the *Justicia* bed, the D-frame or triangular kicknet is worked over about one meter section in a jabbing motion and any *Justicia* stems are thoroughly washed, then discarded.
  - v. Leaf Pack Sample: Small, aged leaf and stick packs from a variety of locations, i.e. riffles, runs and pools, are collected and placed in a wash-bucket and thoroughly rinsed.
- 3. Silt, Sand, and Fine Gravel Sample: This type of material is sampled using two methods.
  - i. Sieving: A number 10 sieve is used to sort out larger invertebrates from silt, sand, and gravel. The sieve is scooped through each of the substrate types, penetrating the substrate at least five cm. Fine material is rinsed away from the sample. Each substrate type (silt, sand, and gravel) is sampled three times.
  - ii. Netting: A fine-mesh Surber Sampler or a fine-mesh bag (300 um), is used to collect an area of about 1/3 square meter in sand and silt depositional areas. All materials are removed from the sampler and placed in a pan for sorting.
- 4. Aufwuchs Sample: This habitat is collected by washing rocks, sticks, leaves, filamentous algae, and moss in a medium to large-sized bucket 1/2 to 2/3 full of water. After sample material is washed and discarded, the elutriate in the bucket is swirled and poured through a Nitex sampler. The sampler is placed in 95% alcohol and let stand from 5 to 15 minutes before sorting.

- 5. Rock Picking Sample: 30 rocks are selected from the site. Ten rocks each are taken from the riffles, runs, and pools. The sizes of the rocks range from that of a softball to a small dinner plate (10-30 cm). Rocks are placed in a sorting pan, carefully picked, removing all invertebrates and cases, which are placed in a collection jar. Rocks are replaced into the streams.
- 6. Wood Sample: About 20 linear feet of submerged wood ranging in diameter from 5 to 8 cm are selected. Wood is placed into the wash-bucket and rinsed of all surface material. Wood is inspected for burrowing invertebrates. Large diameter logs are hand picked. Well-seasoned wood (log, limb, etc) is exposed to air for 15-20 minutes, because many burrowing types will crawl to the surface.
- 7. Sorting: After the collections have been made, the samples are sorted in the field. All collected material is sorted in a white pan. Sorting is accomplished with the following procedures:
  - i. Place a small amount of water in the pan (no more than a quarter inch.)
  - ii. From the wash buckets, remove about a tablespoon of material and place in the pan.
  - iii. Swirl the material to distribute it evenly throughout the pan.
  - iv. Remove invertebrates from the pan with forceps and place into a collection jar, filled with 95% alcohol.
- 8. Preservation and labeling: Samples are sorted into collection jars containing 95% ethyl alcohol in the field. Samples are transferred to 70% ethyl alcohol solution in the laboratory. Before leaving the site, all invertebrates are placed in the sample jar(s) and all jars are completely filled with 95% alcohol. Completely filling jars reduces damaging movement of the enclosed invertebrates.
- 9. In the field, a label is placed in each collection jar. The label includes the site number, stream name, location, and date sampled. When changing the sample over in the laboratory a permanent label is placed in the collection jar. This label includes the site number, stream name, state, county, locality, date, mile-point, latitude, longitude, and collectors' names.
- 10. Identification: All macroinvertebrates are identified to the lowest possible taxonomic level. In most cases, this is species level. When listing the organism on the Macroinvertebrate Laboratory Data Sheet (MLDS) the family name also is included so that the data can be entered easily into the

biological database. A MLDS is completed for each site. After the data from the MLDS have been entered into EDAS, the MLDS is filed under the appropriate segment in the Intensive Survey files.

11. One goal of the Intensive Survey program is to establish a voucher specimen of every macroinvertebrate taxon found in Kentucky. Vouchers will be used to verify identifications. Vouchers will be sent to acknowledged experts for verification. The vouchers will be stored in the Macroinvertebrate Laboratory and organized by order. Voucher specimens kept in 70% ethyl alcohol are placed in tightly capped vials. Chironomids, oligochaetes, and other slide-mounted species are kept in slide cabinets. All specimens contain a label that includes order, family, genus, and species; site number; stream name, and date collected.

#### **B3: Sample Handling and Custody**

Macroinvertebrate preservation and labeling: Samples are sorted into collection jars containing 95% ethyl alcohol in the field. Samples are transferred to 70% ethyl alcohol solution in the laboratory. Before leaving the site, all invertebrates are placed in the sample jar(s) and all jars are completely filled with 95% alcohol. Completely filling jars reduces damaging movement of the enclosed invertebrates.

In the field, a label is placed in each collection jar. The label includes site number, stream name, location, and date sampled. When changing the sample over in the laboratory a permanent label is placed in the collection jar. This label includes the site number, stream name, state, county, locality, date, mile-point, latitude, longitude, and collectors' names.

Fish are identified to the lowest possible taxonomic unit and verified by at least two people knowledgeable in fish identification. All data are entered into field notebooks. Voucher specimens are saved and preserved in 10% formalin buffered with CaCO<sub>3</sub> and identifications are verified.

Wet mount slides (a minimum of three) for non-diatom taxa are examined at 200x and 400x. Taxa present are recorded in a logbook along with estimated relative abundance (abundant, common, rare). In determining abundance, colonial, connubial, or filamentous forms are recorded as units rather than counting the individual cells present. Digital photographs of each taxon are taken and used to create a species archive. All identifications are verified by at least two people knowledgeable in algal identification.

Diatoms are examined using the hydrogen peroxide/potassium dichromate oxidation method for clearing. Cleared diatoms are mounted in Nephrax. A minimum of 300 to 500 valves is identified and the numbers of each taxon recorded on bench data sheets. Digital photographs of each taxon are taken and used to create a species archive. All identifications are verified by at least two people knowledgeable in algal identification.

#### **B4: Analytical Methods**

A YSI multiparameter environmental monitoring system will be used to measure dissolved oxygen, temperature, turbidity, oxidation-reduction potential, pH, and conductivity. This instrument is calibrated each day sampling is to occur. A digital flow meter is used to measure discharge. A pH meter and digital titrator will be used in the laboratory to calculate alkalinity. The pH meter will be calibrated for each use.

#### **B5: Quality Control**

All algal identifications are verified by at least two people knowledgeable in algal identification. Fish are identified to the lowest possible taxonomic unit and verified by at least two people knowledgeable in fish identification. Macroinvertebrates are identified to the lowest possible taxonomic unit and verified by at least two people knowledgeable in macroinvertebrate identification.

#### B6: Instrument/Equipment Testing, Inspection, and Maintenance

All field monitoring equipment will be calibrated in accordance with the manufacturer's user's manuals.

### **B7: Instrument/Equipment Calibration and Frequency**

The YSI and pH meter will be calibrated on each sample date.

#### **B8: Inspection/Acceptance of Supplies and Consumables**

Supplies and consumables will be provided and inspected by Hancock Biological Station and the Center for Reservoir Research.

#### **B9: Non-direct Measurements**

Detailed topographic maps (1:150,000) of the sampling area are used to locate sampling sites.

#### **B10: Data Management**

At the end of each day, the Field Sampling Supervisor will check all field data sheets for completeness and accuracy. The sheets are taken to Hancock Biological Station and the data are entered into spreadsheets. All data will be examined and evaluated by the project officer.

#### C1: Assessments and Response Actions

The Project Officer will review the biological sampling project on a regular basis and will communicate with KDOW. The Field Sampling Supervisor will train all field workers and require them to periodically review established sampling protocols.

### C2: Reports to Management

Project officer will submit reports as required by KDOW.

### D1: Data Review, Verification, and Validation

Data is to be compared to previous KDOW (1996) study of the same sites.

Multi-metric scoring systems will be used to integrate algae, macroinvertebrate, and fish metrics (Fish Index of Biotic Integrity (IBI), Macroinvertebrate Bioassessment Index (MBI), and Diatom Bioassessment Index (DBI) and Non-diatom Scores).

Biological and habitat data will be entered into the Kentucky's Ecological Database System (EDAS).

#### **D2: Verification and Validation Methods**

The Project Officer will regularly review all data resulting from this project and determine whether it is acceptable.

Biological data collected during this project will be compared to two previous studies on the same sites. Ten percent of samples (invertebrates, fish, and algae) will be submitted to KDOW/NPS for verification.

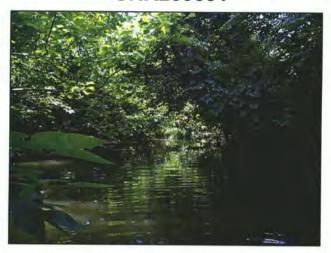
## D3: Reconciliation with User Requirements

Soon after each sampling event, data will be evaluated for completeness, precision, and accuracy. If data are not acceptable, re-sampling will occur. Depending upon the cause of the problem, corrective measures will be made.

## APPENDIX C

PHOTOGRAPHS OF EACH STUDY SITE

# SOUTH FORK OF LITTLE RIVER CRR200001



Predominant Substrate: Sand (40%), Gravel (25%), Bedrock(18%), Silt (10%), Cobble (3%), Boulder (2%), Detritus (2%)

Canopy Cover: Partially Shaded (50-75%)

Habitat Cover Types: Undercut Banks, Tree Roots, Coarse Woody Debris, Large

Surrounding Land Use: Row Crops, Pasture Grazing, Residential

# SOUTH FORK OF LITTLE RIVER CRR20002



Predominant Substrate: Sand (30%), Silt (20%), Bedrock (20%), Clay (10%), Cobble (10%),

Detritus (5%), Boulder (5%)

Canopy Cover: Partially Shaded (50-75%)

Habitat Cover Types: Undercut Banks, Tree Roots, Coarse Woody Debris, Boulders

Surrounding Land Use: Row Crops, Pasture Grazing

Erosion: Moderate-Heavy

# LOWER BRANCH OF LITTLE RIVER

## CRR200003



Predominant Substrate: Clay (60%), Sand (20%), Silt (10%), Gravel (10%)

Canopy Cover: Partially Exposed (25-50%)

Habitat Cover Types: Undercut Banks, Tree Roots, Coarse Woody Debris

Surrounding Land Use: Row Crops, Pasture Grazing, Residential

# UPPER BRANCH OF LITTLE RIVER CRR200004



Predominant Substrate: Sand (55%), Silt (20%), Boulder (10%), Detritus (10%), Cobble (5%)

Canopy Cover: Partially Shaded (50-75%)

Habitat Cover Types: Under Cut Banks, Rock Ledges, Tree Roots, Coarse Woody Debris, Boulders

Surrounding Land Use: Row Crops, Automobile Shop

# SOUTH FORK OF LITTLE RIVER CRR200005



Predominant Substrate: Cobble (45%), Silt (20%), Sand (20%), Clay (5%), Boulder (5%), Detritus (5%)

Canopy Cover: Partially Exposed (25-50%)

Habitat Cover Types: Undercut Banks, Rock Ledges, Tree Roots, Coarse Woody Debris, Boulders

Surrounding Land Use: Industrial, Residential

# NORTH FORK OF LITTLE RIVER CRR200006



Predominant Substrate: Sand (40%), Silt (20%), Clay (20%), Boulder (5%), Cobble (5%), Gravel (5%), Detritus (5%)

Detitus (570)

Canopy Cover: Partially Shaded (50-75%)

Habitat Cover Types: Undercut Banks, Rock Ledges, Coarse Woody Debris, Man-made Objects

Surrounding Land Use: Row Crops, Pasture Grazing, Residential

# NORTH FORK OF LITTLE RIVER CRR200007



Predominant Substrate: Clay (50%), Silt (20%), Sand (20%), Detritus (10%)

Canopy Cover: Partially Shaded (50-75%)

Habitat Cover Types: Undercut Banks, Rock Ledges, Tree Roots, Coarse Woody

Debris, Man-made Objects

Surrounding Land Use: Waste Water Treatment Plant, Row Crops, Residential, Forest

Erosion: Heavy

# NORTH FORK OF LITTLE RIVER CRR200008



Predominant Substrate: Sand (60%), Silt (20%), Detritus (10%), Cobble (5%), Gravel (5%)

Canopy Cover: Partially Shaded (50-75%)

Habitat Cover Types: Undercut Banks, Tree Roots, Coarse Woody Debris, Man-made Objects

Surrounding Land Use: Row Crops, Residential

Erosion: Heavy

# CRR200009



Predominant Substrate: Sand (30%), Silt (25%), Detritus (20%), Bedrock (20%), Boulder (5%)

Canopy Cover: Partially Exposed (25-50%)

Habitat Cover Types: Rock Ledges, Tree Roots, Coarse Woody Debris Surrounding Land Use: Residential, Row Crops, Forest, Pasture Grazing

## SINKING FORK CREEK CRR200010



Predominant Substrate: Bedrock (50%), Gravel (20%), Detritus (10%), Sand (5%), Silt (5%),

Cobble (5%), Boulder (5%)

Canopy Cover: Partially Shaded (50-75%)

Habitat Cover Types: Undercut Banks, Tree Roots, Coarse Woody Debris, Boulders

Surrounding Land Use: Row Crops, Pasture Grazing, Residential

# SINKING FORK CRR200011



Predominant Substrate: Sand (30%), Bedrock (30%), Clay (15%), Detritus (15%)Gravel (5%), Silt (5%)

Canopy Cover: Partially Shaded (50-75%)

Habitat Cover Types: Undercut Banks, Tree Roots, Coarse Woody Debris

Surrounding Land Use: Row Crops, Pasture Grazing, Residential

# CRR200012



Predominant Substrate: Bedrock (50%), Sand (15%), Silt (12%), Gravel (10%), Cobble (5%), Detritus (5%),

Boulder (3%)

Canopy Cover: Partially Exposed (25-50%)

Habitat Cover Types: Undercut Banks, Rock Ledges, Tree Roots, Coarse Woody Debris

Surrounding Land Use: Row Crop, Forest, Pasture Grazing, Residential

# CRR200013



Predominant Substrate: Gravel (40%), Sand(20%), Cobble (20%), Silt (8%), Clay(8%), Boulder (2%), Detritus (2%)

Canopy Cover: Fully Exposed (0-25%)

Habitat Cover Types: Undercut Banks, Tree Roots, Coarse Woody Debris

Surrounding Land Use: Row Crops, Pasture Grazing, Residential

# CASEY CREEK CRR200014



Predominant Substrate: Gravel (60%), Sand (20%), Cobble (10%), Silt (5%), Detritus (5%)

Canopy Cover: Partially Exposed (25-50%)

Habitat Cover Types: Undercut Banks, Tree Roots, Coarse Woody Debris

Surrounding Land Use: Row Crops, Forest, Pasture Grazing

Erosion: Minimal-Moderate

# CASEY CREEK CRR200015



Predominant Substrate: Gravel (50%), Sand (20%), Silt (10%), Clay (5%), Bedrock (5%), Detritus (5%), Cobble (5%)

Canopy Cover: Partially Exposed (50-75%)

Habitat Cover Types: Undercut Banks, Tree Roots, Coarse Woody Debris

Surrounding Land Use: Row Crops, Pasture Grazing, Forest

# SINKING FORK CRR200016

Predominant Substrate:

Gravel (50%), Sand (30%), Detritus (10%),

Cobble (5%), Boulder (5%)

Canopy Cover: Partially Shaded (50-75%)

Habitat Cover Types:

Undercut Banks, Tree Roots, Coarse Woody Debris

Surrounding Land Use: Row Crops, Forest



APPENDIX D

TAXA LIST

Station ID: CRR200001

Basin: LOWER CUMBERLAND

County: CHRISTIAN Catchment Area: 4.2

**Lat Dec:** 36.88174

Location: S.R. 508 @ BRIDGE

**Ecoregion:** INTERIOR PLATEAU

Stream Name: SOUTH FORK LITTLE RIVER

Map Name: HONEY GROVE

River Mile: 80.74 Stream Order: 4

**Long Dec:** -87.34167

### **FISHES**

Common Name	Scientific Name	Individuals	<b>July 2003</b>
Largescale Stoneroller	Campostoma oligolepis	- 4	
Striped Shiner	Luxilus chrysocephalus	27	
Rosefin Shiner	Lythrurus fasciolaris	87	
Bluntnose Minnow	Pimephales notatus	18	
Creek Chub	Semotilus atromaculatus	2	
White Sucker	Catostomus commersoni	1	
Creek Chubsucker	Erimyzon oblongus	1	
Yellow Bullhead	Ameiurus natalis	3	
Blackspotted Topminnow	Fundulus olivaceus	18	
Green Sunfish	Lepomis cyanellus	14	
Bluegill	Lepomis macrochirus	5	
Longear Sunfish	Lepomis megalotis	1	
Redear Sunfish	Lepomis microlophus	4	
Fringed Darter	Etheostoma crossopterum	7	

### **INVERTEBRATES**

Taxa	Individuals	May 2003
Oligochaeta	32	•
Valvata sp	8	
Physella sp	62	
Elimia sp	26	
Gyraulus sp	1	
Planorbella sp	3	
Corbicula fluminea	2	
Isotoma sp	3	
Paraleptophlebia sp	15	
Stenonema sp	39	
Heptageniidae	5	
Eurylophella sp	3	
Caenis sp	4	
Acentrella sp	21	
Baetis sp	130	
Procloeon sp	68	
Baetidae	80	
Enallagma sp	1	
Calopteryx maculata	2	
Aeshna sp	1	
Somatochlora sp	4	

Cordulegaster sp	1
Isoperla sp	1
Perlesta sp	37
Homoptera (not aquatic)	1
Microvelia sp	9
Gerris sp	14
Cheumatopsyche sp	130
Hydropsyche sp	2
Carabidae sp (adult)	1
Helichus striatus (adult)	3
Peltodytes sp (adult)	18
Hydrobius sp (adult)	4
Agabus sp (adult)	3
Hydaticus sp (adult)	8
Hydroporus sp (adult)	3
Stenelmis sp (adult)	123
Tipula sp	3
Tetanocera	1
Chironomidae (pupae)	45
Ablabesmyia mallochi gr	1
Apedilum elachistum	116
Brillia sp	5
Chironomus sp	1128
Conchapelopia sp	17
Cricotopus sp	102
Cricotopus/Orthocladius gr	22
Helopelopia sp 1	
Larsia sp	3
Limnophyes sp	62
Paratrichocladius sp.	20
Parametriocnemus sp	46
Phaenopsectra sp	128
Polypedilum aviceps	128
Polypedilum convictum	396
Polypedilum tritum	23
Potthastia sp	5
Psectrocladius sp	5
Rheopelopia sp	7
Stictochironomus sp	256
Tanytarsus sp	13
Orthoclad	
	19
	19 1
Psychoda sp.	
Psychoda sp. Simulium sp	1
Psychoda sp. Simulium sp Chrysops sp	1 351
Psychoda sp. Simulium sp	1 351 1

Culicoides sp	2
Caecidotea sp	2
Asellus sp.	2
Lirceus sp.	50
Orconectes sp	56
Hydracarina	1

## **DIATOMS**

Taxa	Individuals	May 2003
Achnanathes lanceolata	31	•
Achnanthes pusilla	2	
Achnanthidium minutissima	var. saprophila	5
Achnanthidium minutissimum	n 18	
Caloneis bacillum	2	
Cocconeis pediculus	15	
Cocconeis placentula var. eu	glypta 41	
Cyclotella sp.	2	
Cymbella minuta	7	
Cymbella naviculiformis	1	
Cymbella silesiaca	8	
Diatoma vulgare	1	
Gomphonema angustatum	4	
Gomphonema minutum	76	,
Gomphonema parvulum	18	
Hippodonta capitata	10	
Meridion circulare	1	
Navicula auriculata	2	
Navicula capitatoradiata	15	
Navicula contenta	3	
Navicula cryptocephala	14	
Navicula cryptocephala var.		
Navicula cryptotenella	30	
Navicula decussis	13	
Navicula menisculus	10	
Navicula menisculus var. up		
Navicula minima	3	
Navicula pupula	5	
Navicula secreta var. apicul		
Navicula seminulum	26	
Navicula subhamulata	6	
Navicula tantula	8	
Navicula tripunctata	6	
Navicula trivialis	24	
Nitzschia amphibia	1	
Nitzschia capitellata	6	
Nitzschia clausii	6	

Nitzschia dissipata	13
Nitzschia fonticola	3
Nitzschia palea	60
Nitzschia sp. 3	1
Nitzschia sp	1
Pinnularia microstauron	1
Rhoicosphenia curvata	6
Stephanocyclus meneghiniana	2
Surirella angustata	8
Surirella ovata	43
Surirella ovata var. pinnata	7
Synedra acus	2
Synedra ulna	19

FISHES			
Common Name	Scientific Name	Individuals	<b>Sept 2003</b>
Largescale Stoneroller	Campostoma oligolepis	20	-
Striped Shiner	Luxilus chrysocephalus	12	
Rosefin Shiner	Lythrurus fasciolaris	4	
Bluntnose Minnow	Pimephales notatus	9	
Creek Chub	Semotilus atromaculatus	6	
White Sucker	Catostomus commersoni	5	
Creek Chubsucker	Erimyzon oblongus	7	
Yellow Bullhead	Ameiurus natalis	1	
Blackspotted Topminnow	Fundulus olivaceus	4	
Green Sunfish	Lepomis cyanellus	11	
Bluegill	Lepomis macrochirus	1	
Longear Sunfish	Lepomis megalotis	21	
Fringed Darter	Etheostoma crossopterum	3	
Snubnose Darter	Etheostoma simoterum	1	
Orangethroat Darter	Etheostoma spectabile	2	
INVERTEBRATES	Taxa	Individuals	Sept 2003
	Planaria sp	10	•
	Elimia sp	472	
	Stenonema sp	239	
	Caenis sp	54	
	Procloeon sp	51	
	Argia sp	10	
	Enallagma sp	131	
	Calopteryx maculata	28	
	Basiaeschna sp	3	
	Boyeria sp	4	
	Dromogomphus sp	2	
	Libellula sp	9	

Saldula sp	10	
Gerris sp	1	
Agraylea sp	1	
Brachycentrus sp	1	
Cheumatopsyche sp	66	
Hydropsyche sp	1	
Potamyia flava	4	
Helichus striatus (adult)	2	
Peltodytes sp (adult)	23	
Scirtes sp (adult)	1	
Berosus sp (adult)	1	
Gyrinus sp (adult)	4	
Ancyronyx variegates (adult)	). 1	
Macronychus glabratus (adu		
Stenelmis sp (adult)	7	
Stenelmis sp (larvae)	127	
Tipula sp	1	
Pericoma sp	2	
Simulium sp	5	
Chironomidae (pupae)	23	
Stratiomys sp	1	
Tabanus sp	14	
Bezzia sp	2	
Caecidotea sp	58	
Orconectes sp	12	
Taxa	Individuals	S
Achnanathes lanceolata	25	
	<del>-</del> -	

## **DIATOMS**

Taxa	Individuals	<b>Sept 2003</b>
Achnanathes lanceolata	25	
Achnanathes minutissima	26	
Achnanthes sp. 2	16	
Achnanthes sp.1	3	
Achnanthidium minutissima	var. saprophila	10
Achnanthidium minutissimun	ı 4	
Amphora perpusilla	3	
Amphora submontana	11	
Cocconeis pediculus	93	
Cocconeis placentula var. eu	glypta 3	
Cymbella minuta	6	
Diploneis sp.	5	
Gomphonema gracile	6	
Gomphonema intricatum var	. pulvinatum	9
Gomphonema parvulum	27	
Gomphonema sphaerophoru	m 14	
Gyrosigma scalproides	11	
Gyrosigma spencerii var. cui	rvula 1	
Melosira varians	7	

Meriaion circulare	2
Navicula capitatoradiata	1
Navicula cryptocephala	3
Navicula cryptotenella	16
Navicula decussis	24
Navicula hustedtii	2
Navicula minima	46
Navicula molestiformis	2
Navicula schadei	3
Navicula schroeterii	14
Navicula secreta var. apiculata	1
Navicula seminulum	2
Navicula sp.	1
Navicula sp. 9a	6
Navicula subminuscula	4
Navicula tantula	4
Navicula tenelloides	67
Navicula tripunctata	4
Navicula trivialis	1
Nitzschia amphibia	16
Nitzschia constricta	1
Nitzschia dissipata	4
Nitzschia fonticola	1
Nitzschia frustulum	7
Nitzschia linearis	1
Nitzschia palea	24
Nitzschia parvula	9
Nitzschia sp.	6
Nitzschia sp. 4	1
Sellophora pupula	1
Stephanocyclus meneghiniana	3
Synedra parasitica var. subconstrict	ta4
Tryblionella victoriae	2

RIVER

County: CHRISTIAN Map Name: PEMBROKE

Catchment Area: 23.29 River Mile: 76.22 Stream Order: 3

**Lat Dec:** 36.84893 **Long Dec:** -87.37433 **Location:**E. HOPKINSVILLE UPSTREAM OF HWY 68-80 BRIDGE

FISHES			
Common Name	Scientific Name	Individuals	<b>July 2003</b>
Largescale Stoneroller	Campostoma oligolepis	5	
Striped Shiner	Luxilus chrysocephalus	16	
Rosefin Shiner	Lythrurus fasciolaris	105	
Bluntnose Minnow	Pimephales notatus	22	
White Sucker	Catostomus commersoni	2	
Yellow Bullhead	Ameiurus natalis	2	
Blackspotted Topminnow	Fundulus olivaceus	3	
Banded Sculpin	Cottus carolinae	2	
Rockbass	Ambloplites rupestris	11	
Green Sunfish	Lepomis cyanellus	1	
Bluegill	Lepomis macrochirus	1	
Longear Sunfish	Lepomis megalotis	12	
Largemouth Bass	Micropterus salmoides	1	
Fringed Darter	Etheostoma crossopterum	3	
Snubnose Darter	Etheostoma simoterum	5	

INVERTEBRATES	Taxa	Individuals	May 2003
	Oligochaeta	67	·
	Planaria sp	7	
	Physella sp	5	
	Elimia sp	495	
	<i>Planorbella</i> sp	5	
	Pisidium sp	1	
	Stenonema sp	14	
	Eurylophella sp	7	
	Caenis sp	14	
	Argia sp	2	
	Enallagma sp	28	
	Calopteryx maculata	2	
	Boyeria sp	2	
	Gomphus sp	1	,
	Epitheca (Epicordulia) sp	2	
	Hydroptila sp	2	
	Cheumatopsyche sp	94	
	Peltodytes sp (adult)	3	

Stenelmis sp (adult)	188	
Dicranopselaphus sp (adult)	2	
Curculionidae (adult)	64	
Tipula sp	1	
Apedilum elachistum	56	
Brillia sp	7 .	
Conchapelopia sp	3	
Cricotopus sp	90	
Cricotopus/Orthocladius gr	28	
Dicrotendipes sp	36	
Glyptotendipes sp	21	
Parachironomus sp	21	
Paratrichocladius sp.	14	
Parametriocnemus sp	10	
Phaenopsectra sp	57	
Polypedilum sp	162	
Polypedilum convictum	212	
Polypedilum tritum	42	
Psectrocladius sp	3	
Pseudochironomus sp	35	
Stenochironomus sp	14	
Tanytarsus sp	15	
Tribelos sp	14	
Simulium sp	265	
Chrysops sp	1	
Hydracarina	16	
Orconectes sp 1		
Taxa	Individuals	May 2003
Achnanathes lanceolata	11	•
Achnanathes lanceolata var.di	ıbia 14	
Achnanathes minutissima	16	
Achnanthes pinnata	14	
Achnanthes sp. 2	4	
Amphora perpusilla	5	
Amphora submontana	2	
Caloneis bacillum	14	

9

3

34

13

4

1

1

3

Hydrobius sp (adult)

Dineutus sp (adult)

Dytiscus sp (adult)

Ancyronyx variegates (adult)

Cocconeis pediculus

Gomphonema minutum

Cymbella minuta

Cocconeis placentula var. lineata

Gomphonema intricatum var. pulvinatum

**DIATOMS** 

Gyrosigma scalproides	4
Melosira varians	13
Meridion circulare	2
Navicula capitatoradiata	13
Navicula cryptocephala	8
Navicula cryptotenella	22
Navicula decussis	41
Navicula menisculus var. upsaliensis	51
Navicula minima	18
Navicula phyllepta	8
Navicula subminuscula	33
Navicula tripunctata	10
Navicula trivialis	9
Navicula viridula var. rostellata	7
Nitzschia amphibia	4
Nitzschia capitellata	12
Nitzschia dissipata	62
Nitzschia frustulum	21
Nitzschia palea	17
Nitzschia parvula	10
Nitzschia recta	7
Nitzschia sp.	44
Rhoicosphenia curvata	3
Stephanocyclus meneghiniana	2
Surirella ovata	61
Synedra rumpens var. familiaris	3
Synedra ulna	3

FISHES Common Name	Scientific Name	Individuals	Sept 2003
Common Name			Scpt 2003
Largescale Stoneroller	Campostoma oligolepis	26	
Common Carp	Cyprinus carpio	1	
Striped Shine	Luxilus chrysocephalus	27	
Rosefin Shiner	Lythrurus fasciolaris	42	
Bluntnose Minnow	Pimephales notatus	63	
Yellow Bullhead	Ameiurus natalis	2	
Banded Sculpin	Cottus carolinae	41	
Rockbass	Ambloplites rupestris	5	
Green Sunfish	Lepomis cyanellus	7	
Bluegill	Lepomis macrochirus	1	
Longear Sunfish	Lepomis megalotis	6	
Fringed Darter	Etheostoma crossopterum	6	
Snubnose Darter	Etheostoma simoterum	26	
Orangethroat Darter	Etheostoma spectabile	2	

INVERTEBRATES	Taxa	Individuals	Sept 2003
	Planaria sp	12	
	Elimia sp	49	
	Stenacron sp	9	
	Stenonema sp	29	
	Caenis sp	3	
	Baetis sp	325	
	Enallagma sp	4	
	Calopteryx maculata	22	
	Basiaeschna sp	9	
	Boyeria sp	2	
	Microvelia sp	5	
	Gerris sp	6	
	Orthotrichia sp	2	
	Cheumatopsyche sp	- 68	
	Chimarra sp	2	
	Helichus striatus (adult)	3	
	Psephenus herricki (larvae)	2	
	Peltodytes sp (adult)	1	
	Peltodytes sp (larva)	5	
	Hydrobius sp (adult)	1	
	Dineutus sp (adult)	3	
	Dineutus sp (larva)	1	
	Hydrovatus sp (adult)	i	
	Ancyronyx variegatus. (adult)		
	Stenelmis sp (adult)	8	
	Stenelmis sp (larva)	4	
	Chironomidae (pupae)	17	
	Tipula sp	5	
	Simulium sp	19	
	Orconectes sp	8	
	от солистов вр	G	
DIATOMS	Taxa	Individuals	<b>Sept 2003</b>
	Achnanathes lanceolata	16	
	Achnanathes minutissima	37	
	Achnanthes biasolettiana	19	
	Achnanthes pusilla	46	
	Achnanthes sp. 2	14	
	Achnanthes sp.1	21	
	Amphora perpusilla	4	
	Cocconeis pediculus	11	
	Cymatopleura solea	1	
	Cymbella affinis	32	
	Cymbella minuta	11	
	Cymbella silesiaca	12	

Gomphonema affine	4	
Gomphonema intricatum var. pulvir	natum	7
Gomphonema minutum	4	
Gomphonema parvulum	16	
Gyrosigma spencerii var. curvula	1	
Luticola mutica	6	
Navicula capitatoradiata	34	
Navicula cryptotenella	60	
Navicula decussis	8	
Navicula minima	53	
Navicula pupula	1	
Navicula schroeterii	20	
Navicula sp. 9a	4	
Navicula tantula	6	
Navicula tripunctata	13	
Navicula trivialis	6	
Nitzschia amphibia	68	
Nitzschia capitellata	2	
Nitzschia constricta	2	
Nitzschia dissipata	6	
Nitzschia frustulum	3	
Nitzschia palea	18	
Nitzschia parvula	3	
Nitzschia sp.	3	
Planothidium lanceolata	4	
Rhoicosphenia curvata	61	
Stephanocyclus meneghiniana	1	
Surirella ovata	4	
Synedra parasitica var. subconstric	eta 3	
Synedra ulna	1	

Station ID: CRR200003 Ecoregion: INTERIOR PLATEAU

Basin: LOWER CUMBERLAND Stream Name: LOWER BRANCH NORTH

FORK LITTLE RIVER

County: CHRISTIAN Map Name: KELLY

Catchment Area: 2.95 River Mile: 79.54 Stream Order: 3

**Lat Dec:** 36.89947 **Long Dec:** -87.39161

Location: 507 N.E. HOPKINSVILLE-BEHIND CHURCH APP. 150 M

#### **FISHES**

Common Name	Scientific Name	Individuals	<b>July 2003</b>
Bluntnose Minnow	Pimephales notatus	1	•
Yellow Bullhead	Ameiurus natalis	3	
Blackspotted Topminnow	Fundulus olivaceus	13	
Green Sunfish	Lepomis cyanellus	2	
Longear Sunfish	Lepomis megalotis	3	
Largemouth Bass	Micropterus salmoides	2	

### INVERTEBRATES

Taxa	Individuals	May 2003
Oligochaeta	124	•
Planaria sp	3	
Fossaria sp	4	
Physella sp	65	
Menetus dilatatus	4	
Planorbella sp	4	
Pisidium sp	2	
Sphaerium sp	1	
Hirudinea	1	
Stenacron sp	1	
Caenis sp	1	
Baetis sp	28	
Baetidae	5	
Argia sp	3	
Enallagma sp	5	
Calopteryx maculata	1	
Gomphus sp	2	
Trichocorixa sp	2	
Cheumatopsyche sp	27	
Helichus striatus (adult)	2	
Peltodytes sp (adult)	2	
Hydrobius sp (adult)	1	
Ancyronyx variegates (adult)	1	
Dubiraphia sp (adult)	1	
Dubiraphia sp (larvae)	1	
Stenelmis sp (adult)	15	
Lixus sp	1	
Limonia sp	3	

Dictya sp	1
Chironomidae (pupae)	62
Apedilum elachistum	24
Brillia sp	4
Chironomus sp	25
Cricotopus sp	101
Cricotopus/Orthocladius gr	89
Cryptochironomus sp	9
Dicrotendipes sp	17
Endochironomus sp	34
Glyptotendipes sp	17
Paratrichocladius sp.	8
Phaenopsectra sp	26
Polypedilum sp	17
Polypedilum convictum	291
Polypedilum tritum	17
Potthastia sp	6
Orthoclad	4
Simulium sp	188
Culicoides sp	1
Asellus sp.	1
Orconectes sp	1
<del>-</del>	

## **DIATOMS**

Taxa	Individuals	May 2003
Achnanathes lanceolata	2	-
Achnanathes minutissima	61	
Achnanthes curtissima	5	
Achnanthes sp. 3	6	
Achnanthidium minutissima	var. saprophila	52
Caloneis bacillum	7	
Cocconeis pediculus	5	
Cymbella minuta	6	
Cymbella silesiaca	6	
Gomphonema angustatum	4	
Gomphonema minutum	220	
Gomphonema parvulum	11	
Gyrosigma scalproides	1	
Meridion circulare	1	
Navicula contenta	3	
Navicula cryptocephala	7	
Navicula cryptotenella	11	
Navicula decussis	10	
Navicula minima	10	
Navicula secreta var. apicul	ata 28	
Navicula seminulum	2	

Navicula subminuscula	3
Navicula trivialis	6
Nitzschia acicularis	2
Nitzschia apiculata	1
Nitzschia dissipata	8
Nitzschia gracilis	2
Nitzschia linearis	2
Nitzschia palea	20
Nitzschia perminuta	2
Nitzschia sp. 5	1
Rhoicosphenia curvata	1
Stauroneis anceps	2
Surirella angustata	3
Surirella ovata	24
Synedra acus	3
Synedra rumpens var. familiaris	2
Synedra ulna	4

FISHES			
<b>Common Name</b>	Scientific Name	Individuals	<b>Sept 2003</b>
Bluntnose Minnow	Pimephales notatus	3	
Yellow Bullhead	Ameiurus natalis	1	
Blackspotted Topminnow	Fundulus olivaceus	2	
Green Sunfish	Lepomis cyanellus	3	
Warmouth	Lepomis gulosus	1	
Bluegill	Lepomis macrochirus	15	
Longear Sunfish	Lepomis megalotis	6	
Largemouth Bass	Micropterus salmoides	1	
Snubnose Darter	Etheostoma simoterum	1	

INVERTEBRATES	Taxa	Individuals	<b>Sept 2003</b>
	Planaria sp	2	_
	Elimia sp	3	
	Heptagenia sp	8	
	Stenacron sp	2	
	Stenonema sp	3	
	Caenis sp	15	
	Fallceon sp	31	
	Enallagma sp	83	
	Calopteryx maculata	8	
	Basiaeschna sp	5	
	Gomphus sp	1	
	Didymops sp	2	
	Epitheca (Epicordulia) sp	1	

Libellula sp	2
Microvelia sp	32
Gelastocoris occulata	1
Aquarius sp	1
Gerris sp	5
Hydroptila sp	1
Neotrichia sp	3
Cheumatopsyche sp	223
Potamyia flava	5
Lype diversa	2
Helichus striatus (adult)	7
Pelonomus obscurus (adult)	1
Peltodytes sp (adult)	11
Berosus sp (adult)	1
Micralymma sp (adult)	1
Dineutus sp (adult)	63
Gyrinus sp (adult)	5
Hydrovatus sp (adult)	1
Ancyronyx variegates (adult)	3
Dubiraphia sp (larvae)	3
Stenelmis sp (larvae)	6
Chironomidae (pupae)	26
Hemerodromia sp	2
Simulium sp	18
Stratiomys sp	1
Caecidotea sp	2
Orconectes sp	1
•	

## **DIATOMS**

Taxa	Individuals	Sept 2003
Achnanathes minutissima	49	
Achnanthidium minutissima	var. saprophila	12
Achnanthidium minutissimun	<i>i</i> 12	
Amphipleura pellucida	1	
Caloneis bacillum	3	
Cocconeis pediculus	9	
Craticula cuspidata	1	
Cymatopleura elliptica	1	
Cymbella affinis	42	
Cymbella silesiaca	12	
Cymbella triangulum	1	
Cymbella tumida	1	
Cymbella turgidula	6	
Diploneis sp.	3	
Gomphonema parvulum	4	
Gomphonema sphaerophoru	m 16	
Gomphonema truncatum	6	

Hantzschia amphioxys	2
Hippodonta capitata	1
Melosira varians	28
Navicula capitatoradiata	36
Navicula cryptocephala	23
Navicula decussis	5
Navicula phyllepta	1
Navicula schroeterii	44
Navicula secreta var. apiculata	2
Navicula tenelloides	1
Navicula trivialis	4
Navicula viridula var. rostellata	29
Nitzschia constricta	1
Nitzschia denticula	18
Nitzschia dissipata	7
Nitzschia palea	26
Nitzschia palea var. tenuirostris	8
Nitzschia sinuata var. tabellaria	8
Nitzschia sp.	6
Rhoicosphenia curvata	2
Stephanocyclus meneghiniana	118
Surirella angustata	2
Surirella ovata var. pinnata	3
Svnedra ulna	11

Station ID: CRR200004 Ecoregion: INTERIOR PLATEAU

Basin: LOWER CUMBERLAND Stream Name: UPPER BRANCH NORTH

FORK LITTLE RIVER

County: CHRISTIAN Map Name: KELLY

Catchment Area: 16.29 River Mile: 74.47 Stream Order: 3

**Lat Dec:** 36.88908 **Long Dec:** -87.45583

Location: 107 N.E. HOPKINSVILLE -CLOSE TO 1682 INTERSECTION

#### **FISHES**

Common Name	Scientific Name	Individuals	<b>July 2003</b>
Bluntnose Minnow	Pimephales notatus	2	
Yellow Bullhead	Ameiurus natalis	3	
Blackspotted Topminnow	Fundulus olivaceus	1	
Western Mosquitofish	Gambusia affinis	2	
Banded Sculpin	Cottus carolinae	1	
Rockbass	Ambloplites rupestris	2	
Bluegill	Lepomis macrochirus	1	
Longear Sunfish	Lepomis megalotis	4	
Fringed Darter	Etheostoma crossopterum	1	

#### **INVERTEBRATES**

Individuals	May 2003
225	·
69	
439	
2	
5	
2	
3	
12	
1	
1	
3	
1	
2	
1	
2	
22	
1	
5	
5	
1	
1	
1	
243	
12	
	225 69 439 2 5 2 3 12 1 1 2 2 2 1 2 2 2 1 5 5 5

Abiabesmyia rnampne	/
Chironomus sp	25
Conchapelopia sp	7
Cricotopus sp	60
Cricotopus/Orthocladius gr	18
Dicrotendipes sp	73
Glyptotendipes sp	24
Helopelopia sp	4
Parachironomus sp	36
Paratrichocladius sp.	13
Phaenopsectra sp	49
Polypedilum convictum	390
Polypedilum tritum	183
Potthastia sp	14
Pseudochironomus sp	12
Tanytarsus sp	12
Chironomidae	12
Orthoclad	4
Simulium sp	217
Bezzia sp	2
Serromyia sp	1
Gammarus sp	39
Caecidotea sp	1
Lirceus sp.	1
Orconectes sp	14

Taxa	Individuals	May 2003
Achnanathes lanceolata	6	
Achnanathes minutissima	1	
Asterionella formosa	1	
Aulacoseira granulata	68	
Cocconeis pediculus	24	
Cocconeis placentula var. eug	lypta 6	
Gomphonema angustatum	3	
Gomphonema intricatum var.	pulvinatum	16
Gomphonema parvulum	26	
Melosira ambigua	45	
Melosira granulata var. angus	stissima 10	
Melosira italica	171	
Melosira varians	9	
Navicula capitatoradiata	12	
Navicula contenta	3	
Navicula cryptocephala	4	
Navicula cryptocephala var. v	eneta 3	
Navicula cryptotenella	3	
Navicula helensis	2	

Navicula ingenua	6
Navicula menisculus	3
Navicula minima	26
Navicula seminulum	4
Navicula tripunctata	6
Navicula trivialis	3
Navicula viridula	3
Neidium affine	2
Nitzschia amphibia	6
Nitzschia apiculata	1
Nitzschia clausii	6
Nitzschia dissipata	33
Nitzschia palea	5
Nitzschia sp.	8
Rhoicosphenia curvata	64
Stephanocyclus meneghiniana	2
Stephanodiscus hantzschii	8
Stephanodiscus sp.	6
Stephanodiscus tenuis	2
Surirella angustata	6
Surirella ovata	14
Surirella ovata var. pinnata	6
Synedra acus	1
Synedra rumpens var. familiaris	14
Synedra rumpens var. meneghiniana	14

FISHES Common Name	Scientific Name	Individuals	Sept 2003
Rosefin Shiner	Lythrurus fasciolaris	1	
Bluntnose Minnow	Pimephales notatus	12	
Yellow Bullhead	Ameiurus natalis	2	
Blackspotted Topminnow	Fundulus olivaceus	5	
Western Mosquitofish	Gambusia affinis	16	
Banded Sculpin	Cottus carolinae	3	
Green Sunfish	Lepomis cyanellus	1	
Warmouth	Lepomis gulosus	7	
Bluegill	Lepomis macrochirus	11	
Longear Sunfish	Lepomis megalotis	27	
Largemouth Bass	Micropterus salmoides	2	
Fringed Darter	Etheostoma crossopterum	1	
Slabrock Darter	Etheostoma smithi	6	

INVERTEBRATES	Taxa	T., 3!! 31.	C 4 2002
INVERTEBRATES	Planaria sp	Individuals	<b>Sept 2003</b>
	Elimia sp	180 38	
	Stenacron sp	_	
	Caenis sp	1	
	*	6	
	Argia sp	7	
	Enallagma sp	5	
	Calopteryx maculata	1	
	Boyeria sp	6	
	Libellula sp	1	
	Microvelia sp	2	•
	Notonecta sp	1	
	Rhyacophila sp	1	
	Agapetus sp	2	
	Hydropsyche sp	1	
	Potamyia flava	3	
	Haliplus sp (adult)	6	
	Peltodytes sp (adult)	11	
	Berosus sp (adult)	4	
	Berosus sp (larva)	1	
	Dineutus sp (adult)	1	
	Hydrobiomorpha sp (adult)	1	
	Hydrovatus sp (adult)	4	
	Dubiraphia sp (adult)	18	
	Dubiraphia sp (larvae)	6	
	Chironomidae (pupae)	46	
	Dolichopeza sp	1	
	Ephydra sp	1	
	Psychoda sp.	1	
	Chrysops sp	3	
	Probezzia sp	1	
	Gammarus sp	10	
	Lirceus sp	2	
DIATOMS	Taxa	Individuals	Sept 2003
	Achnanathes lanceolata var.d		Sept 2003
	Amphora sp.	<i>uviu 5</i> 1	
	Caloneis bacillum	2	
		2 3	
	Caloneis sp.	3	
	Cymatopleura solea	1	
	Cymbella minuta	4	
	Fragilaria capucina var. meso	•	
	Gomphonema affine	2	
	Gomphonema clavatum	7	
	Gomphonema intricatum var.	-	17
	Gomphonema parvulum	9	

Gyrosigma scalproides	3
Gyrosigma spencerii var. curvula	18
Hippodonta capitata	6
Melosira ambigua	11
Melosira varians	154
Navicula capitatoradiata	5
Navicula cryptocephala	33
Navicula cryptotenella	18
Navicula decussis	7
Navicula elginensis	7
Navicula halophila	1
Navicula ingenua	1
Navicula minima	17
Navicula molestiformis	2
Navicula pupula	31
Navicula schadei	3
Navicula schroeterii	2 2
Navicula seminulum	2
Navicula sp.	1
Navicula sp. 7	7
Navicula sp. 9a	1
Navicula subminuscula	2
Navicula tantula	9
Navicula tenelloides	10
Navicula viridula var. rostellata	34
Nitzschia amphibia	12
Nitzschia constricta	1
Nitzschia dissipata	2
Nitzschia palea	12
Nitzschia sp.	18
Rhoicosphenia curvata	6
Stauroneis smithii	2
Stephanocyclus meneghiniana	24
Surirella angustata	3
Surirella ovata var. pinnata	3
Surirella sp.	1
Tryblionella victoriae	1

Station ID: CRR200005 Ecoregion: INTERIOR PLATEAU

Basin: LOWER CUMBERLAND Stream Name: SOUTH FORK LITTLE RIVER

County: CHRISTIAN Map Name: HOPKINSVILLE

Catchment Area: 45.39 River Mile: 67.18 Stream Order: 4

**Lat Dec:** 36.85292 **Long Dec:** -87.46967

**Location:** TRAIL OF TEARS COMMEMORATIVE PARK

<b>FISHES</b>	
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Common Name	Scientific Name	Individuals	<b>July 2003</b>
Large Stoneroller	Campostoma oligolepis	3	
Striped Shiner	Luxilus chrysocephalus	5	
Rosefin Shiner	Lythrurus fasciolaris	135	
Bluntnose Minnow	Pimephales notatus	32	
Blackspotted Topminnow	Fundulus olivaceus	2	
Banded Sculpin	Cottus carolinae	4	
Rockbass	Ambloplites rupestris	3	
Bluegill	Lepomis macrochirus	8	
Longear Sunfish	Lepomis megalotis	2	
Spotted Bass	Micropterus punctulatus	1	
Greenside Darter	Etheostoma blennioides	1	
Fringed Darter	Etheostoma crossopterum	2	
Snubnose Darter	Etheostoma simoterum	1	
Orangethroat Darter	Etheostoma spectabile	1	

#### **INVERTEBRATES**

Taxa	Individuals	May 2003
Oligochaeta	26	•
Physella sp	4	
Elimia sp	149	
Pisidium sp	2	
Sphaerium sp	4	
Corbicula fluminea	12	
Stenacron sp	2	
Eurylophella sp	2	
Caenis sp	7	
Baetidae	5	
Argia sp	1	
Enallagma sp	3	
Calopteryx maculata	1	
Boyeria sp	1	
Cheumatopsyche sp	32	
Peltodytes sp (adult)	2	
Ancyronyx variegatus (adult)	2	
Macronychus glabratus (adu		
Stenelmis sp (adult)	1	
Hexatoma sp	1	
Tipula sp	1	

Chironomidae (pupae)	20
Apedilum elachistum	16
Brillia sp	1
Chironomus sp	8
Cricotopus sp	33
Cricotopus/Orthocladius gr	11
Dicrotendipes sp	8
Endochironomus sp	36
Larsia sp	2
Phaenopsectra sp	8
Polypedilum convictum	52
Polypedilum tritum	60
Potthastia sp	1
Pseudochironomus sp	4
Tanytarsus sp	8
Ephydridae	1
Hydracarina	2
Gammarus sp	2
Lirceus sp	3
Orconectes sp	2
<del>-</del>	

Taxa	Individuals	May 2003
Achnanathes lanceolata	3	
Achnanathes minutissima	29	
Achnanthes exigua	2	
Achnanthes hauckiana	5	
Amphora ovalis var. pediculi	us 8	
Cocconeis pediculus	7	
Cocconeis placentula var. eu	glypta 22	
Cymbella minuta	8	
Cymbella silesiaca	6	
Gomphonema intricatum var	. pulvinatum	2
Gomphonema minutum	14	
Gomphonema olivaceum	21	
Gomphonema parvulum	28	
Gyrosigma scalproides	7	
Hippodonta capitata	1	
Meridion circulare	3	
Navicula capitatoradiata	28	
Navicula cryptocephala	7	
Navicula cryptocephala var.	veneta 8	
Navicula cryptotenella	73	
Navicula decussis	8	
Navicula helensis	2	
Navicula menisculus var. ups	saliensis 8	
Navicula minima	16	

Navicula secreta var. apiculata	32
Navicula seminulum	11
Navicula sp.	4
Navicula sp. 1	9
Navicula sp. 3	4
Navicula sp. 4	1
Navicula tripunctata	28
Navicula trivialis	13
Nitzschia apiculata	1
Nitzschia dissipata	47
Nitzschia fonticola	3
Nitzschia frustulum	11
Nitzschia linearis	14
Nitzschia palea	16
Nitzschia perminuta	11
Nitzschia sp.	4
Nitzschia sp. 4	4
Nitzschia sp. 5	5
Rhoicosphenia curvata	12
Stephanocyclus meneghiniana	3
Surirella angustata	3
Surirella ovata	41
Surirella ovata var. pinnata	6
Synedra rumpens var. familiaris	2
_ •	

FISHES			
Common Name	Scientific Name	Individuals	Sept 2003
Rosefin Shiner	Lythrurus fasciolaris	20	•
Bluntnose Minnow	Pimephales notatus	11	
Blackspotted Topminnow	Fundulus olivaceus	7	
Banded Sculpin	Cottus carolinae	18	
Rockbass	Ambloplites rupestris	14	
Green Sunfish	Lepomis cyanellus	5	
Longear Sunfish	Lepomis megalotis	29	
Greenside Darter	Etheostoma blennioides	2	
Fringed Darter	Etheostoma crossopterum	2	
Snubnose Darter	Etheostoma simoterum	8	
INVERTEBRATES	Taxa	Individuals	Sept 2003
	Elimia sp	154	-
	Stenacron sp	8	
	Argia sp	3	
	Enallagma sp	22	
	Basiaeschna sp	1	
	Boyeria sp	1	

Microvelia sp	1
Rhagovelia sp	1
Ochrotrichia sp	4
Potamyia flava	18
Helichus striatus (adult)	2
Psephenus herricki (larvae)	3
Peltodytes sp (adult)	1
Berosus sp (adult)	1
Ancyronyx variegates (adult)	1
Ancyronyx variegates (larvae)	2
Dineutus sp (adult)	2
Dubiraphia sp (larvae)	1
Macronychus glabratus (adult)	2
Stenelmis sp (larvae)	4
Chironomidae (pupae)	6
Simulium sp	5
Hydrodroma sp	3
•	

Taxa	Individuals	Sept 2003
Achnanathes lanceolata	16	
Achnanathes lanceolata var.da	ubia 7	
Achnanathes minutissima	3	
Achnanthes pinnata	3	
Achnanthes sp. 2	4	
Amphora ovalis	1	
Amphora perpusilla	9	
Amphora submontana	4	
Caloneis bacillum	3	
Cocconeis pediculus	4	
Cocconeis placentula var. eug	lypta 11	
Craticula cuspidata	1	
Cymbella minuta	17	
Cymbella silesiaca	13	
Diploneis sp.	6	
Fallacia pygmaea	3	
Fragilaria vaucheriae	1	
Gomphonema affine	1	
Gomphonema brasiliense	2	
Gomphonema olivaceum	6	
Gomphonema parvulum	7	
Gomphonema sphaerophorum	: 1	
Gyrosigma scalproides	5	
Gyrosigma spencerii var. curv	rula 3	
Hantzschia amphioxys	2 5	
Hippodonta capitata	5	
Luticola mutica	2	

Meiosira varians	13
Meridion circulare	4
Navicula capitatoradiata	24
Navicula cf. goeppertiana	14
Navicula contenta	4
Navicula cryptocephala	19
Navicula cryptotenella	18
Navicula decussis	40
Navicula integra	3
Navicula menisculus var. upsaliensis	3
Navicula minima	15
Navicula pupula	3
Navicula schadei	13
Navicula schroeterii	48
Navicula sp.	21
Navicula sp. 9a	3
Navicula subminuscula	5
Navicula tantula	6
Navicula tenelloides	19
Navicula tenera	1
Navicula tripunctata	1
Navicula trivialis	11
Navicula viridula	1
Navicula viridula var. rostellata	23
Nitzschia amphibia	1
Nitzschia dissipata	6
Nitzschia fonticola	1
Nitzschia frustulum	2
Nitzschia linearis	4
Nitzschia palea	18
Nitzschia sinuata var. tabellaria	1
Nitzschia sp.	4
Rhoicosphenia curvata	4
Stauroneis smithii	2
Stephanocyclus meneghiniana	9
Surirella angustata	3
Surirella linearis var. helvetica	1
Surirella ovata	25
Synedra acus	1
Synedra ulna	5
Tryblionella levidensis	3

Station ID: CRR200006 Ecoregion:INTERIOR PLATEAU

Basin: LOWER CUMBERLAND Stream Name: NORTH FORK LITTLE

RIVER

County: CHRISTIAN Map Name: CHURCH HILL

Catchment Area: 54.2 River Mile: 63.58 Stream Order:5

**Lat Dec:** 36.83155 **Long Dec:** -87.52454

Location: HOPKINSVILLE BYPASS 3495 SOUTH SIDE-200 m UPSTREAM FROM

**BRIDGE** 

FISHES			
Common Name	Scientific Name	Individuals	<b>July 2003</b>
Largescale Stoneroller	Campostoma oligolepis	7	
Spotfin Shiner	Cyprinella spiloptera	1	
Common Carp	Cyprinus carpio	1	
Striped Shiner	Luxilus chrysocephalus	15	
Rosefin Shiner	Lythrurus fasciolaris	174	
Redtail Chub	Nocomis effusus	3	
Golden Shiner	Notemigonus crysoleucas	1	
Bluntnose minnow	Pimephales notatus	12	
Creek Chub	Semotilus atromaculatus	2	
Banded Sculpin	Cottus carolinae	18	
Longear Sunfish	Lepomis megalotis	2	
Fringed Darter	Etheostoma crossopterum	1	
Freshwater Drum	Aplodinotus grunniens	1	
INVERTEBRATES	Taxa	Individuals	May 2003
	Oligochaeta	31	·
	Planaria sp	1	
	Physella sp	1	
	Elimia sp	496	
	<i>Planorbella</i> sp	2	
	Corbicula fluminea	10	
	Stenacron sp	13	
	Caenis sp	4	
	Argia sp	33	
	Enallagma sp	5	
	<i>Boyeria</i> sp	1	
	Epitheca (Epicordulia) sp	4	
	Hydroptila sp	1	
	Cheumatopsyche sp	184	
	Homoptera (not aquatic)	1	
	Curculionidae (adult)	14	
	Microbledius sp (adult)	1	
	Helichus striatus (adult)	1	
	Berosus sp (adult)	1	

Ancyronyx variegates (adult)

Stenelmis sp (adult)	13	
Chironomidae (pupae)	9	
Ablabesmyia sp	1	
Conchapelopia sp	6	
Cryptochironomus sp	20	
Dicrotendipes sp	4	
Helopelopia sp	2	
Larsia sp	3	
Phaenopsectra sp	32	
Polypedilum convictum	123	
Polypedilum tritum	28	
Stictochironomus sp	8	
Tanytarsus sp	4	
Simulium sp	i	
Bezzia sp	1	
Ceratopogon sp	4	
Caecidotea sp	328	
Orconectes sp	6	
or conceres sp	O	
Taxa	Individuals	May 2003
Achnanathes minutissima	12	111uy 2005
Achnanthes hauckiana	4	
Achnanthes sp.	2	
Asterionella formosa	2	
Cocconeis pediculus	1	
Cocconeis placentula var. et	_	
Cyclotella pseudostelligera	13	
Cymbella minuta	3	
Gomphonema intricatum va	_	6
Gomphonema minutum	1. paivinaiam 11	U
Gomphonema olivaceum	11	
Gomphonema parvulum	8	
Gyrosigma attenuatum	1	
Melosira granulata var. ang		
Navicula capitatoradiata	18	
Navicula contenta	3	
Navicula cryptocephala	1	
Navicula cryptotenella	23	
Navicula ingenua	4	
Navicula menisculus	13	
Navicula menisculus Navicula minima	42	
Navicula minima Navicula secreta var. apicul		
Navicula secreta var. apticul Navicula seminulum	aia 57 63	
Navicula sp.	98 17	
Navicula trivialis	17	

Navicula viridula var. rostellata

12

Neidium affine var. longiceps	2
Nitzschia amphibia	3
Nitzschia apiculata	7
Nitzschia capitellata	6
Nitzschia clausii	2
Nitzschia dissipata	41
Nitzschia frustulum	2
Nitzschia linearis	1
Nitzschia palea	13
Pinnularia subcapitata	1
Reimeria sinuata	1
Rhoicosphenia curvata	4
Stephanocyclus meneghiniana	3
Stephanodiscus hantzschii	41
Stephanodiscus tenuis	9
Surirella angustata	1
Surirella ovata	23
Surirella ovata var. pinnata	12
Synedra rumpens var. familiaris	11
Synedra ulna	1

#### **FISHES Common Name** Individuals **Sept 2003** Scientific Name Largescale Stoneroller Campostoma oligolepis 1 Striped Shiner Luxilus chrysocephalus 2 Rosefin Shiner Lythrurus fasciolaris 60 Bluntnose Minnow Pimephales notatus 7 Blackspotted Topminnow 4 Fundulus olivaceus Western Mosquitofish Gambusia affinis 2 Banded Sculpin 2 Cottus carolinae 2 **Rockbass** Ambloplites rupestris Green Sunfish 3 Lepomis cyanellus 2 Bluegill Lepomis macrochirus 7 Longear Sunfish Lepomis megalotis Fringed Darter 2 Etheostoma crossopterum **INVERTEBRATES Individuals Sept 2003** Taxa Planaria sp 11 Elimia sp 207 Stenacron sp 14 Brachycercus sp 1 Heterocloeon curiosum 11 88 Argia sp Enallagma sp 6 Calopteryx maculata 5

Basiaeschna sp	3
Ladona exusta	1
Macromia sp	3
Microvelia sp	17
Rhagovelia sp	1
Gerris sp	1
Ochrotrichia sp	6
Cheumatopsyche sp	268
Peltodytes sp (adult)	3
Berosus sp (adult)	1
Ancyronyx variegates (adult)	1
Ancyronyx variegates (larvae)	14
Dubiraphia sp (adult)	1
Dubiraphia sp (larvae)	5
Stenelmis sp (adult)	15
Hemerodromia sp	2
Simulium sp	21
Chironomidae (pupae)	13
Ceratopogon sp	1
Gammarus sp	2
Caecidotea sp	34
Lirceus sp.	1
Orconectes sp	2

Taxa	Individuals	Sept 2003
Achnanathes minutissima	4	•
Achnanthes sp. 2	14	
Achnanthidium minutissima	var. saprophila	6
Amphora perpusilla	11	
Aulacoseira granulata	3	
Gomphonema brasiliense	8	
Gomphonema intricatum var	. pulvinatum	3
Gomphonema truncatum	3	
Gyrosigma scalproides	2	
Melosira varians	2	
Navicula capitatoradiata	13	
Navicula cf. goeppertiana	8	
Navicula contenta	21	
Navicula cryptocephala	11	
Navicula cryptotenella	7	
Navicula hustedtii	6	
Navicula menisculus	7	
Navicula minima	73	
Navicula schroeterii	68	
Navicula secreta var. apicula	ita 8	
Navicula seminulum	7	

Navicula sp.	18
Navicula sp. 9a	23
Navicula subminuscula	23
Navicula tenelloides	42
Navicula tripunctata	2
Navicula trivialis	3
Navicula viridula var. rostellata	53
Nitzschia acicularis	4
Nitzschia amphibia	14
Nitzschia constricta	1
Nitzschia dissipata	9
Nitzschia dissipata var. media	9
Nitzschia frustulum	9
Nitzschia palea	51
Nitzschia sp.	14
Surirella angustata	2
Surirella ovata	5

Station ID: CRR200007 Ecoregion: INTERIOR PLATEAU

Basin: LOWER CUMBERLAND Stream Name: NORTH FORK LITTLE

**RIVER** 

County: CHRISTIAN Map Name: CHURCH HILL

Catchment Area: 58.54 River Mile: 58.34 Stream Order: 5

**Lat Dec:** 36.80178 **Long Dec:** -87.51382

Location: 107 TO GRAY LANE-JUST BELOW WASTE WATER TREATMENT PLANT

FISHES Common Name	Scientific Name	Individuals	July 2003
Striped Shiner	Luxilus chrysocephalus	11	
Rosefin Shiner	Lythrurus fasciolaris	176	
Banded Sculpin	Cottus carolinae	5	
Longear Sunfish	Lepomis megalotis	2	
INVERTEBRATES	Taxa	Individuals	May 2003
	Oligochaeta	79	•
	Planaria sp	2	
	Physella sp	9	
	Elimia sp	96	
	Corbicula fluminea	4	
	Hirudinea	1	
	Stenacron sp	26	
	Heptageniidae	8	
	Eurylophella sp	1	
	Caenis sp	1	
	Baetis sp	3	
	Baetidae	2	
	Argia sp	80	
	Enallagma sp	16	
	Calopteryx maculata	1	
	Hagenius brevistylus	1	
	Epitheca (Epicordulia) sp	1	
	Macromia sp	1	
	Hydroptila sp	1	
	Cheumatopsyche sp	172	
	Ancyronyx variegates (adult)	17	
	Dubiraphia sp (adult)	2	
	Macronychus glabratus (adul	t) 1	
	Stenelmis sp (adult)	66	
	Chironomidae (pupae)	15	
	Chironomus sp	5	
	Conchapelopia sp	6	
	Cricotopus sp	5	
	Cryptochironomus sp	8	

Endochironomus sp	7	
Phaenopsectra sp	1	
Polypedilum convictum	47	
Polypedilum tritum	10	
Potthastia sp	1	
Psectrocladius sp	1	
Tanytarsus sp	6	
Simulium sp	2	
Ceratopogon sp	1	
Gammarus sp	19	
Caecidotea sp	31	
Orconectes sp	2	
Taxa	Individuals	May 2003
Achnanathes lanceolata	16	
Achnanathes minutissima	8	
Amphora perpusilla	4	
Caloneis bacillum	13	
Cocconeis pediculus	21	
Cocconeis placentula var. eug	glypta 7	
Cyclotella pseudostelligera	7	
Cymbella minuta	2	
Fragilaria capucina var. meso	olepta 3	
Gomphonema intricatum var.		15
Gomphonema minutum	10	
Gomphonema olivaceum	6	
Gomphonema parvulum	16	
Gyrosigma scalproides	4	
Hippodonta capitata	2	
Melosira ambigua	19	
Melosira granulata var. angu	stissima 13	
Melosira varians	13	
Navicula capitatoradiata	14	
Navicula cf. goeppertiana	11	
Navicula cryptocephala	6	
Navicula cryptotenella	37	
Navicula menisculus	4	
Navicula menisculus var. upse	aliensis 13	
Navicula minima	40	
Navicula secreta var. apicula	ta 37	
Navicula seminulum	11	
Navicula sp.	18	
Navicula tenera	1	
Navicula tripunctata	54	
Navicula trivialis	4	

2 7

Dicrotendipes sp

Nitzschia amphibia	11
Nitzschia apiculata	2
Nitzschia dissipata	31
Nitzschia frustulum	2
Nitzschia hungarica	1
Nitzschia ignorata	2
Nitzschia linearis	4
Nitzschia palea	2
Punctastriata pinnata	3
Reimeria sinuata	3
Rhoicosphenia curvata	58
Stephanodiscus hantzschii	8
Stephanodiscus tenuis	4
Synedra rumpens var. familiaris	11
Synedra rumpens var. fragilarioides	8
Synedra ulna	3

FISHES Common Name	Scientific Name	Individuals	<b>Sept 2003</b>
Largescale Stoneroller	Campostoma oligolepis	1	
Spotfin Shiner	Cyprinella spiloptera	2	
Striped Shiner	Luxilus chrysocephalus	4	
Western Mosquitofish	Gambusia affinis	1	
Banded Sculpin	Cottus carolinae	29	
Rockbass	Ambloplites rupestris	11	
Green Sunfish	Lepomis cyanellus	3	
Bluegill	Lepomis macrochirus	1	
Longear Sunfish	Lepomis megalotis	11	
Greenside Darter	Etheostoma blennioides	1	
Smallscale Darter	Etheostoma microlepidum	1	
INVERTEBRATES	Taxa	Individuals	Sept 2003
	<i>Planaria</i> sp	1	-
	Elimia sp	73	
	<i> եւլուա</i> օր	13	
	Heptagenia sp	1	
	<u>-</u>	1 1 18	
	Heptagenia sp Stenacron sp	1	
	Heptagenia sp Stenacron sp Stenonema sp	1 18	
	Heptagenia sp Stenacron sp Stenonema sp Caenis sp	1 18 7	
	Heptagenia sp Stenacron sp Stenonema sp Caenis sp Heterocloeon frivolus	1 18 7 4	
	Heptagenia sp Stenacron sp Stenonema sp Caenis sp Heterocloeon frivolus Argia sp	1 18 7 4 2	
	Heptagenia sp Stenacron sp Stenonema sp Caenis sp Heterocloeon frivolus Argia sp Enallagma sp	1 18 7 4 2 72	
	Heptagenia sp Stenacron sp Stenonema sp Caenis sp Heterocloeon frivolus Argia sp	1 18 7 4 2 72 4	

23
10
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11
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43
2
1
1
1
11
1
1
19
7
1
3
2
30
48
3
13
1
1
38
3

Taxa	Individuals	Sept 2003
Achnanathes lanceolata	2	
Achnanathes minutissima	2	
Achnanthes pinnata	6	
Achnanthes sp. 2	8	
Amphora perpusilla	28	
Amphora submontana	14	
Caloneis bacillum	4	
Cocconeis placentula var. eug	glypta 6	
Cyclostephanos dubius	1	
Cyclotella stelligera	1	
Diploneis sp.	2	
Fragilaria vaucheriae	1	
Gomphonema brasiliense	3	
Gomphonema intricatum var.	pulvinatum	4
Gomphonema parvulum	6	
Gyrosigma attenuatum	2	
Gyrosigma scalproides	7	
Gyrosigma spencerii var. curv	rula 4	

Hippodonta capitata	I
Navicula auriculata	6
Navicula cf. goeppertiana	5
Navicula contenta	1
Navicula cryptocephala	2
Navicula elginensis	1
Navicula hustedtii	8
Navicula ingenua	17
Navicula menisculus	5
Navicula minima	120
Navicula pupula	6
Navicula schadei	4
Navicula schroeterii	24
Navicula secreta var. apiculata	5
Navicula seminulum	16
Navicula sp.	1
Navicula sp. 9a	4
Navicula tantula	4
Navicula tenelloides	79
Navicula tripunctata	7
Navicula viridula var. rostellata	4
Nitzschia amphibia	9
Nitzschia dissipata	22
Nitzschia dissipata var. media	12
Nitzschia sigma	1
Pinnularia microstauron	1
Reimeria sinuata	1
Rhoicosphenia curvata	2
Stauroneis smithii	1
Synedra rumpens var. familiaris	1
Tryblionella levidensis	61
Tryblionella victoriae	5

Station ID: CRR200008 Ecoregion: INTERIOR PLATEAU

Basin: LOWER CUMBERLAND Stream Name: NORTH FORK LITTLE

**RIVER** 

County: CHRISTIAN Map Name: CHURCHHILL

Catchment Area: 46.16 River Mile: 67.00 Stream Order: 5

**Lat Dec:** 36.86183 **Long Dec:** -87.51936

Location: 272 W. SIDE HOPKINSVILLE-200 M UPSTREAM FROM BRIDGE

#### **FISHES**

Common Name	Scientific Name	Individuals	<b>July 2003</b>
Striped Shiner	Luxilus chrysocephalus	1	
Rosefin Shiner	Lythrurus fasciolaris	96	
Bluntnose Minnow	Pimephales notatus	10	
Creek Chub	Semotilus atromaculatus	2	
Spotted Sucker	Minytrema melanops	12	
Bluegill	Lepomis macrochirus	4	
Longear Sunfish	Lepomis megalotis	23	
Redear Sunfish	Lepomis microlophus	1	

INVERTEBRATES	Taxa	Individuals May 2003

Taxa	Individuals	May 200
Oligochaeta	265	
Physella sp	14	
Elimia sp	374	
Planorbella sp	4	
Pisidium sp	5	
Corbicula fluminea	6	
Hirudinea	1	
Stenacron sp	2	
Caenis sp	19	
Argia sp	50	
Enallagma sp	12	
Calopteryx maculata	2	
<i>Epitheca (Epicordulia)</i> sp	3	
<i>Libellula</i> sp	1	
Macromia sp	1	
<i>Hydroptila</i> sp	2	
Cheumatopsyche sp	48	
Curculionidae (adult)	3	
Peltodytes sp (adult)	1	
Ancyronyx variegates (adult)	) 1	
<i>Tipula</i> sp	3	
Chironomidae (pupae)	13	
Ablabesmyia sp	2	
Chironomus sp	3	
Conchapelopia sp	8	
Cryptochironomus sp	5	

	Diouatou din ar an	12	
	Dicrotendipes sp	13	
	Endochironomus sp	40	
	Phaenopsectra sp	33 5	
	Polypedilum sp	3 20	
	Polypedilum convictum		
	Polypedilum tritum	10	
	Psectrocladius sp	1 7	
	Tanytarsus sp	_	
	Ceratopogon sp	1	
	Gammarus sp	1 10	*
	Caecidotea sp		
	Orconectes sp	10	
DIATOMS	Taxa I	ndividuals	May 2003
	Achnanathes lanceolata	8	
	Asterionella formosa	3	
	Aulacoseira granulata	4	
	Cyclotella pseudostelligera	3	
	Melosira varians	107	
	Navicula contenta	3	
	Navicula cryptocephala	5	
	Navicula menisculus	7	
	Navicula minima	11	
	Navicula pupula	7	
	Navicula secreta var. apiculata	22	
	Navicula viridula var. rostellat	a 12	
	Nitzschia capitellata	3	
	Nitzschia dissipata	12	
	Nitzschia palea	13	
	Nitzschia sp.	8	
	Stephanocyclus meneghiniana	3	
	Stephanodiscus sp.	24	
	Surirella angustata	4	
	Surirella ovalis	241	
	Surirella ovata	22	
	Surirella ovata var. pinnata	21	
FISHES			
Common Name	Scientific Name	ndividuals	Sept 2003
Striped Shiner	Luxilus chrysocephalus	1	<u>1</u>
Rosefin Shiner	Lythrurus fasciolaris	64	
Bluntnose Minnow	Pimephales notatus	3	
Creek Chub	Semotilus atromaculatus	1	
Spotted Sucker	Minytrema melanops	1	
Yellow Bullhead	Ameiurus natalis	1	
I THO IT DUTINIOUG	111100001 010 110000000	•	

Blackspotted Topminnow	Fundulus olivaceus	1	
Western Mosquitofish	Gambusia affinis	5	
Redbreast Sunfish	Lepomis auritus	8	
Green Sunfish	Lepomis cyanellus	3	
Longear Sunfish	Lepomis megalotis	27	
Largemouth Bass	Micropterus salmoides	1	
Fringed Darter	Etheostoma crossopterum	. 1	
INVERTEBRATES	Taxa I	ndividuals	<b>Sept 2003</b>
	<i>Elimia</i> sp	206	
	Stenacron sp	48	
	Caenis sp	7	
	<i>Argia</i> sp	88	
	Enallagma sp	28	
	Calopteryx maculata	6	
	Aeshna sp	1	
	Boyeria sp	1	
	Macromia sp	2	
	Perithemis sp	4	
	Microvelia sp	3	
	Rhagovelia sp	1	
	Aquarius sp	3	
	Gerris sp	8	
	Molanna sp	4	
	Ochrotrichia sp	1	
	Cheumatopsyche sp	29	
	Scirtes sp (larvae)	6	
	Ancyronyx variegates (adult)	1	
	Dubiraphia sp (adult)	2	
	Stenelmis sp (adult)	3	
	Stenelmis sp(larvae)	1	
	Tipula sp	1	
	Chironomidae (pupae)	15	
	Simulium sp	3	
	Odontomyia sp	2	
	Chrysops sp	1	
	Caecidotea sp	8	
DIATOMS	Taxa	Individuals	<b>Sept 2003</b>
	Achnanathes lanceolata	22	
	Achnanthes curtissima	5	
	Achnanthes pinnata	6	
	Amphora submontana	14	
	Caloneis bacillum	16	
	Cocconeis pediculus	2	
	Cocconeis placentula var. eug	glypta 20	

Cyclotella pseudostelligera	2	
Cyclotella stelligera	8	
Diploneis sp.	7	
Frustulia vulgaris	3	
Gomphonema intricatum var. pui	-	8
Gomphonema parvulum	22	•
Gyrosigma scalproides	4	
Hippodonta capitata	6	
Melosira ambigua	6	
Melosira distans var. alpigena	33	
Melosira granulata	11	
Navicula cf. goeppertiana	4	
Navicula clementis	6	
Navicula contenta	91	
Navicula cryptocephala	21	
Navicula cryptotenella	14	
Navicula hustedtii	4	
Navicula ingenua	8	
Navicula menisculus	14	
Navicula minima	37	
Navicula phyllepta	2	
Navicula placentula	3	
Navicula pupula	3	
Navicula schroeterii	36	
Navicula secreta var. apiculata	3	
Navicula seminulum	6	
Navicula sp.	26	
Navicula subhamulata	3	
Navicula subminuscula	3	
Navicula subtilissima	4	
Navicula tenelloides	61	
Navicula tenera	7	
Navicula tripunctata	5	
Navicula trivialis	3	
Navicula viridula var. rostellata	16	
Neidium binode	5	
Nitzschia amphibia	11	
Nitzschia constricta	4	
Nitzschia dissipata	9	
Nitzschia dissipata var. media	3	
Nitzschia frustulum	11	
Nitzschia palea	14	
Nitzschia parvula	3	
Nitzschia sp.	17	
Nitzschia sp. 5	2	
Pinnularia biceps	3	
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Reimeria sinuata	2
Rhoicosphenia curvata	18
Stauroneis smithii	3
Stephanocyclus meneghiniana	4
Stephanodiscus sp.	14
Surirella angustata	3
Surirella linearis var. helvetica	3
Surirella ovata	9
Synedra rumpens var. familiaris	4
Tryblionella levidensis	24
Tryblionella victoriae	3

Station ID: CRR200009

Basin: LOWER CUMBERLAND
County: CHRISTIAN

Ecoregion: INTERIOR PLATEAU
Stream Name: LITTLE RIVER
Map Name: CHURCH HILL

Catchment Area: 126.64 River Mile: 53.48 Stream Order: 5

**Lat Dec:**36.78336 **Long Dec:**-87.54604

Location: HUFFMAN MILL RD.-AT OLD DAM, DOWNSTREAM FROM BRIDGE -

DEEP WATER

Common Name	Scientific Name	Individuals	<b>July 2003</b>
Largescale Stoneroller	Campostoma oligolepis	2	·
Spotfin Shiner	Cyprinella spiloptera	6	
Striped Shiner	Luxilus chrysocephalus	17	
Rosefin Shiner	Lythrurus fasciolaris	41	
Redtail Chub	Nocomis effusus	2	
Bluntnose Minnow	Pimephales notatus	5	
Northern Hogsucker	Hypentelium nigricans	1	
Blackspotted Topminnow	Fundulus olivaceus	6	
Banded Sculpin	Cottus carolinae	3	
Rockbass	Ambloplites rupestris	1	
Bluegill	Lepomis macrochirus	1	
Longear Sunfish	Lepomis megalotis	3	
Snubnose Darter	Etheostoma simoterum	3	
Logperch	Percina caprodes	1	
INVERTEBRATES	Taxa	Individuals	May 2003
	Oligochaeta	62	•
	Physella sp	3	
	Elimia sp	155	
	Sphaerium sp	4	
	Corbicula fluminea	1	
	Hirudinea	1	
	Stenacron sp	13	
	Stenonema sp	4	
	Caenis sp	5	
	Baetidae	6	
	Baetis sp	17	
	<i>Argia</i> sp	4	
	Enallagma sp	18	
	Boyeria sp	1	
	Gomphidae	1	
	Hydroptila sp	7	
	Oecetis sp	1	
	Cheumatopsyche sp	235	
	Peltodytes sp	. 2	

Psephenus herricki (larvae)	6
Ancyronyx variegates (adult)	9
Dubiraphia sp (adult)	1
Dubiraphia sp (larvae)	1
Macronychus glabratus (adult)	12
Stenelmis sp (adult)	22
Tipula sp	1
Chironomidae (pupae)	5
Ablabesmyia sp	1
Apedilum elachistum	5
Conchapelopia sp	1
Cricotopus sp	1
Endochironomus sp	18
Helopelopia sp	1
Paratrichocladius sp.	1
Phaenopsectra sp	3
Polypedilum convictum	101
Polypedilum tritum	21
Potthastia sp	2
Tanytarsus sp	8
Simulium sp	2
Tabanidae	1
Gammarus sp	7
Caecidotea sp	13
Lirceus sp.	2
Orconectes sp	2
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#### May 2003 Taxa Individuals Achnanathes lanceolata 2 Achnanathes minutissima Achnanthidium minutissima var. saprophila 12 14 Caloneis bacillum Cocconeis pediculus Cocconeis placentula var. euglypta 13 Cymbella minuta Cymbella minuta var. pseudogracilis 3 8 Fragilaria vaucheriae Gomphonema minutum 33 Gomphonema olivaceum 3 Gomphonema parvulum 3 1 Gomphonema sp. 2 2 Gyrosigma scalproides 3 Hippodonta capitata Luticola mutica 3 137 Melosira varians Navicula contenta 6

Navicula cryptotenella	61
Navicula decussis	2
Navicula menisculus	5
Navicula minima	14
Navicula phyllepta	2
Navicula secreta var. apiculata	7
Navicula tripunctata	74
Nitzschia amphibia	1
Nitzschia dissipata	33
Nitzschia frustulum	3
Nitzschia hantzschiana	1
Nitzschia palea	13
Nitzschia sp. 5	4
Reimeria sinuata	6
Rhoicosphenia curvata	34
Stephanocyclus meneghiniana	2
Surirella angustata	8
Surirella ovata	30
Synedra ulna	3

FISHES			
Common Name	Scientific Name	Individuals	Sept 2003
Largescale Stoneroller	Campostoma oligolepis	2	_
Striped Shiner	Luxilus chrysocephalus	32	
Rosefin Shiner	Lythrurus fasciolaris	25	
Redtail Chub	Nocomis effusus	8	
Bluntnose Minnow	Pimephales notatus	3	
Creek Chubsucker	Erimyzon oblongus	1	
Northern Hogsucker	Hypentelium nigricans	1	
Banded Sculpin	Cottus carolinae	15	
Rockbass	Ambloplites rupestris	9	
Longear Sunfish	Lepomis megalotis	1	
Greenside Darter	Etheostoma blennioides	1	
Smallscale Darter	Etheostoma microlepidum	3	
Snubnose Darter	Etheostoma simoterum	9	
INVERTEBRATES	Taxa	Individuals	Sept 2003
	Planaria sp	3	_
	Elimia sp	133	
	Heptagenia sp	5	
	Stenacron sp	9	
	Procloeon sp	6	
	Argia sp	21	
	Enallagma sp	21	
	Calopteryx maculata	4	

Boyeria sp	2
Microvelia sp	2
Rhagovelia sp	2 3
Gerris sp	3
Ochrotrichia sp	7
Cheumatopsyche sp	18
Psephenus herricki (larvae)	7
Scirtes sp (larvae)	4
Berosus sp (adult)	. 1
Tropisternus sp (adult)	1
Ancyronyx variegates (adult)	6
Ancyronyx variegates (larvae)	4
Macronychus glabratus (adult)	12
Macronychus glabratus (larva)	1
Stenelmis sp (adult)	13
Stenelmis sp (larvae)	19
Chaoborus sp	1
Tipula sp	1
Hemerodromia sp	10
Simulium sp	25
Simulium sp	34
Chironomidae (pupae)	9
Atrichopogon sp	3
Culicoides sp	1
Gammarus sp	3
Caecidotea sp	6

Taxa	Individuals	Sept 2003
Achnanathes lanceolata	11	
Achnanthes curtissima	6	
Achnanthes pusilla	3	
Achnanthidium minutissima	var. saprophila	. 11
Amphora perpusilla	8	
Amphora submontana	3	
Caloneis bacillum	5	
Cocconeis placentula var. eu	iglypta 18	
Cyclotella pseudostelligera	2	
Cyclotella sp.	3	
Cymbella minuta	8	
Diploneis sp.	3	
Gomphonema gracile	2	
Gomphonema intricatum var	. pulvinatum	4
Gomphonema parvulum	8	
Gyrosigma scalproides	8	
Hantzschia amphioxys	5	
Luticola mutica	9	

Melosira granulata	2
Melosira varians	3
Navicula cf. goeppertiana	8
Navicula contenta	2
Navicula cryptocephala	13
Navicula cryptotenella	18
Navicula decussis	2
Navicula hustedtii	8
Navicula ingenua	3
Navicula menisculus	5
Navicula minima	46
Navicula pupula	2
Navicula schadei	6
Navicula schroeterii	81
Navicula secreta var. apiculata	11
Navicula seminulum	15
Navicula sp. 4	3
Navicula subminuscula	18
Navicula subtilissima	7
Navicula tantula	7
Navicula tenelloides	31
Navicula tripunctata	10
Navicula trivialis	8
Navicula viridula	34
Nitzschia capitellata	2
Nitzschia constricta	6
Nitzschia denticula	2
Nitzschia dissipata	16
Nitzschia frustulum	5
Nitzschia hungarica	3
Nitzschia palea	26
Nitzschia sp.	14
Reimeria sinuata	7
Rhoicosphenia curvata	8
Stauroneis smithii	6
Stephanocyclus meneghiniana	1
Stephanodiscus sp.	2
Surirella ovata	9
Synedra rumpens var. familiaris	3
Synedra ulna	6

Station ID: CRR200010 Ecoregi

Basin: LOWER CUMBERLAND

County: CHRISTIAN
Catchment Area: 16.64

Slabrock Darter

Lat Dec: 36.91603

Location: S.R. 91-PRINCETON @ BRIDGE

Ecoregion: IN	TERIOR PLATEAU
Stream Name:	SINKING FORK

Map Name: PLEASANT GREEN HILL River Mile: 30.39 Stream Order: 4

**Long Dec:** -87.57668

FISHES			
Common Name	Scientific Name	Individuals	<b>July 2003</b>
Largescale Stoneroller	Campostoma oligolepis	2	

Largescale Stoneroller	Campostoma oligolepis	2
Striped Shiner	Luxilus chrysocephalus	71
Rosefin Shiner	Lythrurus fasciolaris	250
Bluntnose Minnow	Pimephales notatus	24
Creek Chub	Semotilus atromaculatus	3
Northern Hogsucker	Hypentelium nigricans	2
Blackspotted Topminnow	Fundulus olivaceus	8
Banded Sculpin	Cottus carolinae	10
Bluegill	Lepomis macrochirus	6
Longear Sunfish	Lepomis megalotis	13
Largemouth Bass	Micropterus salmoides	5
Fringed Darter	Etheostoma crossopterum	10

# INVERTEBRATES Taxa Individuals May 2003

Etheostoma smithi

1 axa	Illuividuais	May 2003
Oligochaeta	28	
Physella sp	2	
Elimia sp	83	
Gyraulus sp	1	
Planorbella sp	2	
Sphaerium sp	37	
Paraleptophlebia sp	5	
Stenonema sp	6	
Caenis sp	16	
Acentrella sp	21	
Baetidae	4	
Enallagma sp	2	
Perlesta sp	9	
Trichocorixa sp	1	
Cheumatopsyche sp	43	
Curculionidae (adult)	2	
Lampyridae (larva)	1	
Peltodytes sp (adult)	2	
Thinobius sp (adult)	1	
Hydroporus sp (adult)	1	
Neoporus sp (adult)	2	
Dubiraphia sp (adult)	1	
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Dubiraphia sp (larvae)	2
Macronychus glabratus (adult)	1
Stenelmis sp (adult)	8
Elmidae (larva)	1
Chironomidae (pupae)	10
Ablabesmyia sp	2
Apedilum elachistum	8
Conchapelopia sp	16
Cryptochironomus sp	3
Dicrotendipes sp	8
Endochironomus sp	84
Larsia sp	3
Phaenopsectra sp	17
Polypedilum sp	6
Polypedilum convictum	48
Polypedilum tritum	6
Psectrocladius sp	2
Tanytarsus sp	11
Simulium sp	103
Caecidotea sp	9
Lirceus sp.	2
Orconectes sp	17
Hydracarina	1

Taxa	Individuals	May 2003
Achnanathes lanceolata	12	•
Achnanathes minutissima	205	
Achnanthes pusilla	8	
Achnanthes sp. 2	12	
Achnanthes sp.1	20	
Achnanthidium minutissima	var. saprophila	38
Amphora perpusilla	6	
Caloneis bacillum	14	
Cocconeis pediculus	16	
Cocconeis placentula var. eu	glypta 14	
Ctenophora pulchella	3	
Cymbella minuta	3	
Diploneis sp.	1	
Frustulia vulgaris	1	
Gomphonema minutum	36	
Gomphonema parvulum	6	
Gyrosigma scalproides	1	
Hantzschia amphioxys	1	
Hippodonta capitata	2	
Navicula cryptocephala	10	
Navicula cryptotenella	16	

Navicula menisculus var. upsaliens	is 14
Navicula minima	18
Navicula secreta var. apiculata	10
Navicula subminuscula	6
Navicula tripunctata	7
Nitzschia amphibia	4
Nitzschia dissipata	31
Nitzschia frustulum	16
Nitzschia palea	4
Rhoicosphenia curvata	61
Stephanocyclus meneghiniana	2
Surirella ovata	4

FISHES			
Common Name	Scientific Name	Individuals	<b>Sept 2003</b>
Largescale Stoneroller	Campostoma oligolepis	10	
Striped Shiner	Luxilus chrysocephalus	29	
Rosefin Shiner	Lythrurus fasciolaris	3	
Bluntnose Minnow	Pimephales notatus	14	
Creek Chub	Semotilus atromaculatus	19	
White Sucker	Catostomus commersoni	2	
Creek Chubsucker	Erimyzon oblongus	11	
Yellow Bullhead	Ameiurus natalis	2	
Pirate Perch	Aphredoderus sayanus	3	
Blackspotted Topminnow	Fundulus olivaceus	1	
Western Mosquitofish	Gambusia affinis	1	
Green Sunfish	Lepomis cyanellus	23	
Bluegill	Lepomis macrochirus	4	
Longear Sunfish	Lepomis megalotis	15	
Friged Darter	Etheostoma crossopterum	36	
Slabrock Darter	Etheostoma smithi	20	
INVERTEBRATES	Taxa	Individuals	Sept 2003
	Planaria sp	23	_
	Elimia sp	93	
	Choroterpes sp	8	
	Heptagenia sp	95	
	Stenacron sp	8	
	Caenis sp	10	
	Procloeon sp	1	
	Argia sp	24	
	Enallagma sp	13	
	Calopteryx maculata	16	
	Boyeria sp	3	
	Dromogomphus sp	1	

Epitheca (Epicordulia) sp	1
Microvelia sp	34
Aquarius sp	2
Gerris sp	9
Molanna sp	2
Cheumatopsyche sp	118
Helichus striatus (adult)	11
Ectopria nervosa (larva)	1
Scirtes sp (larva)	1
Hydroporus sp (adult)	1
Hydrovatus sp (adult)	1
Dubiraphia sp (adult)	12
Dubiraphia sp (larvae)	10
Optioservus sp(larvae)	1
Stenelmis sp (adult)	13
Stenelmis sp (larvae)	18
Limonia sp	2
Molophilus sp	1
Hemerodromia sp	1
Chironomidae (pupae)	3
Simulium sp	1
Lirceus sp.	74
Orconectes sp	1

Taxa	Individuals	Sept 2003
Achnanathes lanceolata var.	dubia 3	-
Achnanthes biasolettiana	8	
Achnanthes curtissima	19	
Achnanthes pinnata	67	
Achnanthes sp. 2	23	
Achnanthidium minutissima	var. saprophila	46
Amphora perpusilla	73	
Amphora submontana	6	
Caloneis bacillum	53	
Cocconeis pediculus	4	
Cocconeis placentula	2	
Diploneis sp.	13	
Gomphonema brasiliense	13	
Gyrosigma scalproides	3	
Navicula cryptotenella	9	
Navicula helensis	6	
Navicula hustedtii	4	
Navicula minima	30	
Navicula pupula	3	
Navicula schadei	12	
Navicula seminulum	6	

Navicula subminuscula	3
Navicula tripunctata	2
Navicula viridula	3
Nitzschia amphibia	6
Nitzschia capitellata	3
Nitzschia constricta	3
Nitzschia denticula	36
Nitzschia fonticola	3
Nitzschia frustulum	6
Nitzschia palea	4
Nitzschia sinuata var. tabellaria	9
Nitzschia sp. 4	3
Reimeria sinuata	3
Rhoicosphenia curvata	109

Station ID:CRR200011Ecoregion:INTERIOR PLATEAUBasin:LOWER CUMBERLANDStream Name:SINKING FORK

County:CHRISTIANMap Name:PLEASANT GREEN HILLCatchment Area:30.14River Mile:14.15Stream Order:4

**Lat Dec:** 36.8812 **Long Dec:** -87.60839

Location: HWY 68-SAMPLE BEHIND OLD GREY CHURCH-200 M BELOW 68-80

**BRIDGE** 

FISHES			
Common Name	Scientific Name	Individuals	<b>July 2003</b>
Largescale Stoneroller	Campostoma oligolepis	4	-
Striped Shiner	Luxilus chrysocephalus	22	
Rosefin Shiner	Lythrurus fasciolaris	239	
Bluntnose Minnow	Pimephales notatus	33	
Western Mosquitofish	Gambusia affinis	1	
Banded Sculpin	Cottus carolinae	4	
Rockbass	Ambloplites rupestris	1	
Bluegill	Lepomis macrochirus	13	
Longear Sunfish	Lepomis megalotis	4	
Fringed Darter	Etheostoma crossopterum	8	
Snubnose Darter	Etheostoma simoterum	4	
Slabrock Darter	Etheostoma smithi	1	
Logperch	Percina maculata	1	
INVERTEBRATES	Taxa	Individuals	May 2003
	Oligochaeta	70	•
	Planaria sp	1	
	Viviparus sp	1	
	Physella sp	10	
	Elimia sp	179	
	Sphaerium sp	46	
	Corbicula fluminea	6	
	Hirudinea	2	
	Stenacron sp	7	
	Stenonema sp	34	
	Caenis sp	30	
	Acentrella sp	19	
	Baetis sp	72	
	Argia sp	2	
	Enallagma sp	2	
	Boyeria sp	2	
	Dromogomphus sp	2 3	
	Libellula sp	1	
	Somatochlora sp	1	
	Perlesta sp	50	
	Alloperla sp	2	

<i>Microvelia</i> sp	1	
Hydrometra martini	1	
<i>Hydroptila</i> sp	5	
Cheumatopsyche sp	297	
Hydropsyche sp	1	
Chimarra sp	5	
Helichus striatus (adult)	1	
Peltodytes sp (adult)	3	
Dubiraphia sp (adult)	1	
Dubiraphia sp (larvae)	2	
Stenelmis sp (adult)	317	
Chironomidae (pupae)	12	
Apedilum elachistum	27	
Conchapelopia sp	78	
Corynoneura sp	1	
Cricotopus sp	2	
Cricotopus/Orthocladius gr	2	
Cryptochironomus sp	18	
Endochironomus sp	81	
Larsia sp	2	
Paratrichocladius sp.	2	
Phaenopsectra sp	27	
Polypedilum sp	9 .	
Polypedilum convictum	286	
1 Olypoullant Conficient	200	
	Q	
Polypedilum tritum	9 1	
Polypedilum tritum Potthastia sp	1	
Polypedilum tritum Potthastia sp Psectrocladius sp	1 1	
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp	1 1 18	
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp	1 1 18 15	
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp	1 1 18 15	
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp	1 1 18 15 1 4	
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp.	1 1 18 15 1 4	
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp	1 1 18 15 1 4 1 42	
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp.	1 1 18 15 1 4	
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina	1 1 18 15 1 4 1 42 4	May 2003
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina Indiv	1 1 18 15 1 4 1 42	May 2003
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina  Taxa Indiv	1 18 15 1 4 1 42 4 Viduals 3	May 2003
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina  Taxa Indiv Achnanathes lanceolata Achnanathes lanceolata var.dubia	1 18 15 1 4 1 42 4	May 2003
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina  Taxa Indivachnanathes lanceolata Achnanathes pusilla	1 18 15 1 4 1 42 4 <b>viduals</b> 3 3	·
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina  Taxa Indiv Achnanathes lanceolata Achnanathes pusilla Achnanthidium minutissima var. sa	1 18 15 1 4 1 42 4 viduals 3 3 4	·
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina  Taxa Indiv Achnanathes lanceolata Achnanathes lanceolata var.dubia Achnanthes pusilla Achnanthidium minutissima var. sa Amphora ovalis	1 18 15 1 4 1 42 4 <b>viduals</b> 3 3	·
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina  Taxa Indiv Achnanathes lanceolata Achnanathes pusilla Achnanthidium minutissima var. sa Amphora ovalis Amphora perpusilla	1 18 15 1 4 1 42 4 viduals 3 3 4 prophila 2 5	·
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina  Taxa Indiv Achnanathes lanceolata Achnanathes lanceolata var.dubia Achnanthidium minutissima var. sa Amphora ovalis Amphora perpusilla Caloneis bacillum	1 18 15 1 4 1 42 4 viduals 3 3 4 prophila 2 5	·
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina  Taxa Indiv Achnanathes lanceolata Achnanathes lanceolata var.dubia Achnanthidium minutissima var. sa Amphora ovalis Amphora perpusilla Caloneis bacillum Cocconeis pediculus	1 18 15 1 4 1 42 4 <b>viduals</b> 3 3 4 <b>prophila</b> 2 5 16 44	·
Polypedilum tritum Potthastia sp Psectrocladius sp Tanytarsus sp Simulium sp Chrysops sp Ceratopogon sp Lirceus sp. Orconectes sp Hydracarina  Taxa Indiv Achnanathes lanceolata Achnanathes lanceolata var.dubia Achnanthidium minutissima var. sa Amphora ovalis Amphora perpusilla Caloneis bacillum	1 18 15 1 4 1 42 4 <b>viduals</b> 3 3 4 <b>prophila</b> 2 5 16 44	·

Gomphonema minutum	25
Gomphonema olivaceum	18
Gyrosigma scalproides	3
Melosira varians	8
Navicula cryptocephala	9
Navicula cryptotenella	100
Navicula helensis	7
Navicula menisculus	4
Navicula minima	5
Navicula secreta var. apiculata	6
Navicula seminulum	2
Navicula tripunctata	22
Navicula trivialis	4
Nitzschia amphibia	3
Nitzschia apiculata	2
Nitzschia dissipata	63
Nitzschia fonticola	15
Nitzschia frustulum	1
Nitzschia linearis	7
Nitzschia sp. 5	4
Rhoicosphenia curvata	125
Stauroneis smithii	2
Surirella ovata	19
Synedra ulna	1

FISHES			a
Common Name	Scientific Name	Individuals	<b>Sept 2003</b>
Largescale Stoneroller	Campostoma oligolepis	1	
Striped Shiner	Luxilus chrysocephalus	15	
Rosefin Shiner	Lythrurus fasciolaris	188	
Bluntnose Minnow	Pimephales notatus	57	
Creek Chub	Semotilus atromaculatus	10	
Creek Chubsucker	Erimyzon oblongus	1	
Yellow Bullhead	Ameiurus natalis	2	
Blackspotted Topminnow	Fundulus olivaceus	3	
Banded Sculpin	Cottus carolinae	8	
Green Sunfish	Lepomis cyanellus	2	
Bluegill	Lepomis macrochirus	3	
Longear Sunfish	Lepomis megalotis	3	
Largemouth Bass	Micropterus salmoides	1	
Fringed Darter	Etheostoma crossopterum	25	
Slabrock Darter	Etheostoma smithi	3	
INVERTEBRATES	Taxa	Individuals	Sept 2003
	Planaria sp	6	

Laevapex sp	8
Elimia sp	217
Heptagenia sp	95
Stenacron sp	53
Caenis sp	22
Argia sp	9
Enallagma sp	52
Calopteryx maculata	3
Anax sp	1
Boyeria sp	8
Perithemis sp	7
Microvelia sp	40
Belostoma sp	1
Aquarius sp	1
Gerris sp	7
Climacia sp	2
Cheumatopsyche sp	2 2 5
Chimarra sp	5
Helichus striatus (adult)	7
Ectopria nervosa (larva)	9
Peltodytes sp (adult)	22
Scirtes sp (larvae)	2
Berosus sp (adult)	3
Berosus sp (larvae)	6
Dubiraphia sp (adult)	48
Dubiraphia sp (larvae)	6
Microcylloepus pusillus (adult)	4
Stenelmis sp (adult)	7
Stenelmis sp (larvae)	27
Chironomidae (pupae)	5
Aedes cinereus	1
Gammarus sp	59
Lirceus sp.	8
Orconectes sp	12

Taxa	Individuals	Sept 2003
Achnanathes lanceolata	10	
Achnanthes curtissima	12	
Achnanthidium minutissima ve	ar. saprophila	48
Amphora ovalis var. pediculus	s 4	
Amphora submontana	9	
Caloneis bacillum	2	
Caloneis hyalina	8	
Cocconeis placentula var. eug	lypta 7	
Cymbella minuta	3	
Diploneis sp.	11	

Gomphonema parvulum	5
Gomphonema sp.	8
Gomphonema sphaerophorum	5
Gyrosigma scalproides	3
Gyrosigma spencerii var. curvula	6
Hantzschia amphioxys	6
Hippodonta capitata	4
Navicula capitatoradiata	18
Navicula cf. goeppertiana	4
Navicula cryptocephala	16
Navicula cryptotenella	147
Navicula decussis	4
Navicula hustedtii	7
Navicula menisculus	14
Navicula minima	8
Navicula pupula	6
Navicula schadei	46
Navicula schroeterii	18
Navicula seminulum	5
Navicula sp.	29
Navicula trivialis	6
Navicula viridula	14
Nitzschia amphibia	24
Nitzschia capitellata	3
Nitzschia constricta	2
Nitzschia dissipata '	49
Nitzschia linearis	2
Nitzschia palea	87
Nitzschia sp. 4	6
Pinnularia biceps	3
Rhoicosphenia curvata	22
Stauroneis smithii	3
Stephanocyclus meneghiniana	5
Surirella ovata	3

Station ID:CRR200012Ecoregion:INTERIOR PLATEAUBasin:LOWER CUMBERLANDStream Name:LITTLE RIVER

County: CHRISTIAN Map Name: CHURCH HILL

Catchment Area: 129.64 River Mile: 50.63 Stream Order: 5

**Lat Dec:** 36.76038 **Long Dec:** -87.5501

**Location:** 117 TO STRIPED BRIDGE RD

#### **FISHES**

Common Name	Scientific Name	Individuals	<b>July 2003</b>
Largescale Stoneroller	Campostoma oligolepis	1	
Striped Shiner	Luxilus chrysocephalus	4	
Rosefin Shiner	Lythrurus fasciolaris	92	
Redtail Chub	Nocomis effusus	3	
Banded Sculpin	Cottus carolinae	4	
Rockbass	Ambloplites rupestris	1	
Saffron Darter	Etheostoma flavum	2	
Smallscale Darter	Etheostoma microlepidum	1	
Orangethroat Darter	Etheostoma spectabile	1	

#### **INVERTEBRATES**

Taxa	Individuals	May 2003
Oligochaeta	78	•
Valvata sp.	2	
Fossaria sp	1	
Physella sp	2	
Elimia sp	595	
Planorbella sp	1	
Sphaerium sp	3	
Corbicula fluminea	5	
Stenonema sp	9	
Eurylophella sp	2	
Caenis sp	15	
Baetis sp	6	
Argia sp	7	
Enallagma sp	11	
Dromogomphus sp	1	
Hagenius brevistylus		1
Epitheca (Tetragoneuria) sp	1	
Somatochlora sp	1	
Rhagovelia sp	2	
Oecetis sp	2	
Cheumatopsyche sp	21	
Staphylinidae (adult)	1	
Psephenus herricki (larvae)	13	
Ancyronyx variegates (adult)	3	
Dubiraphia sp (adult)	2	

Macronychus glabratus (adul	(t) 12	
Stenelmis sp (adult)	15	
Limonia sp	2	
Tipula sp	10	
Chironomidae (pupae)	7	
Ablabesmyia sp	2	
Apedilum elachistum	3	
Brillia sp	1	
Conchapelopia sp	2	
Cricotopus/Orthocladius gr	2	
Dicrotendipes sp	1	
Glyptotendipes sp	2	
Larsia sp	1	
Phaenopsectra sp	3	
Polypedilum sp	2	
Polypedilum convictum	7	
Tanytarsus sp	3	
Ephydridae	2	
Simulium sp	2	
Culicoides sp	2	
Gammarus sp	124	
Caecidotea sp	10	
Taxa	Individuals	May
Achnanathes lanceolata	14	•
Amphora perpusilla	2.	

Taxa	Individuals	May 2003
Achnanathes lanceolata	14	
Amphora perpusilla	2	
Aulacoseira granulata	3	
Caloneis bacillum	26	
Cocconeis pediculus	11	
Cocconeis placentula var. eug	lypta 22	
Cyclostephanos dubius	1	
Cyclotella pseudostelligera	2	
Cymbella minuta	3	
Fragilaria vaucheriae	4	
Gomphonema intricatum var.	pulvinatum	8
Gomphonema minutum	9	
Gomphonema olivaceum	16	
Gomphonema parvulum	53	
Gyrosigma scalproides	10	
Hippodonta capitata	2	
Melosira varians	26	
Meridion circulare	9	
Navicula atomus	6	
Navicula auriculata	7	
Navicula cryptocephala	3	
Navicula cryptocephala var. v	eneta 5	

Navicula cryptotenella	74
Navicula decussis	4
Navicula integra	3
Navicula menisculus	5
Navicula menisculus var. upsaliensis	s 4
Navicula minima	13
Navicula phyllepta	3
Navicula pupula	3
Navicula secreta var. apiculata	6
Navicula seminulum	9
Navicula sp.	4
Navicula tripunctata	32
Navicula trivialis	6
Nitzschia apiculata	1
Nitzschia dissipata	55
Nitzschia fonticola	3
Nitzschia gracilis	5
Nitzschia ignorata	4
Nitzschia linearis	7
Nitzschia palea	2
Nitzschia sp.	7
Nitzschia sp. 5	5
Punctastriata pinnata	3
Rhoicosphenia curvata	27
Stephanodiscus tenuis	7
Surirella angustata	14
Surirella ovata	27
Surirella sp. 1	1
Synedra ulna	21

#### **FISHES** Scientific Name Individuals **Sept 2003 Common Name** Cyprinella spiloptera 3 Spotfin Shiner 19 Luxilus chrysocephalus **Striped Shiner** Lythrurus fasciolaris 24 Rosefin Shiner Nocomis effusus 1 Redtail Chub Gambusia affinis Western Mosquitofish 1 Banded Sculpin Cottus carolinae 32 Ambloplites rupestris 11 **Rockbass** Lepomis cyanellus 8 Green Sunfish Lepomis macrochirus 5 Bluegill Etheostoma flavum Saffron Darter 1 Etheostoma microlepidum 3 Smallscale Darter

INVERTEBRATES	<b>Taxa</b> <i>Planaria</i> sp <i>Elimia</i> sp	Individuals 1 2781	Sept 2003
	Isonychia sp	1	
	Stenacron sp	7	
	Stenonema sp	12	
	Baetis sp	11	
	Argia sp	12	
	Enallagma sp	6	
	Calopteryx maculata	1	
	Boyeria sp	1	
	Microvelia sp	7	
	Rhagovelia sp	2	
	Gerris sp	6	
	Cheumatopsyche sp	30	
	Macrostemum zebratum	2	
	Potamyia flava	4	
	Psephenus herricki (larvae)	14	
	Peltodytes sp (adult)	1	
	Ancyronyx variegates (adult)	3	
	Ancyronyx variegates (larvae)		
	Dubiraphia sp (adult)	5	
	Macronychus glabratus (adult		
	Microcylloepus pusillus (adult	,	
	Stenelmis sp (adult)	21	
	Stenelmis sp (larvae)	56	
	Tipula sp	3	
	Chironomidae (pupae)	3	
	Hemerodromia sp	1	
	Simulium sp	2	
	Simulium sp	18	
	Gammarus sp	75	
	Caecidotea sp	2	
	cucouatea sp	~	
DIATOMS	Taxa ]	<b>Individuals</b>	<b>Sept 2003</b>
	Achnanathes lanceolata	18	~ <b>,</b>
	Amphora perpusilla	11	
	Amphora sp.	4	
	Amphora submontana	24	
	Caloneis bacillum	18	
	Cocconeis pediculus	16	
	Cocconeis placentula var. eug		
	Cyclotella sp.	16	
	Fragilaria vaucheriae	9	
	Gomphonema intricatum var.	=	14
	Gyrosigma scalproides	8	21

Melosira granulata	3
Melosira varians	21
Navicula auriculata	3
Navicula cf. goeppertiana	14
Navicula contenta	14
Navicula cryptocephala	8
Navicula cryptotenella	19
Navicula decussis	12
Navicula menisculus	16
Navicula minima	52
Navicula schroeterii	64
Navicula secreta var. apiculata	6
Navicula seminulum	15
Navicula subtilissima	3
Navicula tenelloides	51
Navicula tripunctata	16
Navicula trivialis	7
Navicula viridula	4
Nitzschia amphibia	6
Nitzschia constricta	8
Nitzschia dissipata	16
Nitzschia palea	12
Nitzschia recta	8
Nitzschia sp.	12
Reimeria sinuata	14
Rhoicosphenia curvata	46
Sellophora pupula var. elliptica	8
Sellophora pupula var. mutata	5
Stauroneis smithii	3
Stephanocyclus meneghiniana	4
Synedra ulna	6
Tryblionella victoriae	2

Station ID: CRR200013 Ecoregion: INTERIOR PLATEAU

Position I OWED CHARDED AND

Basin: LOWER CUMBERLAND
County: TRIGG
Stream Name: LITTLE RIVER
Map Name: CALEDONIA

Catchment Area: 243.72 River Mile: 31.46 Stream Order: 5

**Lat Dec:** 36.77781 **Long Dec:** -87.7223

Location: SSR 1253-ABOVE CASEY CREEK CONFLUENCE W/ LITTLE RIVER

#### **FISHES**

Common Name	Scientific Name	Individuals	<b>July 2003</b>
Largescale Stoneroller	Campostoma oligolepis	65	·
Striped Shiner	Luxilus chrysocephalus	38	
Rosefin Shiner	Lythrurus fasciolaris	32	
Redtail Chub	Nocomis effusus	3	
Bluntnose Minnow	Pimephales notatus	3	
Northern Hogsucker	Hypentelium nigricans	3	
Spotted Sucker	Minytrema melanops	1	
Banded Sculpin	Cottus carolinae	1	
Saffron Darter	Etheostoma flavum	2	
Smallscale Darter	Etheostoma microlepidum	13	
Snubnose Darter	Etheostoma simoterum	2	

#### **INVERTEBRATES**

Taxa	Individuals	May 2003
Oligochaeta	15	·
Planaria sp	4	
Physella sp	1	
Elimia sp	63	
Isonychia sp	1	
Stenacron sp	1	
Stenonema sp	4	
Eurylophella sp	11	
Caenis sp	3	
Baetidae	6	
Calopteryx maculata	2	
Somatochlora sp	1	
Oecetis sp	1	
Cernotina sp	1	
Psephenus herricki (larvae)	1	
Helichus striatus (adult)	2	
Peltodytes sp (adult)	3	
Thinobius sp (adult)	1	
Hydaticus sp (adult)	1	
Hydroporus sp (adult)	1	
Neoporus sp (adult)	1	
Dyticidae (adult)	2	
Macronychus glabratus (adu	lt) 7	
Stenelmis sp (adult)	2	

Chironomidae (pupae)	28
Ablabesmyia sp	2
Apedilum elachistum	10
Brillia sp	10
Conchapelopia sp	4
Corynoneura sp	6
Cricotopus/Orthocladius gr	2
Endochironomus sp	10
Larsia sp	5
Paratanytarsus sp	10
Phaenopsectra sp	5
Polypedilum sp	15
Tanytarsus sp	205
Simulium sp	13
Gammarus sp	322
Lirceus sp.	1
Cambaridae	2

Taxa	Individuals	May 2003
Achnanathes lanceolata	34	
Achnanathes lanceolata var.	dubia 12	
Achnanthes curtissima	20	
Achnanthes pusilla	14	
Achnanthidium minutissima	var. saprophila	20
Amphora perpusilla	8	
Gomphonema gracile	3	
Melosira varians	11	
Meridion circulare	2	
Navicula cryptocephala	6	
Navicula cryptotenella	2	
Navicula menisculus	3	
Navicula menisculus var. ups	saliensis 62	
Navicula secreta var. apicula	ata 8	
Navicula seminulum	4	
Navicula subhamulata	1	
Navicula trivialis	8	
Navicula viridula var. rosteli		
Nitzschia dissipata	64	
Nitzschia dissipata var. medi	ia 4	
Nitzschia frustulum	136	
Nitzschia palea	43	
Nitzschia sp.	15	
Planothidium lanceolata	16	
Surirella angustata	2	
Surirella ovata	61	

FISHES			
Common Name	Scientific Name	Individuals	Sept 2003
Longnose Gar	Lepisosteus osseus	1	
Largescale Stoneroller	Campostoma oligolepis	13	
Striped Shiner	Luxilus chrysocephalus	31	
Bluntnose Minnow	Pimephales notatus	2	
Northern Hogsucker	Hypentelium nigricans	1	
Banded Sculpin	Cottus carolinae	37	
Rockbass	Ambloplites rupestris	6	
Largemouth Bass	Micropterus salmoides	1	
Greenside Darter	Etheostoma blennioides	1	
Rainbow Darter	Etheostoma caeruleum	4	
Smallscale Darter	Etheostoma microlepidum	24	
Snubnose Darter	Etheostoma simoterum	10	
Logperch	Percina caprodes	1	
Slenderhead Darter	Percina phoxocephala	1	
	i e. ea pe.eepi.a.a	•	
INVERTEBRATES	Taxa	Individuals	<b>Sept 2003</b>
	Planaria sp	11	_
	Elimia sp	307	
	Choroterpes sp	1	
	Heptagenia sp	60	
	Caenis sp	1	
	Calopteryx maculata	20	
	Boyeria sp	3	
	Leuctra sp	2	
	Aquarius sp	6	
	Microvelia sp	7	
	Rhagovelia sp	3	
	Ranatra sp	2	
	Hydrometra martini	1	
	Agraylea sp	2	
	Hydroptila sp	1	
	Cheumatopsyche sp	26	
	Berosus sp (adult)	1	
	Gyrinus sp (adult)	1	
	Laccophilus sp (adult)	1	
	Ancyronyx variegates (adult)	1	
	Optioservus sp (larvae)	7	
	Stenelmis sp (adult)	3	
	Stenelmis sp (larvae)	3	
	Tipula sp	1	
	Chironomidae (pupae)	44	
	Hemerodromia sp	3	
	Simulium sp	1	
	Simulium sp	8	
	•		

Stratiomys sp	1
Gammarus sp	319
Lirceus sp.	4
Orconectes sp	1

Taxa	Individuals	Sept 2003
Achnanathes lanceolata	30	-
Achnanathes lanceolata var.a	lubia 7	
Achnanathes minutissima	34	
Achnanthes pusilla	34	
Achnanthes sp. 2	7	
Achnanthes sp. 3	10	
Achnanthes sp.1	4	
Achnanthidium minutissima v	ar. saprophila	23
Amphora perpusilla	8	
Cocconeis placentula var. eug	glypta 31	
Cymbella minuta	17	
Cymbella silesiaca	8	
Gomphonema brasiliense	3	
Gomphonema intricatum var.	pulvinatum	4
Gomphonema minutum	2	
Gomphonema sp.	5	
Melosira varians	5	
Meridion circulare	2	
Navicula capitatoradiata	29	
Navicula contenta	6	
Navicula cryptocephala	13	
Navicula cryptotenella	15	
Navicula decussis	1	
Navicula helensis	9	
Navicula hustedtii	1	
Navicula menisculus	6	
Navicula minima	88	
Navicula schadei	2	
Navicula schroeterii	4	
Navicula secreta var. apicula		
Navicula seminulum	27	
Navicula sp. 4	13	
Navicula tantula	8	
Navicula tripunctata	4	
Navicula trivialis	2	
Navicula viridula	7	
Nitzschia capitellata	4	
Nitzschia dissipata	21	
Nitzschia fonticola	22	
Nitzschia palea	14	

Nitzschia sinuata var. tabellaria	2
Nitzschia sp.	1
Reimeria sinuata	3
Rhoicosphenia curvata	6
Stauroneis smithii var. incisa	1
Staurosirella leptostauron	2
Stephanocyclus meneghiniana	2
Surirella ovata	8

Station ID: CRR200014

Basin: LOWER CUMBERLAND

County: TRIGG

Catchment Area: 30.72

**Lat Dec:** 36.75579

Ecoregion: INTERIOR PLATEAU Stream Name: CASEY CREEK Map Name: CALEDONIA

River Mile: 33.66 Stream Order: 4

**Long Dec:** -87.72483

Location: ROARING SPRINGS RD-PUBLIC FISHING AREA HWY 525

### **FISHES**

Common Name	Scientific Name	Individuals	<b>July 2003</b>
Striped Shiner	Luxilus chrysocephalus	5	
Rosefin Shiner	Lythrurus fasciolaris	20	
Creek Chub	Semotilus atromaculatus	4	
Banded Sculpin	Cottus carolinae	1	
Snubnose Darter	Etheostoma simoterum	4	
Orangethroat Darter	Etheostoma spectabile	18	

### **INVERTEBRATES**

Taxa	Individuals	May 2003
Oligochaeta	27	
Elimia sp	51	
Gyraulus sp	1	
Stenacron sp	4	
Attenella sp	1	
Eurylophella sp	8	
Caenis sp	1	
Baetis sp	6	
Enallagma sp	1	
Calopteryx maculata	5	
Corduliidae	2	
Boyeria sp	1	
Cheumatopsyche sp	1	
Helichus striatus (adult)	2	
Scirtidae (larva)	1	
Agabus sp (adult)	1	
Copelatus sp (adult)	1	
Hydaticus sp (adult)	1	
Optioservus sp (adult)	22	
Chironomidae (pupae)	15	
Apedilum elachistum	3	
Brillia sp	15	
Chironomus sp	1	
Conchapelopia sp	6	
Cricotopus sp	1	
Dicrotendipes sp	2	
Endochironomus sp	3	
Larsia sp	1	
Paratanytarsus sp	8	
-		

Phaenopsectra sp	2
Polypedilum convictum	3
Polypedilum tritum	1
Potthastia sp	1
Tanytarsus sp	55
Simulium sp	46
Gammarus sp	1467
Lirceus sp.	40
Hydracarina	2

Taxa	Individuals	May 200
Achnanthes deflexa	18	
Achnanthidium minutissima v	ar. saprophila	16
Amphora perpusilla	7	
Cocconeis placentula var. eug	glypta 3	
Cymbella minuta	5	
Cymbella silesiaca	8	
Gomphonema parvulum	17	
Gomphonema sp.	26	
Gyrosigma scalproides	6	
Melosira varians	6	
Meridion circulare	5	
Navicula cryptocephala	14	
Navicula cryptotenella	3	
Navicula decussis	3	
Navicula minima	86	
Navicula pupula	1	
Navicula radiosa var. tenella	2	
Navicula secreta var. apicular		
Navicula seminulum	69	
Navicula tripunctata	1	
Navicula trivialis	12	
Nitzschia dissipata	38	
Nitzschia fonticola	56	
Nitzschia linearis	3	
Nitzschia palea	7	
Reimeria sinuata	11	
Rossithidium linearis	74	
Stephanocyclus meneghiniana	1	
Surirella ovata	36	
Surirella ovata var. pinnata	8	
Synedra ulna	1	
-		

FISHES			
Common Name	Scientific Name	Individuals	<b>Sept 2003</b>
Largescale Darter	Campostoma oligolepis	6	
Striped Shiner	Luxilus chrysocephalus	9	
Rosefin Shiner	Lythrurus fasciolaris	25	
Redtail Chub	Nocomis effuses	1	
Creek Chub	Semotilus atromaculatus	7	
Golden Redhorse	Moxostoma erythrurum	1	
Steelhead	Onchorhynchus mykiss	3	
Pirate Perch	Aphredoderus sayanus	1	
Banded Sculpin	Cottus carolinae	20	
Rockbass	Ambloplites rupestris	1	
Bluegill	Lepomis macrochirus	2	•
Redear Sunfish	Lepomis microlophus	1	
Rainbow Darter	Etheostoma caeruleum	4	
Saffron Darter	Etheostoma flavum	4	

INVERTEBRATES	Taxa	Individuals	Sept 2003
	Planaria sp	36	-
	Elimia sp	68	
	Heptagenia sp	1	
	Calopteryx maculata	5	
	Boyeria sp	6	
	Perithemis sp	2	
	Leuctra sp	18	
	Microvelia sp	4	
	Aquarius sp	5 3	
	Ranatra sp	3	
	Cheumatopsyche sp	36	
	Scirtes sp (larva)	1	
	Hydrophilus triangularis (adı	ılt) 1	
	Gyrinus sp (adult)	1	
	Celina sp (adult)	1	
	Ancyronyx variegates (adult)	1	
	Dubiraphia sp (adult)	1	
	Optioservus sp(larvae)	22	
	Aedes cinereus	8	
	Chelifera sp	5	
	Chironomidae (pupae)		88
	Hemerodromia sp	19	
	Simulium sp	141	
	Atrichopogon sp	2	
	Gammarus sp	79	
	Caecidotea sp	2	
	Lirceus sp.	1	

## Orconectes sp

DIATOMS	Taxa ]	Individ	uals	Sept 2003
	Achnanathes lanceolata	:	58	•
	Achnanathes lanceolata var.di	ubia	11	
	Achnanathes minutissima		14	
	Achnanthes curtissima	,	7	
	Achnanthes pusilla		16	
	Achnanthes sp.		31	
	Achnanthidium minutissima va	ır. sapr	ophila	53
	Amphora perpusilla	-	8	
	Cocconeis placentula var. eug	lypta	42	
	Cocconeis placentula var. line		4	
	Cymbella minuta		41	
	Cymbella silesiaca	8	8	
	Diploneis puella		1	
	Gomphonema acuminatum	4	4	
	Gomphonema parvulum	2	26	
	Gomphonema truncatum		5	
	Gyrosigma scalproides		5	
	Melosira varians		19	
	Meridion circulare		11	
	Navicula capitatoradiata		31	
	Navicula cryptocephala	3	3	
	Navicula cryptotenella	1	11	
	Navicula menisculus	1	11	
	Navicula menisculus var. upsa	liensis 2	2	
	Navicula minima	(	69	
	Navicula pupula	4	4	
	Navicula seminulum	2	24	
	Navicula tenera	3	3	
	Navicula tripunctata	4	4	
	Navicula trivialis	1	12	
	Navicula viridula var. rostella	ta 8	8	
	Nitzschia dissipata	1	17	
	Nitzschia fonticola	1	13	
	Nitzschia palea	1	14	
	Nitzschia sp. 5		4	
	Stephanocyclus meneghiniana	3	3	
	Surirella ovata		14	
	Synedra sp.	1	1	
	Synedra ulna	4	4	

Station ID:CRR200015Ecoregion:INTERIOR PLATEAUBasin:LOWER CUMBERLANDStream Name:CASEY CREEK

County: TRIGG Map Name: ROARING SPRING

Catchment Area: 8.25 River Mile: 0 Stream Order: 4

**Lat Dec:** 36.74586 **Long Dec:** -87.74755

Location: UP BERKLEY ROAD(ALLEN FARM) TO HOUSE, TAKE LEFT TO STREAM,

CROSS, CUT THROUGH FIELD

#### **FISHES**

Common Name	Scientific Name	Individuals	<b>July 2003</b>
Largescale Stoneroller	Campostoma oligolepis	4	
Striped Shiner	Luxilus chrysocephalus	35	
Rosefin Shiner	Lythrurus fasciolaris	115	
Blacknose Dace	Rhinichthys atratulus	1	
Creek Chub	Semotilus atromaculatus	3	
Banded Sculpin	Cottus carolinae	10	
Orangethroat Darter	Etheostoma spectabile	8	

#### **INVERTEBRATES**

Taxa	Individuals	May 2003
Oligochaeta	65	•
Physella sp	4	
Elimia sp	602	
Pisidium sp	4	
Isonychia sp	8	
Stenonema sp	2	
Eurylophella sp	8	
Caenis sp	2	
Acentrella sp	27	
Unidentified Baetid	8	
Boyeria sp	1	
Somatochlora sp	1	
Trichocorixa sp	1	
Cheumatopsyche sp	2	
Hydropsyche sp	1	
Helichus striatus (adult)	1	
Peltodytes sp (adult)	1	
Agabus sp (adult)	4	
Hydaticus sp (adult)	2	
Curculionidae (adult)	11	
Dytiscidae (adult)	3	
Macronychus glabratus (adı	alt) 1	
Stenelmis sp (adult)	1	
Chironomidae (pupae)	48	
Ablabesmyia sp	1	
Apedilum elachistum	14	
Brillia sp	18	

Chironomus sp	14
Conchapelopia sp	4
Corynoneura sp	1
Cricotopus/Orthocladius gr	1
Dicrotendipes sp	58
Larsia sp	5
Polypedilum convictum	145
Potthastia sp	1
Procladius sp	1
Tanytarsus sp	449
Simulium sp	60
Hydracarina	4
Gammarus sp	978
Asellus sp.	1
Lirceus sp.	35
Orconectes sp	1
m	

Taxa	Individuals	May 2003
Achnanathes lanceolata	108	•
Achnanathes lanceolata var.	dubia 11	
Achnanthes biasolettiana	13	
Achnanthidium minutissima	var. saprophila	26
Amphora perpusilla	4	
Cocconeis placentula var. eu	glypta 5	
Cocconeis placentula var. lin	eata 3	
Cymbella minuta	3	
Cymbella silesiaca	18	
Eunotia tenella	3	
Hantzschia amphioxys	2	
Melosira varians	13	
Meridion circulare	18	
Navicula contenta	3	
Navicula cryptocephala	7	
Navicula cryptotenella	6	
Navicula minima	11	
Navicula secreta var. apicula	ıta 8	
Navicula seminulum	2	
Navicula sp. 3	1	
Navicula trivialis	2	
Nitzschia acicularis	3	
Nitzschia amphibia	6	
Nitzschia dissipata	15	
Nitzschia fonticola	14	
Nitzschia frustulum	3	
Nitzschia linearis	2	
Nitzschia palea	30	

	Stephanocyclus meneghiniana	: 3	
	Surirella ovata	32	
	Surirella ovata var. pinnata	13	
	Synedra rumpens var. familia	ris 5	
	Synedra socia	10	
	Synedra ulna	.12	
FISHES			
Common Name	Scientific Name	Individuals	<b>Sept 2003</b>
Largescale Stoneroller	Campostoma oligolepis	12	•
Striped Shiner	Luxilus chrysocephalus	10	
Rosefin Shiner	Lythrurus fasciolaris	7	
Creek Chub	Semotilus atromaculatus	7	
Creek Chubsucker	Erimyzon oblongus	2	
Grass Pickerel	Esox americanus vermiculatus		
Banded Sculpin	Cottus carolinae	14	
Green Sunfish	Lepomis cyanellus	3	
Saffron Darter	Etheostoma flavum	1	
Orangethroat Darter	Etheostoma spectabile	32	
INVERTEBRATES	Taxa	Individuals	Sept 2003
	Planaria sp	8	•
	Elimia sp	66	
	Heptagenia sp	7	
	Acentrella sp	3	
	Fallceon sp	7	
	Calopteryx maculata	4	
	Boyeria sp	4	
	Epitheca (Epicordulia) sp	1	
	Leuctra sp	7	
	Microvelia sp	3	
	Notonecta sp	1	
	Aquarius sp	1	
	Gerris sp	20	
	Sialis sp	2	
	Lepidostoma sp	1	
	Glossosoma sp	17	
	Cheumatopsyche sp	43	

Nitzschia sp.

Pinnularia nodosa

Reimeria sinuata

Stauroneis anceps

Pinnularia subcapitata var. paucistriata

Sellophora pupula var. capitata

Staurosirella leptostauron

66

2

4

1 2 7

Helichus striatus (adult)	1	
Hydrophilus triangularis (adult)	1	
Copelatus sp (adult)	1	
Dytiscus sp (adult)	1	
Hydrovatus sp (adult)	1	
Laccophilus sp (adult)	1	
Ancyronyx variegates (adult)	1	
Optioservus sp (adult)	6	
Optioservus sp(larvae)	3	
Antocha sp	2	
Hexatoma sp	3	
Chelifera sp	10	
Chironomidae (pupae)	204	
Hemerodromia sp	9	
Simulium sp	1	
Simulium sp	36	
Atrichopogon sp	1	
Gammarus sp	346	
Lirceus sp.	25	
Taxa Individ	luals	<b>Sept 2003</b>
Achnanathes lanceolata	60	-
Anhananathan Innanalata ann Jala	4.4	
Achnanathes lanceolata var.dubia	14	
Achnanathes tanceolata var.dubta Achnanathes minutissima	14 14	
Achnanathes minutissima		
Achnanathes minutissima Achnanthes pusilla	14 6	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapi	14 6	37
Achnanathes minutissima Achnanthes pusilla	14 6 rophila	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapi Amphora perpusilla Caloneis bacillum	14 6 rophila 10	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapi Amphora perpusilla	14 6 rophila 10 3	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapi Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta	14 6 rophila 10 3 14	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapu Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata	14 6 rophila 10 3 14	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapi Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea	14 6 rophila 10 3 14 11	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapi Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula	14 6 rophila 10 3 14 11 2 6 56	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapu Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta	14 6 rophila 10 3 14 11 2 6 56	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta var. pseudogracilis	14 6 rophila 10 3 14 11 2 6 56 8	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta var. pseudogracilis Cymbella tumida	14 6 rophila 10 3 14 11 2 6 56 8 3	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta var. pseudogracilis Cymbella tumida Gomphonema parvulum	14 6 rophila 10 3 14 11 2 6 56 8 3 21	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta var. pseudogracilis Cymbella tumida Gomphonema parvulum Gyrosigma scalproides	14 6 rophila 10 3 14 11 2 6 56 8 3 21	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta Cymbella minuta var. pseudogracilis Cymbella tumida Gomphonema parvulum Gyrosigma scalproides Hippodonta capitata	14 6 rophila 10 3 14 11 2 6 56 8 3 21 7	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta Cymbella minuta var. pseudogracilis Cymbella tumida Gomphonema parvulum Gyrosigma scalproides Hippodonta capitata Melosira varians	14 6 rophila 10 3 14 11 2 6 56 8 3 21 7 5	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta Cymbella minuta Cymbella minuta var. pseudogracilis Cymbella tumida Gomphonema parvulum Gyrosigma scalproides Hippodonta capitata Melosira varians Meridion circulare	14 6 rophila 10 3 14 11 2 6 56 8 3 21 7 5 61 22	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta Cymbella minuta Gymbella tumida Gomphonema parvulum Gyrosigma scalproides Hippodonta capitata Melosira varians Meridion circulare Navicula capitatoradiata Navicula contenta	14 6 rophila 10 3 14 11 2 6 56 8 3 21 7 5 61 22 11	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta Cymbella minuta Cymbella minuta Cymbella tumida Gomphonema parvulum Gyrosigma scalproides Hippodonta capitata Melosira varians Meridion circulare Navicula capitatoradiata Navicula contenta Navicula cryptocephala	14 6 rophila 10 3 14 11 2 6 56 8 3 21 7 5 61 22 11	37
Achnanathes minutissima Achnanthes pusilla Achnanthidium minutissima var. sapa Amphora perpusilla Caloneis bacillum Cocconeis placentula var. euglypta Cocconeis placentula var. lineata Cymatopleura solea Cymbella cistula Cymbella minuta Cymbella minuta Cymbella minuta Gymbella tumida Gomphonema parvulum Gyrosigma scalproides Hippodonta capitata Melosira varians Meridion circulare Navicula capitatoradiata Navicula contenta	14 6 rophila 10 3 14 11 2 6 56 8 3 21 7 5 61 22 11 9	37

Navicula pseudoreinhundtii

1

Navicula secreta var. apiculata	3
Navicula seminulum	5
Navicula sp. 1	8
Navicula tantula	4
Navicula tenelloides	11
Navicula viridula	9
Neidium affine	2
Nitzschia amphibia	3
Nitzschia dissipata	15
Nitzschia fonticola	24
Nitzschia gracilis	34
Nitzschia palea	2
Nitzschia parvula	2
Nitzschia sp.	7
Reimeria sinuata	8
Rhoicosphenia curvata	4
Sellophora pupula var. mutata	3
Staurosirella leptostauron	10
Stephanocyclus meneghiniana	2
Surirella ovata	26
Synedra rumpens var. familiaris	1
Synedra ulna	3
Tryblionella levidensis	1

Station ID: CRR200016

Basin: LOWER CUMBERLAND

County: TRIGG

Catchment Area: 106.93

**Lat Dec:** 36.84078

**Long Dec:** -87.74045

River Mile: 4.12

**Ecoregion:** INTERIOR PLATEAU

**Stream Order:4** 

Stream Name: SINKING FORK

Map Name: CALEDONIA

Location: KINGS CHURCH ROAD@ BRIDGE

### **FISHES**

<b>Common Name</b>	Scientific Name	Individuals	<b>July 2003</b>
Striped Shiner	Luxilus chrysocephalus	15	•
Rosefin Shiner	Lythrurus fasciolaris	19	
Golden Shiner	Notemigonus crysoleucas	1	
Bluntnose Minnow	Pimephales notatus	1	
Creek Chub	Semotilus atromaculatus	4	
Northern Hogsucker	Hypentelium nigricans	2	
Banded Sculpin	Cottus carolinae	12	

## **INVERTEBRATES**

Taxa	Individuals	May 2003
Oligochaeta	18	
Valvata sp.	8	
Planaria sp	2	
Physella sp	9	
Elimia sp	86	
Corbicula fluminea	2	
Ephemerella sp	1	
Eurylophella sp	3	
Caenis sp	4	
Argia sp	1	
Enallagma sp	1	
Calopteryx maculata	4	
Boyeria sp	2	
Cheumatopsyche sp	16	
<i>Hydropsyche</i> sp	2	
Curculionidae (adult)	1	
Lampyridae (larva)	1	
Macronychus glabratus (adu	lt) 6	
Optioservus sp (adult)	10	
Chironomidae (pupae)	13	
Apedilum elachistum	31	
Brillia sp	21	
Cricotopus/Orthocladius gr	1	
Dicrotendipes sp	9	
Endochironomus sp	13	
Paratrichocladius sp.	1	
Polypedilum sp	13	
Polypedilum convictum	69	

Polypedilum tritum	12
Tanytarsus sp	13
Simulium sp	45
Gammarus sp	93
Caecidotea sp	19
Orconectes sp	2

Taxa	Individuals	May 2003
Achnanathes lanceolata	42	
Achnanathes lanceolata var.a	lubia 6	
Achnanathes minutissima	12	
Achnanthidium minutissima v	ar. saprophila	4
Amphora perpusilla	12	
Amphora submontana	3	
Caloneis bacillum	4	
Cocconeis pediculus	4	
Cocconeis placentula var. eu	glypta 9	
Gomphonema minutum	16	
Gomphonema parvulum	6	
Gyrosigma scalproides	7	
Luticola mutica	2	
Melosira granulata	4	
Melosira varians	22	
Meridion circulare	9	
Navicula capitatoradiata	6	
Navicula contenta	4	
Navicula cryptocephala	11	
Navicula cryptotenella	34	
Navicula menisculus	8	
Navicula menisculus var. ups	saliensis 22	
Navicula minima	63	
Navicula secreta var. apicula	ata 2	
Navicula seminulum	7	
Navicula sp. 1	4	
Navicula sp. 3	6	
Navicula subminuscula	11	
Navicula tripunctata	22	
Navicula trivialis	4	
Nitzschia dissipata	64	
Nitzschia dissipata var. medi	<i>a</i> 2	
Nitzschia frustulum	21	
Nitzschia palea	21	
Nitzschia parvula	1	
Nitzschia sp.	7	
Nitzschia sp. 5	9	
Stauroneis smithii	1	

FISHES			
<b>Common Name</b>	Scientific Name	ndividuals	Sept 2003
Largescale Stoneroller	Campostoma oligolepis	1	
Striped Shiner	Luxilus chrysocephalus	6	
Rosefin Shiner	Lythrurus fasciolaris	47	
Creek Chub	Semotilus atromaculatus	2	
Pirate Perch	Aphredoderus sayanus	1	
Banded Sculpin	Ĉottus carolinae	74	
Longear Sunfish	Lepomis megalotis	1	
Saffron Darter	Etheostoma flavum	1	
INVERTEBRATES	Taxa I	ndividuals	Sept 2003
	Planaria sp	2	5 <b>-p</b> -2-005
	Elimia sp	333	
	Heptagenia sp	23	
	Fallceon sp	7	
	Calopteryx maculata	26	
	Boyeria sp	3	
	Gomphus sp	1	
	Rhagovelia sp	3	
	Gelastocoris occulata	1	
	Aquarius sp	1	
	Gerris sp	1	
	Rhyacophila sp	4	
	Glossosoma sp	1	
	Cheumatopsyche sp	34	
	Helichus striatus (adult)	1	
	Peltodytes sp (adult)	1	
	Ancyronyx variegates (adult)	2	
	Ancyronyx variegates (larvae)	5	
	Macronychus glabratu (adult)s		
	Stenelmis sp (adult)	1	
	Stenelmis sp (larvae)	4	
	Antocha sp	1	
	Chironomidae (pupae)	5	
	Hemerodromia sp	2	
	Simulium sp	34	
	Gammarus sp	84	
	Caecidotea sp	39	
	Orconectes sp	5	
DIATOMS	Taxa I	ndividuals	Sept 2003
	Achnanathes lanceolata	22	•
	Achnanathes lanceolata var.du		
	Achnanathes minutissima	5	
	Achnanthes curtissima	4	

Achnanthes pinnata	4	
Achnanthes sp. 2	4	
Amphora perpusilla	4	
Amphora submontana	14	
Cocconeis placentula var. euglypta	8	
Cymbella minuta	4	
Cymbella sp.	2	
Fallacia pygmaea	2	
Gomphonema intricatum var. pulvin		4
Gomphonema minutum	4	•
Gomphonema minatum Gomphonema olivaceum	4	
Gomphonema ouvaceum Gomphonema parvulum	2	
Gyrosigma scalproides	10	
Navicula capitatoradiata	2	
Navicula capitatoraatata Navicula contenta	21	
Navicula comenia Navicula cryptotenella	16	
Navicula crypioienena Navicula hustedtii	8	
Navicula nusieuni Navicula menisculus	8	
Navicula menisculus Navicula minima	137	
Navicula minima Navicula notha	4	
Navicula noina Navicula schadei	8	
Navicuia schaaei Navicula schroeterii	12	
_	4	
Navicula secreta var. apiculata	32	
Navicula seminulum	34	
Navicula sp.	3 <del>4</del> 4	
Navicula sp. 2	4	
Navicula subminuscula	4	
Navicula subtilissima	4 18	
Navicula tantula	42	
Navicula tenelloides		
Navicula tripunctata	6	
Navicula trivialis	6	
Navicula viridula var. rostellata	6 11	
Nitzschia amphibia	11	
Nitzschia capitellata	_	
Nitzschia dissipata	8	
Nitzschia frustulum	12 11	
Nitzschia palea	12	
Nitzschia sp.		
Planothidium lanceolata	24	
Rhoicosphenia curvata	4	
Stauroneis sp.	1	
Stephanocyclus meneghiniana	4	
Surirella linearis	1	
Surirella ovata	2	

## **APPENDIX E**

## **Habitat Assessment Forms**

#### Low Gradient Stream Data Sheet

		L	711 0.	radiciti bu	Turin D	one one		
STREAM NAM	ECRE 20	10 00	Sour	throck	LOCATI	ON:		
	10000				BASIN/	WATERSH	ED: Xittl	e Rue
LAT.:	LONG.:						ton USGS	
DATE: 05//	4/03 TIME:		rs	бам Прм			_	
TYPE SAMPLE	P-CHEM C	Macroinve	rtebrate	FISH O	BACT.	ALGAE	, 117.	-, 0.00
WEATHER:	Now I	Past 24 hour Heavy rai Steady ra	s in in ent show	H	Yes Air Tempe	een a heavy	y rain in the last _°C. Inches rain	7 days?  nfall in past 24 hoursin.
P-Chem: Temp(	°C)D	O.O. (mg/l)_		%Saturati	on	pH(S	S.U.)	Cond 🗅 Grab
INSTREAM W FEATURES: Stream Width Range of Depth Average Velocit Discharge Est. Reach Leng	by <u> </u>	ft Predeft Suffers December 1		ning		Constr Comm	ercial rial	☐ Forest ☑ Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Storm Sewers
Hydraulic Struct  Dams & B  Island U	ridge Abutments			Stream Flow: Dry High	Pooled			Stream Type:  Perennial Intermittent Ephemeral Seep
Riparian Vegeta Dominate Type Trees St Grasses Ho Number of strat	ation: Dom. Francis Francis Syc	Tree/Shrub	Taxa	Canopy Cove  Fully Expo  Partially E  Partially S  Fully Shad	xposed (2: haded (50-	5-50%) -75%)	Channel Alter ☐ Dredging ☐ Channeliza (☐Full ☐Parti	tion
Substrate DEst	L □P.C.	Riff	le_5	_%	R	un 70	_%	Pool 25 %
Silt/Clay (<0.0	1.000					1		×
Sand (0.06 – 2	-					1		/
Gravel (2-64 n		V						
Cobble (64-2		V				1		<b>V</b>
Boulders (>25	6 mm)					V		
Bedrock						V		
Habitat						n Categor		
Parameter	Optin	ıal		Suboptima	l	N	larginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50 substrate favora epifaunal colon fish cover; mix submerged logs banks, cobble o stable habitat at to allow full col potential (i.e., le that are not new not transient).	ible for ization and of snags, undercut other and at stage onization ogs/snags	well-s colon adequ maint preser substr newfa for co	by mix of stables uited for full ization potential to the habitat for the tenance of populate of additionate in the formall, but not yet polonization (majend of scale).	al; ulations; al of	habitat; h availabili desirable;	ty less than substrate disturbed or	Less than 10% stable shabitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 - 19 - 18	17 16	15	(i) 13 1	2 11	10 9	3 = 7 = 6	5.4.3, 2.1.0
2. Pool Substrate Characterizati on	materials, with firm sand preva mats and subme	naterials, with gravel and clay; some sand prevalent; root some subm			Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		or clay or sand ittle or no root ubmerged	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20: 19 18	17 16	415	14 13 1	2 315	(1) 9	8 17 46	5 4 3 2 1 0.
3. Pool Variability	Even mix of lar large-deep, sma small-deep pool	Il-shallow,		rity of pools lar few shallow.	ge-deep;	Shallow prevalent	ools much more than deep pools	Majority of pools small- shallow or pools absent.
SCORE	20 19 118	17 16	15	14 13 1	2 115	10 (9)	8 7 6	5 4 3 2 1 0
	THE PERSON NAMED IN COLUMN 2 I	THE RESERVE OF THE PARTY OF THE	THE PERSON NAMED IN COLUMN	CLEONING THE PROPERTY OF THE PARTY OF THE PA	STATE OF THE PARTY	Control of the last of the las	ATTENDED TO STATE OF THE PARTY	BURNOUS AND SECURITION OF THE SECURITION AND ASSESSMENT OF THE SECURITION

eposition	islands or point bars and less than 20% of the bottom affected by	formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom	sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
CORE	20 19 18 17 16	45 14 43 12 19	10 9 (3) 7 6	5 44 72 1 0	
. Channel low Status	trates and minimal	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
CORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	S 4 3 7 L 0	
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.		Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
CODE	-20 -19 18 -17 16	13-14-(E) T2-113	10 9 58 7 16	5. 4. 3 -2. 1 0	
7. Channel Sinuosity  The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a	
	parameter is not easily rated in these areas.	3 15 114 13 17 11	310 94: 8 (D) 6	5 4 3 2 1 1	
8.Bank Stability (score each bank) Note: determine left or right side by facing	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.		Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of ban has erosional scars.	
SCORE	Left Bank 10 9	8 0 6	<b>建筑34400多</b> 。	即2 15 15 0 0	
SCORE	Right Bank 10 9	8 (2) 6	5, 57, 4-1, 73	7 - 2	
(RB)  9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE (LB)	Left Bank 10 9	8 (7) 6	3 4 23	2 70 4 7 6	
SCORE	<b>利尼亚亚亚洲</b>	8 (2) 6	5 4 3	1 0 0	
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >1: meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.		Width of riparian zone 6 12 meters; human activities have impacted zone a great deal.	- Width of riparian zone <6 meters: little or no riparia	
SCORE (LB)	Left Bank 10 9	8 6 7 6	3 4 3	2. ()0.	
SCORE (RB)	Right Bank 10 9	8 7 6	4 30	2.5 (1) 70	

Total Score

## Low Gradient Stream Data Sheet

STREAM NAME	CFF 2000	001	1	11	LOCATIO	N: S	R 508	@ bridge
STREAM NAME STATION #: SC	outhfork	LIZHE L	ver-	· LL	BASIN/W	ATERSH	ED: Litt	he River
LAT.:	LONG.:						tron_uses 7	
DATE: 09 (05)	03 TIME: L		(D	AM DPM	INVESTI	GATORS		nar, Ker, Natoline
WEATHER:	Now	Past 24 hours  Heavy rain  Steady rain  Intermitted  Clear/sum	n n nt shov	DS.	las there be	en a heavy No ature	y rain in the last 7	days?  sfall in past 24 hours in.
P-Chem: Temp(°	C)I	).O. (mg/l)		%Saturati	on	pH(	S.U.)	Cond U Grab
INSTREAM WATERSHED LOCAL				WATERSHED FEATUREES: nant Surrounding Land Use: the Mining Construction Forest Mining Pasture/Grazing fells Industrial Silviculture				
Hydraulic Struct  Dams	idge Abutments aterfalls			Stream Flow	Pooled	☐ Low d or Torre	2 Normal ntial	Stream Type:  Percannial Intermittent Ephemeral Seep
Riparian Vegetat Dominate Type:  Trees Sh Grasses He Number of strate	rubs rbaceous	Tree/Shrub Tell A Syland O	sh	Canopy Cov Deally Exp Partially E Partially S Deally Shad	osed (0-25% exposed (25 haded (50-	-50%) 75%)	Channel Alters  ☐ Dredging  ☐ Channelizat (☐Full ☐Partis	ion
Substrate QEst.	□P.C.	Riff	le /	_%	Ru	in_/5	_%	Pool_/6_%
Silt/Clay (<0.06	6 mm)							
Sand (0.06-2	mm)		/			5		1
Gravel (2-64 m	m)		/			5		5
Cobble (64 – 2	56 mm)		1,			3		1
Boulders (>256	6 mm)		1,			7		1
Bedrock			1			80		✓
Habitat					Conditio	n Catego		
Parameter	Optio	nal		Suboptima	al	1	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50 substrate favor epifaunal color fish cover; mis submerged log banks, cobble stable habitat to allow full copotential (i.e., that are not ne not transient).	rable for nization and t of snags, s, undercut or other and at stage blonization logs/snags	well- color adeq main preso subs newl for c	0% mix of stab suited for full nization potenti uate habitat for tenance of popence of addition trate in the formall, but not yet colonization (mend of scale).	ial; nulations; nal n of prepared	availabil desirable	ity less than e; substrate ly disturbed or	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE		rwid			DE VALUE			
2. Pool Substrate Characterizati on	Substrate materials, with gravel and clay som mats and submerged clay submerged		some subr	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		All mud or clay or sand bottom; little or no root mat; no submerged vegetation.		Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20, 19, 11	3 (12.0)		5 214 213	12.01 1%	10 2 9	1 8 2 1 1 1 1	
3. Pool Variability	Even mix of la large-deep, sm small-deep po	all-shallow.		ority of pools la few shallow.	arge-deep;	Shallow prevalen	pools much more t than deep pools	Majority of pools small- shallow or pools absent.
SCORE	20 = 19 = 6	3 17 16		5 14 113 4	12: 115.	-10 3 9		

. Sediment Deposition	islands or point bars and less than 20% of the bottom affected by	John State Com	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE				是然是的各位的
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	90 E 17 E			
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	1900 de 101 a 181 de 17 de 167		Similar Services	图1878年的图26日
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16		ROOM TO THE ROOM	)[李灵生形成的是9]
8.Bank Stability (score each bank) Note: determine left or right side by facing	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of crosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE	9 - 60 3 200 200 1			
SCORE SCORE				
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	1-10-3 and 510-55 17 55			
SCORE				
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >1: meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	10 10	Width of riparian zone of 12 meters; human activities have impacted zone a great deal.	vegetation due to human activities.
SCORE (LB)	Len Ban E 4 0			
SCORE (RB)	Right Bank 10 3	7 7	5 4 (3)	2 1 1 1 0 1

Total Score

NOTES/COMMENTS:

99

Low Gradient Stream Data Sheet

17.56

		-		nament bu	vail 1	Jaia SII		C. C.	
STREAM NA	ME: Sout	h For	K Lith	le River	LOCA	TION: CA	£2000	02	
STATION #:	-	MII			Sec. 3	/WATERSI			
LAT.:	LONG	).:			COUN	TY: Chr	Stianusss	7.5 TOPO:	
DATE: 5-14	1.03 TIME	2:20	Г	TAM WIDM				n.D, J.W	
TYPE SAMPL	E: O P-CHEM	☐ Macroin	vertebra	te OFISH O	BACT. E	ALGAE	RACI	DUIGUID WYAT	
WEATHER:	Now	Past 24 ho	ours rain rain ittent sho	H	las there Yes Air Temp	been a heav	y rain in the last	t 7 days?	
		D.O. (mg/l	)	%Saturation	on	pH(	S.U.)	_ Cond □ Grab	
FEATURES:	th	_ft Pr _ft D _ft/s D _cfs D	OCAL Wedominar Surface I Deep Mi Oil Wells Land Dis	ning s	EATUR and Use	Consti	nercial rial	☐ Forest  Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Storm Sewers	
☐ Island ☐ ☐ Other	Bridge Abutmen Waterfalls			Stream Flow:  Dry  High	Pooled	Low oid or Torrer	Normal	Stream Type: Perennial Intermittent Ephemeral Seep	
Riparian Vege Dominate Typ  Trees S Grasses H Number of stra		Toxi	ub Taxa	Canopy Cover  Fully Expose Partially Expose Partially Sh Fully Shade	sed (0-25 posed (2 aded (50	25-50%) 0-75%)	Channel Alter ☐ Dredging ☐ Channeliza (☐Full ☐Parti	tion	
Substrate DE		ffle_/O	_%	Run 26 %		_%	Pool 70 %		
Silt/Clay (<0.						1		/	
Sand (0.06 –			/	/		✓ <b>/</b>		/	
Gravel (2-64)			1			/			
Cobble (64 –									
Boulders (>25	66 mm)					1		1	
Bedrock									
Habitat					Conditio	on Category	y		
Parameter	Opti	mal		Suboptimal		M	larginal	Poor	
1. Epifaunal Substrate/ Available Cover	Greater than 5 substrate favo epifaunal colo fish cover; mis submerged log banks, cobble stable habitat to allow full copotential (i.e., that are not ne not transient).	rable for nization and x of snags, ss, undercut or other and at stage blonization logs/snags	well-s coloni adequ mainto preser substr newfa for co	% mix of stable uited for full ization potential; ate habitat for enance of populace of additional ate in the form oll, but not yet prolonization (may and of scale).	ations;	habitat; ha availabilit desirable;	y less than	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.	
SCORE	201=19=3	17/16	16	14 18 19 10	41	10.76	18 1 46		
2. Pool Substrate Characterizati on	materials, with gravel and firm sand prevalent; root mats and submerged subme		Mixture of soft sand, mud, or lay; mud may be dominant; ome root mats and ubmerged vegetation resent.		All mud or clay or sand bottom; little or no root mat; no submerged vegetation.		Hard-pan clay or bedrock; no root mat or vegetation.		
CORE	20 49 18	1716	1.5	614 13 12	(1)	10 2	8 7 6		
3. Pool Variability	Even mix of la large-deep, sm small-deep poo	all-shallow.	Majori very f	ity of pools large ew shallow.	-deep;	Shallow po	pols much more han deep pools.	Majority of pools small- shallow or pools absent.	
SCORE	20 19 18	17 16	15	514 - 18 - 12 -	NH - /-	10 9	8 7 6		
	THE PARTY OF THE P	4 Line	THE PERSON NAMED IN	THE RESERVE OF THE PERSON OF T	THE RESIDENCE PROPERTY AND	DESCRIPTION OF THE PERSONS	WHEN PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.	THE RESERVE OF THE PARTY OF THE	

# Best Available Copy

eposition	islands or point bars and less than 20% of the bottom affected by	formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	new gravel, sand or fine sediment on old and new bars; 50-80% of the	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
CORE	20 10 6 17 16		0.32.3570.46	2 4 4 7 4 5 0 E	
Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.		Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
CORE	0 9 10 17 16	16 14 18 12 1V	10 2 48 7 10		
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
	20 (9-38-37-16	THE CHIEF PARTY OF THE PARTY OF	0 9: -8 5 6		
SCORE  7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a	
SCORE	rated in these areas.	34512461 165 19 31 10	50 12 5 (S) 7 0	K LLE DE LOC	
8.Bank Stability (score each bank) Note: determin- left or right side by facing	Banks stable; evidence of erosion or bank failure absent or minimal, little potential for future problems. <5% of bank	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of ban has erosional scars.	
downstream. SCORE	Left Built - 10	8 0	5 4 3	2.50	
(LB) SCORE	Right bank (07 9 -	是10年		Less than 50% of the	
(RB)  9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowin minimal or not evident; almost all plants allowed grow naturally.	affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble heigh remaining.	closely cropped vegetation common; less than one-half of the	streambank surfaces cover by vegetation; disruption streambank vegetation is very high; vegetation has been removed to	
SCORE (LB)	Teft Bank 10 9	. 8 0 6			
SCORE (RB)	Right Bank 10 9	8 7 6		Will Science 2002 (6	
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not	impacted zone only minimally.	Width of riparian zone 12 meters; human activities have impacted zone a great deal.	meters: little of no riparta	
SCORE (LB)	(15),Bark 20 9	7 3			
SCORE (RB)	Right Bank 10 9	8 7 6	5 (4.3)	2 (1) 9	

Total Score

## Low Gradient Stream Data Sheet

STREAM NAME	: Southfor	k Ltt	e River	LOCATI	ON: 2	hopskin	itle ups	s con
	7000007			BASIN/WATERSHED: LILLE RIVET				
LAT.:	2 7000				.Chr	tor		
-01	5/03TIME: 10	16	Бам □рм	BREET	CATORE	Roka A	nar, Notalia	a Among
	DP-CHEM MM		ite OFISH O	BACT:	ALGAE	30	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	7.
WEATHER:		24 hours leavy rain teady rain ntermittent she clear/sunny	C	Air Temper	) No	rain in the last	7 days? nfall in past 24 ho	ours in.
P-Chem: Temp(	PC) D.O.	(mg/l)	%Saturati	ion	pH(S	s.U. <u>)</u>	Cond	☐ Grab
INSTREAM W FEATURES: Stream Width Range of Depth Average Velocity Discharge	ft	The second second	ant Surrounding Mining Ining	FEATUREES:				
Est. Reach Leng		□ Land D	isposal		Row C	rops	Urban Runoff/S	Storm Sewers
Hydraulic Struct  Dams Bi Island W  Other	ridge Abutments			Pooled	□ Low d or Torrer	☐ Normal ntial	Stream Type:  Perennial  Ephemeral	man decides 164124
Riparian Vegeta Dominate Type:  Type:	rubs rbaceous	ee/Shrub Taxa	Canopy Cove  Fully Expo  Carrially Expo  Partially S  Fully Shad	exposed (25 haded (50-	5-50%) -75%)	Channel Alter Channeliza Channeliza Channeliza Channeliza	tion	
Substrate QEst		Riffle	<b>∂</b> ≠%	Run 90 %		_%	Pool_1	_%
Silt/Clay (<0.00		_						
Sand (0.06 – 2					600	10	6001	0
Gravel (2-64 m			1D%		ð	50/0		
Cobble (64-2 Boulders (>256	Y Company				10 0/2		501	,
Bedrock	) many			-	don	2	300	0
Habitat				Candida	- Catagor			-
Parameter	Optimal		Suboptima		n Categor	1arginal	Pos	or
I. Epifaunal Substrate/ Available Cover	ifaunal bstrate/ substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags		50% mix of stable-suited for full onization potentiquate habitat for intenance of popisence of addition estrate in the formurall, but not yet colonization (mathematical).	o mix of stable habitat; ited for full attion potential; te habitat for nance of populations; te of additional te in the form of l, but not yet prepared onization (may rate at ad of scale).		nix of stable abitat ty less than substrate y disturbed or	Less than 10% habitat; lack of obvious; substr or lacking.	habitat is ate unstable
SCORE				ka ahiti				是是是自己的
2. Pool Substrate Characterizati on	betrate materials, with gravel and clay; i		ixture of soft sand, mud, or ay; mud may be dominant; me root mats and bmerged vegetation esent.		All mud or clay or sand bottom; little or no root mat; no submerged vegetation.		Hard-pan clay no root mat or	
SCORE	20, 19, 18, 1	7 - 96 .	B. C. Elle	2:10	10 . 9			Value 1
3. Pool Variability	Even mix of large- large-deep, small-si small-deep pools pr	shallow, Ma	jority of pools la y few shallow.		Shallow	pools much more than deep pools		ols small- ls absent.
SCORE	20 19 18 J	7 16	K M ke i	o all	- 1/31 = 9V	1 8 77 6		2/41-07

. Sediment Deposition	islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
CORE		THE VOICE WHE	pools prevalent.	
6. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel, or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE				
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	250(25)25 - 18 5 5 7 15 16 5		E1018/07/1938 1974 26	图图 19 20 19 19 19 19 19 19 19 19 19 19 19 19 19
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 months areas.		10/29/18 (2) [56	
8.Bank Stability (score each bank) Note: determine left or right side by facing	absent or minimal; little potential for future problems. <5% of bank	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE				
SCORE	Print ne D. 1977			
(RB)  9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE	· A · A · A · A · A · A · A · A · A · A			
(LB) SCORE		CHAPPEN AND		
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities hav impacted zone only minimally.	Width of riparian zone 6 12 meters; human activities have impacted zone a great deal.	meters: little or no ripariar
SCORE	Can Blanc 410 2 2 20			
SCORE (RB)	Righ Bank 10 9		7.37 4.47 2.0	2 (0)

Total Score

NOTES/COMMENTS:

TOTAL SOLD STATE

STREAM NAME	Lower	Branch			LOCATI				
STATION#: CL					BASIN/	VATERSH	ED. Rifth	e River	4
LAT.:	LONG.						GAN USGS		
DATE: 05/14	103 TIME	11:00	152	Ам Прм			7.8, m		
TYPE SAMPLE:				O FISH O	BACT.	ALGAE	, , ,		
WEATHER:	Now	Past 24 hour  Heavy rai  Steady ra  Intermitte	n in ent show	P	Yes [	No rature 21	rain in the last	1 - 1 - 1	hoursin.
P-Chem: Temp(°	PC)	D.O. (mg/l)_		%Saturati	on	pH(S	3.U.)	Cond.	☐ Grab
INSTREAM W. FEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Leng	у	ft Prede	ominan			CES:  Constr  Comm	ercial [	Forest Pasture/Grazi Silviculture Urban Runof	
				Stream Flow				2007	
Hydraulic Struct  □ Dams p □ Br □ Island □ W □ Other	ridge Abutment	s			Pooled			Stream Type Perennial D Ephemera	☐ Intermittent
Riparian Vegeta Dominate Type: Trees Sh Grasses He Number of strate	rubs erbaceous	n. Tree/Shrub	Taxa	Canopy Cow  Fully Expe Partially Experience Partially S Fully Shad	osed (0-25° exposed (25° haded (50°	5-50%) -75%)	Channel Alter □ Dredging Channelizat (□Full □Partic	tion	
Substrate QEst		Riff	le	_%	R	un 50	_%	Pool_5	0_%
Silt/Clay (<0.0					V	/ (e	dpe)		
Sand (0.06 – 2	11.11.						0	/	
Gravel (2-64 m									
Cobble (64 – 2						V		/	
Boulders (>256 Bedrock	min)			*		-			- 1-5
						V		V (	edpe)
Habitat Parameter	Opti	mal		Subontino		n Categor	y Iarginal	1 2	oor
1. Epifaunal Substrate/ Available Cover	Greater than 5 substrate favo epifaunal colo fish cover; mi submerged log banks, cobble stable habitat to allow full copotential (i.e., that are not not transient).	0% of rable for nization and x of snags, gs, undercut or other and at stage olonization logs/snags	well-colon adequation mainst prese subst newforco	Suboptimal 30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).		10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		Less than 109 habitat; lack	% stable
SCORE	20 (9 1	8 17 16.	N.	14 13 1	2 (11 -	10 9	(8) 7 6	5 4 3	2 1 0
2. Pool Substrate Characterizati on	Mixture of sul materials, with firm sand prev mats and subt vegetation con	n gravel and valent; root nerged	clay; some	ure of soft sand mud may be do root mats and erged vegetationt.	ominant;	bottom; l	or clay or sand ittle or no root ubmerged	Hard-pan cla no root mat o	y or bedrock; or vegetation.
SCORE	20 19 1	8 17 16	1	5 14 13 I	2. 11	10 9	(8) 3 6	52.4 3	2 1 0
3. Pool Variability	Even mix of la large-deep, sn small-deep po	nall-shallow,	Majo	rity of pools la few shallow.	rge-deep;	Shallow prevalent	pools much more than deep pools.	Majority of p	ools small- ools absent.
SCORE	20 19 1	8 - 17 - 16	1 1	5 14 13 1	2(1)	10 9	8 7 7	5+4 3	2 1 0

Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
CORE	20 19 18 17 16	15: 14 13 12 (11	pools prevalent.	5 4 3 2 1 0		
		N - 50 > 750/ -54b-	Water fills 25-75% of the	Very little water in channel		
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	available channel, and/or riffle substrates are mostly exposed.	and mostly present as standing pools.		
SCORE	20 19 18 17 16	15, 14, 13, 12, 10 - 1, 2, 2, 2, 3	10 9 8 7 6	3 4/3 2 1 0		
6. Channel Alteration  Channelization or dredging absent or minimal; stream with normal pattern.		t or minimal; stream usually in areas of bridge		Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
SCORE	20 19 18 17 16	7 16 14 18 (B) H	10 9 8 7 6	5 4 9 2 1 0		
7. Channel Sinuosity  The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0		
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of ban has erosional scars.		
SCORE	Left Bank 10 9	8 (1) -6 -	5 4 3 4	2		
(LB) SCORE	Right Bank 10 - 9	8 (7) 6	5 4 3	2 2 1 1 0		
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow, naturally.	remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE		8 (7) 6		e = 2 % = +1 = % 0 = 5		
SCORE	Left Bank 10 2			2 24 0		
(RB)	Right Bank 10 - 9	8 7 -6 Width of riparian zone 12-18	Width of riparian zone 6	- Width of riparian zone <6		
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	meters; human activities have impacted zone only minimally.		meters: little or no ripariar		
SCORE (LB)	Left Bank 10 9	8 765	5. 4. 3.	2 (1) 0		
SCORE (RB)	Right Bank 10 9	. 8: 7 - 6	5 4 3			

P-Chem: Temp(°C)_ INSTREAM WATI FEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Length  Hydraulic Structures Dams Bridge Island Water Other Riparian Vegetation	2000 3 1  LONG.:  23TIME: 7.4  P-CHEM DMac  Now Past 2-  D He	MILE:		BASIN/W	ATERSH	ED: 22t1	e liver		
P-Chem: Temp(°C)_ INSTREAM WATIFEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Length  Hydraulic Structures Dams Bridge Island Water Other Riparian Vegetation	LONG.:  DESTIME: DAG  P-CHEM DAG  Now Past 2-  D He  D Ste	0 1							
P-Chem: Temp(°C)_ INSTREAM WATI FEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Length  Hydraulic Structures Dams Bridge Island Water Other Riparian Vegetation	Now Past 2-	O		COUNTY	. Chris	to 000000			
P-Chem: Temp(°C)_ INSTREAM WATIFEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Length  Hydraulic Structures Dams Pringe Island Water Other Riparian Vegetation	Now Past 2-	o		COUNTY: Christianusgs 7.5 TOPO:  MINVESTIGATORS: Pinar, Bohn, Ker, Notalie, H					
P-Chem: Temp(°C)_ INSTREAM WATIFEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Length  Hydraulic Structures Dams Pringe Island Water Other Riparian Vegetation	Now Past 2-	roinvertebra	TAM MIPM	INVESTI	GATORS:	Pinar, Go	hn, der, Note	Vierx	
P-Chem: Temp(°C)_ INSTREAM WATIFEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Length  Hydraulic Structures Dams Bridge Island Water Other Riparian Vegetation	D Her	TOTAL TOTAL	te OFISH O	BACT. A	LGAE			1	
INSTREAM WATIFEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Length  Hydraulic Structures Dams Bridge Island Water Other Riparian Vegetation		4 hours avy rain ady rain ermittent she ear/sunny	>	NVan F	No XC	rain in the last 7	days?	ර in.	
FEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Length  Hydraulic Structures Dams Bridge Island Water Other Riparian Vegetation			%Saturat	tion	pH(S	3.U.)	Cond	☐ Grab	
☐ Dams Æ Bridge ☐ Island ☐ Water ☐ Other ☐ Riparian Vegetation	ERSHED  ft ft ft/s cfs	The second secon	fining lls risposal	Land Use:	Constr Comm Comm Industr	ercial %	l Forest APasture/Grazing I Silviculture I Urban Runoff/Stori	m Sewers	
	e Abutments rfalls		High	Pooled		ntial	Stream Type: Perennial O Into		
Riparian Vegetation: Dom. Tree/Shrub Dominate Type:  ☐ Trees			Canopy Cover:  Fully Exposed (0-25%)  Partially Exposed (25-50%)  Partially Shaded (50-75%)  Fully Shaded (75-100%)  Channel Alterations  Channel Alterations  Channel Alterations			on			
Substrate QEst. QI	P.C.	Riffle	<u>~</u> %	Rı	ın 85	_% _	Pool O	%	
Silt/Clay (<0.06 m									
Sand (0.06 – 2 mm					5				
Gravel (2-64 mm)		S			5				
Cobble (64 - 256 1									
Boulders (>256 mg	un)	90	an l		90				
Habitat		10		Conditio	n Categor			W	
Parameter	Ontimal		Suboptim			Marginal	Poor		
I. Epifaunal Substrate/ fis Available Cover batton poor the new field of t	substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags		30-50% mix of stable habitat; well-suited for full		10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		Less than 10% stat habitat; lack of hat obvious; substrate or lacking.	pitat is	
SCORE	Mark Bally	<b>建</b> 基础		Baselin				ATT ST	
Substrate m Characterizati fir on m	firm sand prevalent; root		Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		All mud or clay or sand bottom; little or no root mat; no submerged vegetation.		Hard-pan clay or b no root mat or veg	edrock; etation.	
SCORE	1500 1100 12 18 E 18 E 18 E 18 E 1		46 TYLES	12204海	10 2 9		KWYY		
3. Pool Evariability la	Even mix of large-shallow.		Majority of pools large-deep; very few shallow.		Shallow pools much more prevalent than deep pools.		Majority of pools	small-	
SCORE 2	rge-deep, small-sh	allow, ve	ajority of pools l ry few shallow.	large-deep;	prevalen	t than deep pools.	shallow or pools a		

. Sediment eposition	islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
CORE	on to say the production		pools prevalent	<b>通过包含于10万里的国际</b>	
. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	96. 9 (3)		1 4 34 7 0		
6. Channel Alteration  Channelization or dredging absent or minimal; stream with normal pattern.		Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
CORE	15052 10 3 8 2 15 1 do 5	CONTRACTOR DESIGNATION	intermediate in the second	图 是1985/改成图》	
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	20 0 18 18 17 16	是15.00mm 中央15.00mm	10 24 25 11 11	<b>《美国社会》</b>	
8.Bank Stability (score each bank) Note: determine left or right side by facing	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank	Moderately stable; infrequent small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of ban has erosional scars.	
SCORE	ren Bank a Dia 1/2				
SCORE					
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble heigh remaining.	closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces cover by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE (LB)	henound to the	是是是是			
SCORE	Supplement to the supplement of the supplement o			<b>对性的主要的</b> 包含	
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >1 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawre or crons) have not	impacted zone only minimally.	8 Width of riparian zone of 12 meters; human activities have impacted zone a great deal.	meters: little of no riparia	
SCORE (LB)	Cel Bank 40 Lac A	2.6			
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	3 1 1 10 9	

		and the same			1	-			
STREAM NAME	North Fo	d of	dit	tleQuer	LOCATIO	ON:			
STATION#: C						VATERSH	ED: Little	e frer	
LAT.:	LONG.:				COUNTY	r. Chris	tion uses	7.5 TOPO:	
DATE:05/13/	03 тіме:	1:12 pm	1 0	AM DPM	INVEST	GATORS:	P.B. S	.H, M.D	, S, B
TYPE SAMPLE:	□ P-CHEM □	Macroinver	tebrate	□ FISH □	BACT.	ALGAE		-	
WEATHER:	0 0	ast 24 hours  Heavy rain  Steady rain  Intermitten  Clear/sunn	n nat show				rain in the last	7 days? nfall in past 24 l	hours in.
P-Chem: Temp(°	PC) D.	O. (mg/l)		%Saturati	ion	pH(S	s.U.)	Cond	Grab
INSTREAM W FEATURES:		Predo		ATERSHED I		EES:			
Stream Width Range of Depth Average Velocity Discharge Est. Reach Leng	yf	t Sur t/s Dee cfs Oil	rface Mining  ep Mining  Wells			Constr Comm Industr Row C	ercial .	□ Forest ☑ Pasture/Grazi □ Silviculture ☑ Urban Runoff	
Hydraulic Struct  Dams Br Island W Other	ridge Abutments			Stream Flow Dry High Succession	Pooled Very Rapi			Stream Type Perennial Dephemera	☐ Intermittent
Riparian Vegeta Dominate Type: Trees Sh Grasses He Number of strata	rubs erbaceous	Tree/Shrub	Taxa	Canopy Cov  Fully Exp  Partially E  Partially S  Fully Shad	osed (0-259 Exposed (25 Shaded (50-	75%)	Channel Alter  ☐ Dredging  ☐ Channeliza  ☐ Full ☐ Parti	tion	
Substrate □Est. □P.C. Riff			e	_%	R	un 50	_%	Pool_5	2 %
	Silt/Clay (<0.06 mm)			V				V	-
Sand (0.06 – 2									
Gravel (2-64 m								-	
Cobble (64 – 2	-					/	11	//	
Boulders (>256 Bedrock	o mun)	_	_	(edge)		(SPE)	V (edpe)		
Habitat					C	- 0			
Parameter	Optim	al		Suboptima		n Categor	y Iarginal	P	00r
1. Epifaunal Substrate/ Available Cover	substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags		well-s coloni adequi maint presen substr newfa for co	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).		10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		Less than 109 habitat; lack of obvious; subsor lacking.	
SCORE	20. 1018	17 + 16	15	14 13 1	12: The	10 9	8 (7) 8	5 4 3	2 1 0
2. Pool Substrate Characterizati on	materials, with gravel and if firm sand prevalent; root mats and submerged		Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		ominant;	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.		Hard-pan cla no root mat o	y or bedrock; or vegetation.
SCORE	20=-19:18:	17. 16	15	14 13,	12 11 :	10 . 9	8 7 6	) 5 4 3	2 1 0
3. Pool Variability	Even mix of lar large-deep, sma small-deep pool	ll-shallow,		rity of pools la few shallow.	rge-deep;		pools much mor than deep pools		
SCORE	20 - 19 - 18	17 16		5 14 13	12=11	10 9	(3) n	5 4 3	2 1 0
L. Commission of the Commissio			Control of						and prediction of the same

acui Available Copy

	islands or point bars and less than 20% of the bottom affected by	ormation, mostly from gravel, sand or fine sediment; 0-50% of the bottom affected; slight deposition in bools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
CORE	20 19 18 32 16	ali5 14 713 12 11 1	10 9 8 17 6	5(3) 472 120	
. Channel low Status	Water readings oddering	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
CORE		75, 14, 13, 12, 13, 1	10) 9 8 7 16	-5 4 2 L 0	
i. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
COPF	20 - 19 18 17 16	15 (4) 13-12-11	10 9 8 7 8	5 4 3 2 1 9	
7. Channel Sinuosity  The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	long distance.	
SCORE	20 19 18 17 16	10-15-014 B 12 11	10 9 8 (7) 6		
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	potential for future problems. <5% of bank	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE (LB)	Left Bank 10 9	8 7 6	3 4 (3)		
SCORE	Reght Bank 40 9	8 47 6	+ 13 + 14 (3)		
9. Vegetative Protection (score each bank)  More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowin minimal or not evident; almost all plants allowed to grow naturally.		affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble heigh remaining.	patches of bare soil or closely cropped vegetation common; les than one-half of the	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high, vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE (LB)	Left Bank 10 9	8 7 6)	5 4 1 3	1 2 3 1 1 0	
SCORE (RB)	Right Bank 10 9		3 4 37	2 1 6 6- Width of riparian zone <6	
10. Riparian Vegetative Zone Width (score each bank riparian zone)  Width of riparian zone > 1 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.		impacted zone only minimally.	activities have impacte zone a great deal.	meters: little or no riparial vegetation due to human activities.	
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 @	2 13 0	
SCORE	<b>对外,</b>	S 8 - 1 - 6	5 4 (8	) -2 . 1 1 6 .	

Total Score

Low Gradient Stream Data Sheet STREAM NAME: Upper Branch 107 NE Hopskinville OCATION: STATION #: CLR2000 CK BASIN/WATERSHED: MILE: USGS 7.5 TOPO: LONG .: LAT : Pinar, Ker, Matter Minaral DAM DEM INVESTIGATORS: JOHN DATE:09/05/03 TIME: 2. TYPE SAMPLE: P-CHEM Macroinvertebrate FISH BACT. ALGAE Has there been a heavy rain in the last 7 days? Past 24 hours WEATHER: Now Air Temperature 80 °C. Inches rainfall in past 24 hours \_\_\_\_\_ % Cloud Cover ₩ es ☐ Heavy rain Steady rain 0 0 ☐ Intermittent showers Clear/sunny 80 Grab Cond. pH(S.U.) %Saturation D.O. (mg/l)\_ P-Chem: Temp(°C) INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: ft Stream Width ☐ Forest ☐ Construction ☐ Surface Mining ft Range of Depth ☐ Pasture/Grazing ☐ Commercial Deep Mining ft/s Average Velocity ☐ Industrial ☐ Silviculture Oil Wells cfs Discharge ☐ Urban Runoff/Storm Sewers Row Crops ☐ Land Disposal Est. Reach Length Stream Type: Stream Flow: Hydraulic Structures: Perennial | Intermittent □ Low □ Normal □ Pooled Dry ☐ Dams ☐ Bridge Abutments☐ Island ☐ Waterfalls ☐ Very Rapid or Torrential ☐ Ephemeral ☐ Seep High O Other Channel Alterations: Dom. Tree/Shrub Taxa Canopy Cover: Riparian Vegetation: Grasses | Herbaceous | BM | Flyder | Number of street ☐ Fully Exposed (0-25%) O Dredging Partially Exposed (25-50%) Channelization (OFull (Partial) Partially Shaded (50-75%) ☐ Fully Shaded (75-100%) Run /00 % Pool % Riffle Substrate QEst. QP.C. 100 Silt/Clay (<0.06 mm) Sand (0.06 - 2 mm) Gravel (2-64 mm) Cobble (64-256 mm) Boulders (>256 mm) Bedrock Condition Category Habitat Poor Marginal Suboptimal Optimal Parameter Less than 10% stable 30-50% mix of stable habitat; 10-30% mix of stable Greater than 50% of habitat; lack of habitat is substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other habitat; habitat availability less than well-suited for full obvious; substrate unstable colonization potential; adequate habitat for Epifaunal desirable; substrate frequently disturbed or or lacking. Substrate/ Available Cover maintenance of populations; presence of additional substrate in the form of removed stable habitat and at stage newfall, but not yet prepared to allow full colonization potential (i.e., logs/snags that are not new fall and for colonization (may rate at high end of scale). not transient). and the second of the second SCORE Hard-pan clay or bedrock; no root mat or vegetation. All mud or clay or sand Mixture of soft sand, mud, or Mixture of substrate 2. Pool bottom; little or no root clay; mud may be dominant; materials, with gravel and firm sand prevalent; root mats and submerged Substrate mat; no submerged some root mats and Characterizati submerged vegetation present. vegetation. vegetation common. 20, 19, 18, 17, 16 5 94 98 42 41 5 SCORE

Majority of pools large-deep;

15 14 313 12 311

very few shallow.

Even mix of large-shallow, large-deep, small-shallow,

20 19 18 17 16.

small-deep pools present.

3. Pool Variability

SCORE

Shallow pools much more

prevalent than deep pools.

Majority of pools small-

shallow or pools absent.

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	200年9年8年7年20日	<b>医斯伊尼氏的</b> 1000 新疆		
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE				7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 2 19 -18 2 7 12 16	G-16*114_7B 10*111-14		是一种。 10.30 中的
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length increase the stream length 2 to 3 times longer than if it was in a straight line.  The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.  The bends in the stream increase the stream length 2 increase the stream length 2 to 3 times longer than if it was in a straight line.		Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17576		10 19 (8) n st	是各种企业的企业。 10.1000年,10.1000年,10.1000年,10.1000年,10.1000年,10.100年,10.100年,10.100年,10.100年,10.100年,10.100年,10.100年
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of crosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE	PARTITION OF STREET			
(LB) SCORE (RB)				
9: Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)				
SCORE		<b>在一个工作工作</b>		
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	nen-Baile eto espe	1.8 (-/g <sub>2</sub> ) 46 (-)		
CORE (RB)	Right Bank 10s 29	8 7 6 -	3 1 4 1 4	

NOTES/COMMENTS:

88

ATE   5   13   O.3 TIME   11   3.0   DMM   DM   INVESTIGATORS   H.S. & D.W. Personne.	and the second second							^ .	
AT: LONG: COUNTY: CLASS USGS 7.5 TOPO:  DATE: \$\sigma \text{TIMES} \text{ UNGS 7.5 TOPO:} \text{ DATE: \$\sigma \text{ UNGS 7.5 TOPO:}  DATE: \$\sigma	STREAM NAME	So Fork Li	Hle Ri	ver	LOCATIO	ON: Tra	il of Te	ears Park	
ANTE: 5   3   0 3 TIME:   11 3 0	STATION#: CA	2200005	MILE:		BASIN/V	VATERSHI	ED: Liffle	e Rwei	
YEATHER: Now Part All Anous Present Services and Services	LAT.:	LONG.:				-			
YEATHER: Now Part All Anous Present Services and Services	DATE: 5/13	03 TIME: 113.	30	AM DPM	INVEST	GATORS:	HB5 &	KDN personne	
Greater than 50% of substrate and submerged to cover   Proceed the stable habitat and at stage of haracterization   Proced   Proced than 50% of substrate and submerged logs, underent cover   Proced than 50% of substrate   Proced than 50% of subst	TYPE SAMPLE:	DP-CHEM DMac	roinvertebrate	DIFISH O	BACT. 194	ALGAE			
Pechem: Temp(*C)   S = 2 D. 0. (mg/l)   10    %Saturation   C 3    pH(S.U)   7.3    Cond 4C - 1.9    Grab  INSTREAM WATERSHED  FEATURES:  Stream Width	WEATHER:	G G He	avy rain ady rain ermittent show	2	Yes C	No ature 70	2 °C. Inches rain		
Stream Width   ft   Range of Depth   ft   Surface Mining   Deep Mining   Depth	P-Chem: Temp(°	ic a		%Saturati	ion_103	pH(S	.u.) 7.3	Cond. 40 . 19 Grab	
Average Velocity   Cris	INSTREAM W. FEATURES: Stream Width	ft	Predominar	t Surrounding				6	
Dams   Bridge Abutments   Dams   Bridge Abutments   Dams   Bridge Abutments   Demorate Type;   Demorate Type;   His hard by   Demorate Demorat	Discharge	y ft/s cfs	☐ Deep Min ☐ Oil Wells	ning S		Commo	ercial @	Pasture/Grazing	
Dominate Type:  ##Triese ##Sphubs @*Grasses ##Arbaceous Number of stratta	☐ Dams ☐ Bi	ridge Abutments		□ Dry □	Pooled			Perennial Intermittent	
Silt/Clay (<0.06 mm)  Sand (0.06 – 2 mm)  Gravel (2-64 mm)  Cobble (64 – 256 mm)  Boulders (>256 mm)  Bedrock  Habitat  Parameter  Optimal  Greater than 50% of substrate favorable for epifaunal colonization and substrate favorable for on allow full colonization potential; and the substrate favorable for colonization potential; and the substrate in the form of the substrate in the form of the substrate in the form of colonization potential; and not transient).  SCORE  2. Pool  SCORE  20. 19 18 17 16  3. Pool Variability  Even mix of large-shallow, small-deep pools present.  Majority of pools large-deep; well-allow, small-deep pools present.  Majority of pools large-deep; well-allow, shallow or pools absent.	Dominate Type: Trees OSh Orasses OHe	rubs Ash- Willa	Hackber	☐ Fully Expo ☐ Partially E ☐ Partially S	osed (0-259 Exposed (25 Shaded (50-	5-50%) ·75%)	Dredging Channelizati	ion	
Sand (0.06 – 2 mm)  Gravel (2-64 mm)  Cobble (64 – 256 mm)  Boulders (>256 mm)  Bedrock  Habitat  Condition Category  Parameter  Optimal  Greater than 50% of substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/maisert).  SCORE  20 19 18 17 16  Mixture of substrate and firm sand prevalent; root mats and submerged vegetation common.  SCORE  20 19 18 17 16  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation present.  Even mix of large-shallow, Variability  Even mix of large-shallow, small-deep pools present.  Majority of pools large-deep; every few shallow or pools absent.	Characteristic house		Riffle /	0_%	R	un 40	% 45	Pool_40 % 45	
Gravel (2-64 mm)  Cobble (64 – 256 mm)  Boulders (>256 mm)  Bedrock  Habitat  Parameter  Optimal  Greater than 50% of substrate favorable for epifaunal colonization and substrate favorable for full colonization potential; substrate favorable for epifaunal colonization and substrate for full colonization potential; substrate favorable for epifaunal colonization and substrate favorable for colonization potential; substrate and in transient).  SCORE  20 19 18 17 76  Mixture of soft sand, mud, or clay or sand bottom; little or no root mats and submerged vegetation common.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mats, no submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mats, no submerged vegetation.  SCORE  20 19 18 17 16  15 14 13 12 (i) 10 9 8 6 5 3 1 0  Mixture of soft sand, mud, or clay or sand bottom; little or no root mats, no submerged vegetation.  SCORE  20 19 18 17 16  SCORE  3. Pool  Variability  Even mix of large-shallow, small-deep pools present.  Majority of pools large-deep; very few shallow. small-deep pools present.			~			V			
Bedrock  Habitat  Parameter Optimal Suboptimal Suboptimal Occondition Category  Ranginal Poor  Greater than 50% of substrate favorable for epifaunal colonization and fish cover, mix of snages, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).  SCORE  26 19 18 17 16  Mixture of substrate materials, with gravel and firm sand prevalent; root on mat and submerged vegetation common.  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation on transient).  SCORE  20 19 18 17 16  SCORE  20 19 18 17 16  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom, title or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom, title or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay or sa		100							
Boulders (>256 mm)  Bedrock  Habitat  Parameter Optimal Suboptimal Suboptimal Marginal Poor  Greater than 50% of substrate favorable for epifaunal colonization and fish sover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).  SCORE  20 19 18 17 16  Less than 10% stable habitat; habitat and desirable; substrate frequently disturbed or removed.  Mixture of substrate materials, with gravel and firm sand prevalent; root materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Marginal Poor  Less than 10% stable habitat; habitat and at stage colonization potential; adequate habitat for all colonization potential; adequate habitat for an internace of populations; resence of additional substrate in the form of removed.  SCORE  20 19 18 17 16  45 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Marginal Poor  Less than 10% stable habitat; habitat and at stage frequently disturbed or removed.  SCORE  3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; or submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; or submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; or submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; or submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no ro									
Parameter   Optimal   Suboptimal   Marginal   Poor			V		V				
Parameter  Optimal  Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat are not new fall and not transient).  SCORE  20 19 18 17 16  Characterization  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of substrate characterization  SCORE  20 19 18 17 16  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation present.  Mixture of substrate substrate materials, with gravel and firm sand prevalent, root mats and submerged vegetation present.  Mixture of substrate substrate at high end of scale).  Mixture of substrate materials, with gravel and firm sand prevalent, root mats and submerged vegetation present.  Mixture of substrate at high end of scale).  All mud or clay or sand bottom; little or no root mat; no submerged vegetation.  All mud or clay or sand bottom; little or no root mat; no submerged vegetation.  Majority of pools large-deep; overy few shallow.  Score substrate favorable for substrate well-suited for full colonization potential; adequate habitat; availability less than desirable; abbitat; habitat; availability less than desirable; abustrate in the form of newfall, but not yet prepared of removed.  Less than 10% stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate at high end of scale).  Less than 10% stable habitat; availability less than desirable; abustrate in the form of newfall and not removed.  Less than 10% stable habitat; availability less than d		o mm)			V				
Parameter Optimal Suboptimal Marginal Poor  Greater than 50% of substrate favorable for epifaunal colonization and fish cover, mix of snage, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).  SCORE 76 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 10 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 6 15 14 13 12 11 10 9 8 7 7 6 15 14 13 12 11 10 10 10 10 10 10 10 10 10 10 10 10	7.01								
Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).  SCORE  20 19 18 17 16  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  SCORE  20 19 18 17 16  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation common.  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  SCORE  20 19 18 17 16  45 14 13 12 (11)  10 9 8 7 6  Majority of pools small-shallow, small-deep pools present.  Majority of pools small-shallow or pools absent.	0.00000	Ontimal		Subontime			Poor		
Epifaunal Substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).  SCORE  20 19 18 17 16  Mixture of substrate materials, with gravel and form and submerged vegetation common.  Mixture of substrate materials, with gravel and submerged vegetation common.  Mixture of substrate materials with gravel and submerged vegetation present.  Mixture of substrate materials with gravel and submerged vegetation present.  Mixture of substrate materials with gravel and submerged vegetation.  Mixture of substrate materials with gravel and submerged vegetation present.  Mixture of substrate materials with gravel and submerged vegetation present.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat or vegetation.  Mixture of substrate materials with gravel and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  SCORE  20 19 18 17 16  15 14 13 12 (1) 10 9 8 7 6 5 4 3 2 1 0  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay; or sand bottom; little or no root mat or vegetation.  SCORE  20 19 18 17 16  Mixture of soft sand, mud, or clay; or sand bottom; little or no root mat or vegetation.  SCORE  SCORE  20 19 18 17 16  Mixture of soft sand, mud, or clay; or sand bottom; little or no root mat or vegetation.  SCORE  SCORE  SCORE  20 19 18 17 16  Mixture of soft sand, mud, or clay; or sand bottom; little or no root mat; or sand bottom; little or no root mat; or sand bottom; little or no root mat; or sand submerged vegetation.  SCORE  SCORE  SCORE	1 at atticted								
Mixture of substrate Characterizati on  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  No root mat or vegetation.  SCORE  20 19 18 17 16 15 14 13 12 (11) 10 29 8 7 6 5 4 3 2 4 0  3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  Shallow pools much more prevalent than deep pools.  Majority of pools small- shallow or pools absent.	I. Epifaunal Substrate/ Available Cover	substrate favorable fit epifaunal colonization fish cover; mix of sn submerged logs, und banks, cobble or other stable habitat and at to allow full colonization fit in the stable habitat and at to allow full colonization fit in the stable habitat and the stable habitat and the stable habitat and the stable habitat are not new fall not transient).	or well- color ags, adeq ercut main prese stage subs ation newf and high	vell-suited for full olonization potential; dequate habitat for naintenance of populations resence of additional ubstrate in the form of the form of the prepare or colonization (may rate a		Il habitat; ha availabilit desirable; frequently removed. or mo formay rate at		habitat; lack of habitat is obvious; substrate unstable	
Characterizati on firm sand prevalent; root mats and submerged vegetation present.  SCORE 20 19 18 17 16 15 14 13 12 (11) 10 29 8 7 6 5 4 3 2 4 0  3. Pool Variability Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Majority of pools large-deep; Very few shallow.  Majority of pools large-deep; prevalent than deep pools. Shallow or pools absent.	SCORE	20 19 18 17	16. I	5 14 13	12 11	10 9	8 7 6	5 (1) 1 2 1 0	
3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Majority of pools large-deep; very few shallow.  Shallow pools much more prevalent than deep pools.  Majority of pools small-shallow or pools absent.	2. Pool Substrate Characterizati on	materials, with grave firm sand prevalent; mats and submerged	root some	e root mats and nerged vegetation		mat; no submerged			
Variability large-deep, small-shallow, small-deep pools present. very few shallow. prevalent than deep pools. shallow or pools absent.	SCORE	20 19 18 17	16 1	5 14 13	12 (11)	10 9	8 7 6	5 4 3 2 4 0	
SCORE 20 19 18 17 16 15 14 (13) 12 11 10 9 8 7 6 5 4 3 2 1 0	3. Pool Variability	large-deep, small-sh	allow, very		arge-deep;				
	SCORE	20 19 18 17	16 1	5 14 (13)	12, 11	10 . 9	. 8 7 6	5 4 3 2 1 0	

eposition	THE OF HO CHIME BOTTON	Some new mercus	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	20 -19 18 17 16	15 14 (3) 12 11	10 9 8 7 6	5 4 3 2 1 0
CORE  Channel Flow Status	Water reaches base of both lower banks, and minimal	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	standing pools.
SCORE	substrate is exposed.	15 14 13 12 11	10 9 8 7 6	5 44.2 2 3 0
CORE			Channelization may be	Banks shored with gabion or
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
CORE	20 19 18 17 16	(15 (4 (9) 12 1)	10 9 8 7	6 5 4 3 2 1 0
SCORE 7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream leng 2 to 1 times longer than it was in a straight line.	if long distance.
SCORE	20 18 18 17 F		10 9 8 9	
8.Bank Stability (scoreach bank) Note: determine left or right side by facing downstream.	potential for future	Moderately stable; infrequer small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion	areas of erosion; high	areas; "raw" areas frequent along straight sections and
SCORE (LB)	Left Bank 10 9	8 7 6		
SCORE	Right Bank 10 9	8 7 6		Less than 50% of the
(RB)  9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including tre understory shrubs, or nonwoody macrophytes vegetative disruption through grazing or mow minimal or not evident; almost all plants allowers grow naturally.	vegetation, but one class of plants is not well-represent disruption evident but not affecting full plant growth potential to any great exter more than one-half of the potential plant stubble heir remaining.	patches of bare soil or closely cropped vegetation common; I than one-half of the	streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9	(8) 7 - 6	5 4	3 - 2 1 - 0 -
SCORE (RB)	Right Bank 10 9	8 7 6		ne 6- Width of riparian zone <6
10. Riparia Vegetative Zone Width (score each bank riparia zone)	width of riparian zone meters; human activiti (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have	impacted zone only minimally.	2-18 Width of riparian zo 12 meters; human activities have impa zone a great deal.	meters: little or no riparia vegetation due to human activities.
SCORE (LB)	Left Bank 10	9 8 7 6	5 4	3 2 1 0
SCORE (RB)	Right Bank 10	9 8 7 6	$\mathcal{A} = \{ \mathbf{c}_{i}^{(i)}, \mathbf{c}_{i}^{(i)} \in \mathcal{A}_{i} \}$	3 1 (3) 1 7 0

							0 1		
TREAM NAME:	Sofork L	Hle K	wer	LOCATIO	N: Tro	is of T.	ears Park		
STATION #: CR	2 0000 5	MILE:	-	BASIN/W	ATERSHI	ED: Li#1	e Rwe-		
AT.:	LONG.:			COUNTY	: Chr	ist uses 7	.5 TOPO:		
DATE: 5/13 /	03 TIME: 113.	30	DAM □PM	INVESTI	GATORS:	HBS &	KDW personne		
TYPE SAMPLE:	P-CHEM DMac	roinvertebra	ate OFISH O	BACT.	LGAE		1000		
WEATHER:	□ □ He □ □ Ste □ □ Int	4 hours avy rain ady rain ermittent shear/sunny	owers .	Air Temper	No ature 70 loud Cove	г	7 days? nfall in past 24 hours in.		
P-Chem: Temp(°	c) 18.2 D.O. (1	mg/l) /O	%Satura	tion_103	pH(S	.u.) 7.3	Cond. 40. 19 Grab		
INSTREAM WA	ATERSHED		WATERSHED		ES:				
Stream Width	ft		ant Surrounding	Land Use:			n6		
Range of Depth					□ Constru		Forest Pasture/Grazing		
Average Velocity		Oil We			Industr		Silviculture		
Discharge Est. Reach Lengt	thcfs	☐ Land D			Row C		Urban Runoff/Storm Sewers		
Hydraulic Struct	idge Abutments				Low d or Torren	☐ Normal	Stream Type:  Percanial Intermittent Ephemeral Seep		
Other_	tion: Dom Tree	/Shrub Taxa	a Canopy Co	ver		Channel Alter	ations:		
Riparian Vegetat Dominate Type:	A-1	Hank L	Fully Ex	posed (0-25%	6)	☐ Dredging			
Be Trees Or Shu	Trees Or Shrubs			Exposed (25		Dehanneliza			
Grasses THe	charenus Willia	0	Partially	Shaded (50-		(OFull OFarti	al)		
	imber of strata Cottonwood   Fully				1%)				
Substrate Est.			10 %	Ri	m 40	_% 45	Pool 40 % 45		
Silt/Clay (<0.06		U			-				
Sand (0.06-2				-		-			
Gravel (2-64 m						int			
Cobble (64-2			<u> </u>		1/				
Boulders (>256 Bedrock	5 mm)	V	1	+	-				
Habitat				Conditio	n Categor	-v			
Parameter	Optimal		Suboptin	A STORY		/arginal	Poor		
	Greater than 50% of	30	50% mix of sta	hle hahitat	10-30%	mix of stable	Less than 10% stable		
1. Epifaunal Substrate/ Available Cover	substrate favorable i epifaunal colonizati fish cover; mix of si submerged logs, und banks, cobble or oth stable habitat and at to allow full coloniz potential (i.e., logs/st that are not new fall not transient).	for and co nags, addercut mater product stage aution ne mags and high	ell-suited for full blonization potential; lequate habitat for aintenance of populations;		habitat; h availabili desirable frequentl removed.	nabitat ity less than ; substrate y disturbed or	habitat; lack of habitat is obvious; substrate unstable or lacking.		
SCORE	200 0 18 1	16:1	08/04/0132	D 新原	10 0				
2. Pool Substrate Characterizati on	Mixture of substrate materials, with grav firm sand prevalent mats and submerged vegetation common	ay; mud may be dominant; bo		bottom;	or clay or sand little or no root submerged on.	Hard-pan clay or bedrock; no root mat or vegetation.			
SCORE	20 19 18	7 16	15 -14 1 43	12 (11)	10 3	8	2 2 3 2 500		
3. Pool Variability	Even mix of large-s large-deep, small-sh small-deep pools pr	allow. ve	ajority of pools ry few shallow	large-deep;	Shallow prevalen	pools much mon t than deep pool	Majority of pools small- shallow or pools absent.		
SCORE	20 19 18 1	7 16	35 JU (1)	- 14 C	1 10	- 1 8 TV9-1 1	6 26 21 3 2 1 0		
OCORD		PERSONAL PROPERTY AND ADDRESS.	WAS PUBLISHED DESIGNATION OF THE PARTY OF	CONTRACTOR CONTRACTOR	OF THE PERSON NAMED IN		THE RESERVE OF THE PERSON OF T		

Peposition	islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
CORE	7) 19 110 12 16 16 16 16 16 16 16 16 16 16 16 16 16		200 57 8 7 14			
c. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
CORE	20 (0) 18 17 16	15 (A 18 (2) 417	10 -9 -3 - 1, 6	3 4 3 2 0		
6. Channel Alteration Channelization or dredging absent or minimal; stream with normal pattern.		nt or minimal; stream usually in areas of bridge		Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
SCORE			2107-20-58-73-6	5 (2.00.20.20.20.		
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	图图图图图图		
8.Bank Stability (score each bank) Note: determine left or right side by facing	absent or minimal; little potential for future problems <5% of bank	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
SCORE	seen strike in the 19 he					
(LB) SCORE	Right Explorer 22	6				
SCORE (RB)  9. Vegetative Protection (score each bank)  make the streambank surfaces and immediate riparian zone covered by native vegetation, including trees understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.		remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE	den Bank 10 19		3 14 19			
SCORE	Right Bank 10 1 9	1 6				
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.		Width of riparian zone of 12 meters; human activities have impacted zone a great deal.	meters: little or no ripariar		
SCORE (LB)	15t Bank 10 2 9	8 7 0		9 1.50		
SCORE (RB)	Right Bank 10 9	8 7 6	3 4 3	(2) 1 , 0 =		

		LOW	Ort	Idioni Str				-		
TREAM NAME:	South	Fork Li	24	elio			orl of 7			
TATION #: CRE							id: Little			
AT.:	LONG.:				COUNTY: Christia USGS 7.5 TOPO:  INVESTIGATORS: Colon, Pinar, Matt, Ken, A					
ATE: 09/05		9:00	DX	а́м □РМ	INVESTIG	ATORS:	Bokn, Pina	er, mat	E, Ken, A	
YPE SAMPLE:				OFISH OF	BACT. D A	LGAE				
EATHER:	Now P	Past 24 hours Heavy rain Steady rain Intermittent Clear/sunny	show	H	as there bee	n a heavy No ture 72	rain in the last 7 c		ours <u>O</u> in.	
P-Chem: Temp(°C	DD	).O. (mg/l)		%Saturati	on	pH(S	.U.)	Cond	Grab	
INSTREAM WA FEATURES: Stream Width Range of Depth Average Velocity		ft Predon	ninan ace N		Land Use:	□ Constr	ercial 🔾	Forest Pasture/Grazi	ng	
Discharge Est. Reach Length	cfs Oil W					☐ Industr		Silviculture Urban Runofi	/Storm Sewers	
Hydraulic Structu  ☐ Dams 26 Bri ☐ Island ☐ Wa	res: dge Abutments			Stream Flow Dry C	Pooled	Low for Torrer		Stream Type Perennial DEphemera	☐ Intermittent	
O Other  Riparian Vegetation: Dom. Tree/Shrub T  Dominate Type: Trees D Shrubs Grasses G Herbaceous Number of strata				D Fully Exposed (0-25%)			Dredging Channelization	Channel Alterations:  Dredging Channelization (DFull DPartial)		
Substrate DEst. DP.C. Riffle			- 5	%	Ru	in 20	_%	Pool	5_%	
Silt/Clay (<0.06										
Sand (0.06 – 2 1						1		4		
Gravel (2-64 m	m)	1			/					
Cobble (64 – 25	56 mm)				1/					
Boulders (>256	mm)	1								
Bedrock	70				j					
Habitat					Conditio	n Catego	ry			
Parameter	Opti	mal		Suboptim	al		Marginal		Poor	
1. Epifaunal Substrate/ Available Cover	substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization exercise (i.e. logs/snags for			30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).			10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		% stable of habitat is sstrate unstable	
SCORE			100	rem o	all applied	10000	1111月19年11月11		SANKING SANKIN	
2. Pool Substrate Characterizati on	materials, with gravel and firm sand prevalent; root so mats and submerged st			Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		bottom; mat; no vegetati		no root mat	ay or bedrock; or vegetation.	
SCORE	1570			<b>6</b> 12 A			A PARTY N			
3. Pool Variability	Even mix of	large-shallow,	Ma	jority of pools y few shallow	large-deep;	Shallov	Shallow pools much more prevalent than deep pools.		pools small- pools absent.	
SCORE	20 30	8 17 16		(5) (4) (8)	12 114	10 5	9 8	126,44	a Policia o	
TOTAL STREET	■ 7.47 MARK ADMILLER 中国の12 PA 12 PA	20 19 18 17 16 (5) 14				THE PERSON NAMED IN	the name of Parties of Street, where the parties of	到於 <u> </u>		

4. Sediment Deposition  Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
SCORE				医外侧侧部		
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
SCORE	707 (P) 182-17 = 100					
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
SCORE	20 P 19 - 18 - 15 - 16					
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
SCORE	20 9 8 77 17		10/10 1185 F/W	Date Allegand O		
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing, 60-100% of bank has erosional scars.		
SCORE	isa Ban Sin Sin Sin Sin Sin Sin Sin Sin Sin Si			是一个10年(PE)		
(LB) SCORE	Programme 17					
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the			
SCORE						
(LB) SCORE						
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian zone)	Wight Bank 10 29 31 Wight	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.		
zone) SCORE (LB)	15-ft Bank 40 - 05-c			2 1 (0)		
SCORE (RB)	Right Bank 10 9	8 7 6	3 4 2 3 4	2 (1 (0)		

NOTES/COMMENTS:

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STREAM NAME: Alock Fork of Little RNS  STATION #: CRE 2000 O6 MILE:  LONG:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   INVESTIGATORS: J. U. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   J. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   J. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   J. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME:   O: 20 MM   DM   J. CONTY: Chroate O1 USGS 7.5 TOPO:  DATE: O5/15/03 TIME: O5/15/03 TI			250,				AT	1 4 1	1	al Oim		
ATE OF 1/5 / DS TIME   O = 20   MM   DPM   NVESTIGATORS   T.W.   P.S.   M.   DPM   DPM   NVESTIGATORS   T.W.   P.S.   M.   DPM   DPM	STREAM NAME	: North Fo	rkofo	Lit	He RNO	LOCATIO	IN: HOP	uknuille k	Aborr	3475		
ATE OF 1/5 1/5 TIME: OP. 20 MAN IPM INVESTIGATORS J. W. P. B. M. D.    Port	STATION #: CR	£2000 06	MILE:		+6	BASIN/W	ATERSH	ED: Litt	le Riv	ier		
WEATHER:   Now   Part 24 hours   Heavy rain   Heavy rai	AT:	LONG.:				COUNTY: Chr. 36 27 USGS 7.5 TOPO:						
WEATHER:   Now   Part 24 hours   Heavy rain   Heavy rai	DATE: 05/15	7/03 TIME: /	0:20	Ø	ам ПРМ	INVESTI	GATORS:	J.W. P	BIN	1.0		
Hast there been a heavy rain in the last 7 days?	TYPE SAMPLE:	□ P-CHEM □ N	/acroinvert	ebrate	OFISH OF	BACT. A	LGAE					
P-Chem: Temp(**C)   D.O. (mg/l)   %Saturation   pH(S.U.)   Cond   Grate	doudy/	Now Pas	Heavy rain Steady rain Intermitten	t show	<b>X</b>	Yes  Air Tempera	No 17	°C. Inches rai		at 24 hours in.		
FRATURES: Stream Width fit Range of Depth Average Velocity Discharge Est. Reach Length  Hoffmulic Structures: Dams of Bridge Abuments Stream Flow: Discharge Est. Reach Length  Hoffmulic Structures: Dams of Bridge Abuments Stream Flow: Dry Pooled Low Normal Order Riparian Vegetation: Dry Pooled Construction Stream Flow: Dry Pooled Construction Stream Flow: Dry Pooled Construction Stream Type: Dry Pooled Construction Stream How: Dry Pooled Construction Stream Type: Dry Pooled Construction Order Construction Order Construction Order Construction Stream Type: Dry Pooled Construction Order C			). (mg/l)		%Saturation	on	pH(S	.U.)	Cond	Grab		
Dams   Bridge Abutments   Dry   Decoled   Low   Mormal   Perennial   Intermitter   High   Over Riparian Vegetation:   Dom. Tree/Shrub Taxa   Canopy Cover:   Cytope   Trees   Shrubs   Acc   Partially Exposed (0-25%)   Partially Exposed (0-25%)   Partially Exposed (0-25%)   Partially Shaded (50-75%)   Partial	FEATURES: Stream Width Range of Depth Average Velocit Discharge	ftftftcf	Predor	ninant face M p Min Wells	Surrounding I lining ling		Commo	ercial ial	Pasture/ Silvicult	ure		
Riparian Vegetation: Dom. Tree/Shrub Taxa Dyninate Type: Acc Strees Shrubs Strate Strees Shrubs Strate Strees Shrubs Strate Strate Strees Shrubs Strate Stra	Dams B	tures: ridge Abutments laterfalls		1	Dry D	Pooled			Peren	nial Intermittent		
Silt/Clay (<0.06 mm)  Sand (0.06 - 2 mm)  Gravel (2-64 mm)  Cobble (64 - 256 mm)  Boulders (>256 mm)  Bedrock  Habitat  Parameter  Optimal  Grater than 50% of substrate favorable for epifaunal colonization and substrate favorable for epifaunal substrate favorable for epifaunal colonization and substrate favorable for epifaunal colonization potential (i.e., logs/snags that are ngo new fall and not transient).  SCORE  2. Pool  SCORE  20 19 18 17 16  3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Majority of pools large-deep; very few shallow.  Majority of pools large-deep; very few shallow.  Majority of pools large-deep; very few shallow.  Score large from the colonization potential (i.e., logs/snags that are ngot new fall and pot transient).  SCORE  2. Pool Variability  Even mix of large-shallow, small-deep pools present.  Majority of pools large-deep; very few shallow.  Majority of pools large-deep; very few shallow.  Majority of pools large-deep; very few shallow.  Score for mix of large-shallow, small-deep pools present.	Riparian Vegeta Dominate Type: Trees Sh Grasses He	rubs Acer erbaceous Frax		Гаха	Partially Expo	osed (0-25% exposed (25%) haded (50- led (75-100)	(-50%) (75%) ()%)	☐ Dredging ☐ Channeliza (☐ Full ☐ art	ition ial)			
Sand (0.06 - 2 mm)  Gravel (2-64 mm)  Cobble (64 - 256 mm)  Boulders (>256 mm)  Bedrock  Habitat  Parameter  Optimal  Greater than 50% of substrate favorable for cepifanual colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 5 9 8 1 10 9 9 8 5 5 5 9 8 1 10 9 9 8 5 5 9 8 1 10 9 9 8 5 5 9 9 9 1 10 9 9 8 1 10 9 9 9 9 9 9 9 1 10 9 9 9 9 9 9 9 9	Substrate DEst	. OP.C.	Riffle	e_5	_%	R	ın_25	_%	Poo	1 70 %		
Gravel (2-64 mm)  Cobble (64 – 256 mm)  Boulders (>256 mm)  Bedrock  Habitat  Parameter  Optimal  Greater than 50% of opifisan al Suboptimal Suboptimal Suboptimal  Greater than 50% of opifisan al Suboptimal Suboptimal Suboptimal Suboptimal  Greater than 50% of opifisan al colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat at at stage to allow full colonization potential (i.e., logs/engs that are not new fall and not transient).  SCORE  20 39 18 17 66 15 14 13 12 11 10 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 4 3 2 1 10 9 9 8 5 5 5 4 3 2 1 10 9 9 8 5 5 5 4 3 2 1 10 9 9 8 5 5 5 5 9 9 9 9 9 9 9 9 9 9 9 9 9	CHOLD ST. ST. ST.		,				1			1		
Cobble (64 - 256 mm)   J   J			,	J			1			J		
Boulders (>256 mm)  Bedrock  Habitat  Parameter  Optimal  Greater than 50% of substrate favorable for epifaunal colonization and risk ocver; mix of stags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).  SCORE  20 19 18 17 16  Mixture of substrate and fram and prevalent; root mats and submerged vegetation common.  Mixture of substrate and firm sand prevalent; root mats and submerged vegetation common.  SCORE  20 19 18 17 16  15 14 13 12 11  Mixture of soft sand, mud, or clay, root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay, root mats and submerged vegetation common.  SCORE  20 19 18 17 16  Mixture of soft sand, mud, or clay, root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay, root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay, root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay, root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay, root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay, root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay, root mats and submerged vegetation.  Mixture of soft sand, mud, or clay, root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay, root mats and submerged vegetation.  SCORE  20 19 18 11 16  15 14 13 12 11  10 9 8  Majority of pools large-deep; Shallow pools much more prevalent than deep pools.  Majority of pools absent.		The second secon		1			1,			J		
Parameter   Coptimal   Suboptimal   Marginal   Poor							1			1		
Parameter   Optimal   Suboptimal   Marginal   Poor		o mm)		_		-		-		7		
Parameter Optimal Suboptimal Marginal Poor  1. Epifaunal Substrate favorable for epifaunal colonization and fish cover; mix of snags, substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).  SCORE 20 10 18 17 6 15 14 13 12 11 10 9 8 2 5 5 4 3 2 1 0 10 9 18 17 16 15 14 13 12 11 10 9 18 17 16 17 17 18 17 18 18 18 18 18 18 18 18 18 18 18 18 18				_		Conditto	n Catago	rv.				
Comparison of the content of the c	199911781177	Ontime	ı		Suboptima	F-19-79-40-00-1			1	Poor		
2. Pool Substrate Characterization Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 6  3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation present.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  SCORE  3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  SCORE  SCORE  3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	1. Epifaunal Substrate/ Available	Greater than 50% substrate favorab epifaunal coloniz fish cover; mix o submerged logs, banks, cobble or stable habitat and to allow full colopotential (i.e., log that are not new not transient).	of of old for	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at		10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or		habitat; obvious or lacki	lack of habitat is s; substrate unstable ng.			
Substrate Characterizati on  materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  clay; mud may be dominant; some root mats and submerged vegetation present.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; some root mat; no submerged vegetation.  clay; mud may be dominant; no submerged vegetation.  clay	SCORE	20 : 19   18	17 16		5 14 13	12 11	(10) 9	8 4		4 3 2 1 0		
3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Majority of pools large-deep; Shallow pools much more prevalent than deep pools. Shallow or pools absent.	Substrate Characterizati	rizati materials, with gravel and firm sand prevalent; root mats and submerged		clay; mud may be dominant; some root mats and submerged vegetation		mat; no	submerged	Hard-p no root	an clay or bedrock; mat or vegetation.			
Variability large-deep, small-shallow, small-deep pools present. very few shallow. prevalent than deep pools. shallow or pools absent.	SCORE	26 19 18	17 16	i	5 14 13	12 11	10 9	(8) 7	6. 45	4 . 3 . 2 . 1 . 0		
SCORE 20 19 18 17 16 15 (14) 43 12 11 10 9 8 7 6 5 4 3 2 1		large-deep, smal	l-shallow,	Majo	ority of pools la few shallow.	arge-deep;				ty of pools small- v or pools absent.		
	SCORE	20 19 18	17 16		5 (14) 43	12 11 10 9 8 7 6 5 4				4 3 2 1 0		

. Sediment eposition	islands or point bars and less than 20% of the	formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
CORE	20 19 18 17 16	15 14 13 12 11 7	10 (3) 8 36	3 4 3 2 1 0		
. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
SCORE	26 (19) 18 17 16	15 14 13 12 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10 9 8 7 6	3 4 3 2 1 0		
Channelization or dredging absent or minimal; stream with normal pattern.		Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
SCORE	20 19 18 17 46	18. 14 (Q) (D. 11)	10 9 8 7 6	3 4 3 2 1 0		
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
SCORE	The same of the sa	- 15: 14: ·13: 12: 11:	10, 19   8 - 7   6	5 4 2 2 1 0		
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	absent or minimal; little potential for future problems <5% of bank	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many croded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing, 60-100% of bank has erosional scars.		
SCORE (LB)	Left Bank 10 9	8= - 7= 1= 16	5 14 01	2 1 0		
SCORE	Right Bank 10 9	8 7 6 2	5 = 4 :0	2: - 1: 0		
(RB)  9. Vegetative Protection (score each bank)  More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including tred understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowiminal or not evident; almost all plants allowed grow naturally.		remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 70	2 - 1 - 0 - 5		
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 ""0 - :		
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6 12 meters; human activities have impacted zone a great deal.	meters: little or no riparian		
SCORE (LB)	Ect Bank 10: 9	8 7 6	5 🗿 😘	1.7 1.7		
SCORE (RB)	Right Bank 10 9	18 7 6		1.412 11.41.0		

Low Gradient Stream Data Sheet LOCATION: HODS KINNTLE STREAM NAME: CRR2000 6 STATION # No th BASIN/WATERSHED: COUNTY: Chr36-usgs 7.5 TOPO: LONG .: LAT. John Mott Sara MAM DPM INVESTIGATORS: KOL 10:15 DATE: 09/06/03 TIME: Macroinvertebrate D FISH D BACT, DKALGAE DP-CHEM TYPE SAMPLE: Has there been a heavy rain in the last 7 days? Past 24 hours WEATHER: Now □ No (Yes ☐ Heavy rain Air Temperature 70 %. Inches rainfall in past 24 hours a ☐ Steady rain M Cloud Cover ☐ Intermittent showers Clear/sunny ☐ Grab Cond. pH(S.U.)\_ %Saturation D.O. (mg/l) P-Chem: Temp(°C). INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: ft Stream Width □ Construction ☐ Forest Surface Mining ft Range of Depth ☐ Pasture/Grazing ☐ Commercial ☐ Deep Mining Average Velocity ft/s ☐ Silviculture ☐ Industrial Oil Wells cfs ☐ Urban Runoff/Storm Sewers Discharge Row Crops ☐ Land Disposal Est. Reach Length Stream Type: Stream Flow: Perennial | Intermittent Pooled O Low Normal Hydraulic Structures: Dry Dry ☐ Dams ♣ Bridge Abutments
☐ Island ☐ Waterfalls ☐ Ephemeral ☐ Seep O Very Rapid or Torrential ☐ High O Other Channel Alterations: Canopy Cover: Dom. Tree/Shrub Taxa Riparian Vegetation: ☐ Fully Exposed (0-25%) ☐ Dredging Dominate Type: Channelization Partially Exposed (25-50%) Trees Shrubs (OFull Partial) ☐ Partially Shaded (50-75%) ☐ Grasses ☐ Herbaceous ☐ Fully Shaded (75-100%) Number of strata Pool Run 95 Riffle 5 Substrate DEst. DP.C. Silt/Clay (<0.06 mm) 25 Sand (0.06 - 2 mm)Gravel (2-64 mm) Cobble (64 - 256 mm) Boulders (>256 mm) Bedrock Condition Category Habitat Poor Marginal Suboptimal Optimal Parameter Less than 10% stable 30-50% mix of stable habitat; well-suited for full 10-30% mix of stable Greater than 50% of habitat; lack of habitat is habitat; habitat substrate favorable for obvious; substrate unstable availability less than colonization potential; adequate habitat for submerged logs, undercut banks, cobble or other Epifaunal desirable; substrate frequently disturbed or or lacking. Substrate/ maintenance of populations; presence of additional substrate in the form of Available Cover removed. stable habitat and at stage newfall, but not yet prepared for colonization (may rate at to allow full colonization potential (i.e., logs/snags that are not new fall and high end of scale). not transient). 18 nja 18 nj2 (1 15 SCORE Hard-pan clay or bedrock; no root mat or vegetation. All mud or clay or sand Mixture of soft sand, mud, or Mixture of substrate bottom; little or no root 2. Pool clay; mud may be dominant; materials, with gravel and Substrate mat; no submerged some root mats and firm sand prevalent; root mats and submerged Characterizati submerged vegetation vegetation. present. vegetation common. 1-15 14 13 12 11 20 19 18 17 16 SCORE Majority of pools small-Shallow pools much more prevalent than deep pools. Majority of pools large-deep; Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. shallow or pools absent. 3. Pool very few shallow. Variability 15 14 13 12 14 20 19 18 17 16

SCORE

4. Sediment Deposition  Little or no enlargement islands or point bars at less than 20% of the bottom affected by sediment deposition.		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
SCORE	70 19 18 17 16		10 7 - 8 - 7 - 8	一方在是被紅色		
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
SCORE	20 19< t8 17 16	(6)34 8 12 11	10, 91, 8 7 6	SS 4:3-2 5:0		
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
SCORE	20 19 18 17 16	15 4 3 0/12	0 9 8 7 6	5 4 3 2 6 0		
7. Channel Sinuosity  The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
SCORE	rated in these areas.	2 5 4 10 12 1	10 - 9 - 38 - 7 - 6	5 21 (1) 20 37 10		
8.Bank Stability (score each bank) Note: determine left or right side by facing	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
SCORE	Left Bank 10 9 3	8 10 10 6				
SCORE	Right Bank 10	8		NOTE OF B		
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE	ton Bank 10 5 19 /a	7. 6		1 2 1 0		
SCORE		<b>17.34 22.54 3.65 3.65</b>				
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian zone)	Right Bank 10 9  Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.		Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.		
SCORE (LB)	12-ft Bank 10 2	8 77 - 6	-5 4 9	(1) 1 · 0 ·		
SCORE (RB)	Right Bank 10 9	1 8 7 6	F 5 4 4 3 3 5			

			W O	radicit Su	Cum D	uu one	OL .			
STREAM NAM	E: North	Fork of	-25	HeR.	LOCATI	ION: 10	7 to Gr	oy Lone		
STATION #: <								HERNE		
LAT.:	LONG.						tion uses			
DATEQ5/15	T LAZTIME	11+37	0	YAM FIRM						
TYPE SAMPLE	P-CHEM	☐ Macroinve	rtebrat	e OFISH O	BACT.	ALGAE	. , , , , , ,	3, 5.00		
WEATHER:	Now	Past 24 hour	S	I	las there b	een a heav	y rain in the last	7 days?		
cloudy /		☐ Heavy rai ☐ Steady ra ☐ Intermitte ☐ Clear/sun	in ent sho		Yes Air Tempe <u>/00</u> %	arature Cloud Cov	C. Inches ra	infall in past 24 hours in.		
P-Chem: Temp(	°C)	D.O. (mg/l)_		%Saturat	ion	pH(	S.U.)	Cond 🖸 Grab		
INSTREAM W FEATURES: Stream Width Range of Depth Average Velocit Discharge Est. Reach Leng	у =	ft Pred	ominan	5	Land Use:		rial >	☐ Forest  ☐ Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Storm Sewers		
Hydraulic Struct Dams B Island W Other	ridge Abutment	s		Stream Flow Dry High	Pooled			Stream Type:  Perennial Intermittent Ephemeral Seep		
Riparian Vegeta Dominate Type: Trees Sh Grasses He Number of strate	rubs Sy	n. Tree/Shrub Camore Kelder		Canopy Cow  Fully Expe Partially E Partially S Fully Shad	exposed (2: haded (50-	5-50%) -75%)	Channel Alter Dredging Channeliza Full Parti	tion		
Substrate □Est	. □P.C.	Riff	le_3	_%	R	un 3/17	7%	Pool_20 %		
Silt/Clay (<0.0						/ The said				
Sand (0.06-2					3	19				
Gravel (2-64 m		V				V		V		
Cobble (64 – 2			,							
Boulders (>25	o mm)	V			V					
Bedrock					MV.					
Habitat	0.0					n Categor				
Parameter	Opti	mai		Suboptima	1	N	larginal .	Poor		
1. Epifaunal Substrate/ Available Cover	Greater than 5 substrate favorepifaunal colo fish cover; misubmerged logbanks, cobble stable habitat to allow full copotential (i.e., that are not manient).	rable for nization and x of snags, gs, undercut or other and at stage olonization logs/snags w fall and	well-scolon adequination preses substitute for co-	suited for full ization potentic uate habitat for tenance of popurace of addition rate in the form all, but not yet ; olonization (ma end of scale).	habitat; habitat availability less than desirable; substrate frequently disturbed or removed.  habitat for desirable; substrate frequently disturbed or removed.  habitat; lack obvious; substrate frequently disturbed or removed.			Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.		
SCORE	-20 119 110	8 - 17 16	15	3 44 - (4.5)	2 11 12	507-9	10).56.3	39 4 30 20 00 00		
2. Pool Substrate Characterizati on	materials, with gravel and firm sand prevalent; root som mats and submerged sub			exture of soft sand, mud, or y; mud may be dominant; ne root mats and omerged vegetation sent.		bottom; l	or clay or sand ttle or no root abmerged	Hard-pan clay or bedrock; no root mat or vegetation.		
SCORE	20 - 19 - 1	8 17 16	15	i 44 13 1	2((1))	10 3	8 7 26	5 4 3 9 120E		
3. Pool Variability	Even mix of la large-deep, sm small-deep po	nall-shallow,		rity of pools lar few shallow.	ge-deep;		ools much more than deep pools.			
SCORE	20 19 18	8 19 16	2007		) y	10 19	9 7			

eposition	islands or point bars and less than 20% of the bottom affected by	formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
CORE			而 77 不	<b>学会的自身生态</b>		
i. Channel Flow Status  Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.		Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
CORE	500 (9) 18 17 5 16		10 9 78 7 6	<b>x c z z</b> 1 <b>0</b>		
6. Channel Alteration  Channelization or dredging absent or minimal; stream with normal pattern.		Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
	90 19 18 11 96	BAG WEEL DO NE	200 22 03			
7. Channel Sinuosity  The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding i considered normal in coastal plains and other low-lying areas. This		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
	parameter is not easily rated in these areas.	16 44 3 b d	() 0 2 7 6			
8.Bank Stability (score each bank). Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank	Moderately stable; infrequent small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
SCORE	1-0-Bank 10 11-9	(8) 71 6				
SCORE	Right Bank 18	8 17 6				
(RB)  9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including tree understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowiminmal or not evident; almost all plants allowed grow naturally.	affecting full plant growth potential to any great extent more than one-half of the potential plant stubble heigh remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces cover by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE (LB)	Left Bank 10 79	8 2 2 3				
SCORE	Right Bank 10 9	8 1 6	3 4 3			
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have no	impacted zone only minimally.	Width of riparian zone 12 meters; human activities have impacted zone a great deal.	meters: little of no riparia		
SCORE (LB)	Left Bank 10 9	8 7 6	\$ 4 3	2 () 0		
SCORE	Right Bank 10	8 7 6	ا جدي الإيمال الأوران ا	2 9		

NOTES/COMMENTS:

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Low Gradient Stream Data Sheet STREAM NAME: North Fork Little Roo LOCATION: 272 W. side Hopknuille BASIN/WATERSHED: Little River STATION#: CRF 200008 MILE: COUNTY: Chritten usgs 7.5 TOPO: LONG .: LAT .: 9:30 BAM DPM INVESTIGATORS: JOHN DATE: 09/06/03 TIME: TYPE SAMPLE: P-CHEM / Macroinvertebrate FISH BACTALALGAE Has there been a heavy rain in the last 7 days? Past 24 hours WEATHER: Now TYes O No ☐ Heavy rain Air Temperature 77 • Inches rainfall in past 24 hours a ☐ Steady rain ☐ Intermittent showers 2 % Cloud Cover Clear/sunny pH(S.U.)\_ Cond Grab D.O. (mg/l)\_ %Saturation\_ P-Chem: Temp(°C) INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: Stream Width ft ☐ Construction ☐ Forest ☐ Surface Mining Range of Depth ft ☐ Pasture/Grazing ☐ Commercial Deep Mining Average Velocity ft/s ☐ Silviculture Oil Wells ☐ Industrial cfs Discharge ☐ Urban Runoff/Storm Sewers ☐ Land Disposal Row Crops Est. Reach Length Stream Type: Stream Flow: Hydraulic Structures: Perennial | Intermittent Pooled D Low Normal O Dry Dams Bridge Abutments ☐ Ephemeral ☐ Seep U High ☐ Very Rapid or Torrential ☐ Island ☐ Waterfalls Other Channel Alterations: Dom. Tree/Shrub Taxa Canopy Cover: Riparian Vegetation: ☐ Fully Exposed (0-25%) ☐ Dredging Dominate Type: ☐ Partially Exposed (25-50%) Channelization Trees Shrubs Partially Shaded (50-75%) (OFull @Partial) ☐ Grasses ☐ Herbaceous ☐ Fully Shaded (75-100%) Number of strata Run 200 % Pool C Substrate DEst. DP.C. Riffle Silt/Clay (<0.06 mm) Sand (0.06 - 2 mm) Gravel (2-64 mm) Cobble (64 - 256 mm) Boulders (>256 mm) Bedrock Condition Category Habitat Marginal Poor Suboptimal Optimal Parameter Greater than 50% of substrate favorable for 10-30% mix of stable Less than 10% stable 30-50% mix of stable habitat; habitat; lack of habitat is habitat; habitat availability less than well-suited for full Epifaunal epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other obvious; substrate unstable colonization potential; adequate habitat for desirable; substrate frequently disturbed or Substrate/ Available Cover or lacking. maintenance of populations; presence of additional removed. substrate in the form of stable habitat and at stage newfall, but not yet prepared for colonization (may rate at to allow full colonization potential (i.e., logs/snags that are not new fall and high end of scale) not transient). 15 na 18 12 n 20 19 18 17 16 SCORE All mud or clay or sand bottom; little or no root Mixture of soft sand, mud, or clay; mud may be dominant; Hard-pan clay or bedrock; 2. Pool Mixture of substrate no root mat or vegetation. materials, with gravel and firm sand prevalent; root Substrate mat; no submerged some root mats and Characterizati submerged vegetation vegetation. mats and submerged vegetation common. present 15 14 13 12 11 20 19 18 17 16 SCORE

Majority of pools large-deep;

very few shallow.

Even mix of large-shallow, large-deep, small-shallow,

small-deep pools present.

20 19 18 17 16

3. Pool Variability

SCORE

Shallow pools much more

prevalent than deep pools.

10 9

Majority of pools small-

shallow or pools absent.

l. Sediment Deposition	islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	at the same of A man A as above	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
CORE	20 19 18 17 36	是BS以为1000000000000000000000000000000000000	10 7 38 5 4	是是是是		
. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
SCORE	20 19 18 19 16	15 JA 13 12 11 26 A 15 13	(L)248-749	-5 4 3 2 3 9		
6. Channel Channelization or dredging absent or minimal; stream with normal pattern.		Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
SCORE	20 19 18 17 16	15 14 <b>4</b> 5/10 11	(n=20 - 8 - 5 = 6	<b>医验验验证证</b> 证		
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
SCORE		26-14 13-12 11	10 19 1 8 7 16	STATE OF STATE OF		
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	absent or minimal; little potential for future problems <5% of bank	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
SCORE (LB)	i en Bank 10 9, 1	8 7 6				
SCORE	Right Bank 10	3 (57 6				
(RB)  9. Vegetative Protection (score each bank)  More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to		remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE	grow naturally.	8 7 6	3 4 3			
(LB) SCORE	Right Bank 10 9	6 2 6	3 4 1 3 1			
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.		Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.		
SCORE (LB)	Left Bank 10 79	8 7 6	3 43	2 (1):0		
SCORE (RB)	Right Bank 10 29	8 7 6	1 	2 2 0		

			_						.1.
STREAM NAME:	North.	Fork of	23	deRve	LOCATIO	N: 2	12 0.578	e Hopsk	inite
STATION#: CE	e 2000 c	MILE:			BASIN/W	ATERSH	ED: Litt	te Rive	25
LAT.:	LONG.:				COUNTY	Chr3	DON USGS	7.5 TOPO:	
DATE: 05/20	103 TIME:	10:10	100	ам ПРМ	INVESTI	GATORS	7-B, m	w.c. a.	
TYPE SAMPLE:	DP-CHEM	☐ Macroinvert	ebrate	OFISH O	BACT. A	LGAE			
WEATHER:	0	Past 24 hours  Heavy rain  Steady rain  Intermitten  Clear/sunn	i it show	×	Vec D	No 17	y rain in the last		hoursin.
P-Chem: Temp(%	C)	D.O. (mg/l)		%Saturati	on	pH(	S.U.)	Cond	C Grab
INSTREAM WA FEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Lengt		ft ft Sur ft/s Dec	minan face N ep Mir Wells		Land Use:	Consti	nercial rial	☐ Forest ☐ Pasture/Graz ☐ Silviculture ☐ Urban Runo	ting
Hydraulic Structu  Dams Bri  Island Wa	ures: idge Abutment:	s		Stream Flow	Pooled	Low for Torre	Normal	Stream Typ Perennial D Ephemer	☐ Intermittent
Riparian Vegetat Dominate Type: Trees O Shr Grasses Her Number of strata	rubs rbaceous	n. Tree/Shrub Cer Fraxinu		Canopy Cov.  Fully Expo Partially E	osed (0-25% exposed (25 haded (50-	-50%) 75%)	Channel Alter ☐ Dredging ☐ Channeliza (☐Full Parti	tion	
Substrate QEst.	Substrate □Est. □P.C. Riffle			2%	Ru	m 100	_%	Pool_	0_%
Silt/Clay (<0.06	Silt/Clay (<0.06 mm)					/			
Sand (0.06-2	mm)					/			-
Gravel (2-64 m	-					/			
Cobble (64 – 2:	NAME OF THE OWNER OW								
Boulders (>256	5 mm)			-					
Bedrock									
Habitat					Conditio				
Parameter	Opti	imal		Suboptima	al		Marginal		Poor
1. Epifaunal Substrate/ Available Cover	Greater than a substrate favor epifaunal colo fish cover; mi submerged lo banks, cobble stable habitat to allow full copotential (i.e. that are not mot transient)	orable for onization and ix of snags, gs, undercut or other and at stage colonization , logs/snags ew fall and	well- color adeq main press subs newl for c high	0% mix of stab- suited for full nization potenti- uate habitat for itenance of pop- ence of addition trate in the forr fall, but not yet colonization (m- end of scale).	ial; rulations; nal n of prepared ay rate at	habitat; availabi desirable frequent removed	lity less than e; substrate ly disturbed or		0% stable c of habitat is bstrate unstable
SCORE	THE RESERVE OF THE PARTY OF THE PARTY.	8 17 (16)		5204 - 13 -	医测热	10	語的對於		<b>建物制</b>
2. Pool Substrate Characterizati on	materials, with gravel and firm sand prevalent; root mats and submerged			Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		All mud or clay or sand bottom; little or no root mat; no submerged vegetation.		Hard-pan c no root mat	lay or bedrock; or vegetation.
SCORE	20: 19:11	8 17 76		5 14 13	12 111	10	\$ 35 m		25-70
3. Pool Variability	Even mix of large-deep, st small-deep po	large-shallow, mall-shallow, ools present.	Maj	ority of pools la few shallow.	arge-deep;	Shallow pools much more prevalent than deep pools.			f pools small- pools absent.
SCORE	20 - 19	8 17 16		5 14 13	12, 3 (1)	10	8 8 4 7	81.4	6 2 (Q3)Q

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oposition	islands or point bars and less than 20% of the bottom affected by sediment deposition.	formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
CORE	20 e19 18 Y 16	200年度 成長	30 - 9 - 18 - 18 - 18 H			
Channel low Status  Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.		Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
CORE		15 14 15 12 11 a 15 1 12 15 17 11	10 9 8 7 6			
6. Channel Channelization or dredging absent or minimal; stream with normal pattern.		Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
CORE	20 - 19 - 18 - 17 - 16	3 12 H	ant (20) 18 25 2 3	\$ 10 S S S S S S S S S S S S S S S S S S		
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
SCORE	320 19 18 17 16	- 15" 14 13 127 11	10 9 8 756			
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	absent or minimal; little potential for future problems. <5% of bank	Moderately stable; infrequent small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of ban has erosional scars.		
SCORE	Left Back 110 2 9	8 47 7 9	12 34 3			
(LB) SCORE	Regul Bank 10 1 99	4.48.67.51.35	3			
(RB)  9. Vegetative Protection (score each bank)  More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including tre understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mow minimal or not evident; almost all plants allowed		affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble heigh remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE	grow naturally.	8.2. 7 -16	1975 14 19			
SCORE	Right Bank 10 9		4 3			
10. Riparian Vegetative Zone Width (score each bank riparian		8 Width of riparian zone 12-1 meters; human activities ha impacted zone only minimally.	Width of riparian zone 12 meters; human activities have impacted zone a great deal.	meters: little or no ripartan		
SCORE (LB)	12 (Bank; 10 4 4	d 7 - 6		2 (0)		
SCORE (RB)	Right State 10 29	8 7 . 6	3 1 4 3	2 1 (0)		

Total Score

NOTES/COMMENTS:

47

	2	4 1 1	,	0				Life I	1000	
TREAM NAME:	North	fork d	74	e Kiver	LOCATION	1: 10	7 to 6	ra.	Lone	-
TATION #: CLL	20000	7 MILE:			BASIN/WA	TERSHE	D: Lit	He	Rive	
AT.:	LONG.:				-		bow uses			
ATE: 09/06 A	O3 TIME:	11:11		АМ ПРМ	INVESTIG	ATORS:	Anar &	len,	John M	Wth A
YPE SAMPLE:	P-CHEM	Macroinverte	brate	O FISH O	BACTA	LGAE				
VEATHER:	0 0	Past 24 hours  Heavy rain  Steady rain  Intermittent  Clear/sunny	show	R	Yes D	No ture 75			lys? I in past 24 hou	ırs in.
P-Chem: Temp(°C	D	).O. (mg/l)		%Saturat	rion	pH(S	.U.)	_ c	ond	_ Grab
INSTREAM WA FEATURES: Stream Width		Predon		TERSHED Surrounding		ES:				
Range of Depth Average Velocity Discharge Est. Reach Length	ityft/s Deep Cfs Doil W		p Min Wells	ing		Constru Commo Industr Row C	ercial ial	OP	forest Pasture/Grazing Silviculture Urban Runoff/S	
Hydraulic Structu  Dams Bri Island D Wa  Other	dge Abutments	Plant		Stream Flow	v: D Pooled D Very Rapid		Normal	- 0	Stream Type:  Perennial  Ephemeral	
Riparian Vegetati Dominate Type:  Trees Shr Grasses Her Number of strata	ion: Dom ubs baceous	. Tree/Shrub T	axa	☐ Partially	ver: posed (0-25% Exposed (25- Shaded (50-7 aded (75-100)	·50%) ·5%)	Channel Al Dredging Channel (C)Full C)Pa	g ization		
Substrate DEst.	OP.C.	Riffle	10	%	Ru	n 90	_%		Pool (	_%
Silt/Clay (<0.06	/Clay (<0.06 mm)					30 .	do			
Sand (0.06 - 2 1	mm)					20 -	10			
Gravel (2-64 mi	m)					.,	/			
Cobble (64 - 25		-	50	10	20%					
Boulders (>256	mm)		_	95 e/a		3000				
Bedrock		9.5	1	R	1		1			
Habitat					Condition	n Categor	у	-		
Parameter	Opti	mal		Suboptin	nal	N	Aarginal		Poo	or
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).  30-50% mix of swell-suited for fu colonization potential read to substrate in the for newfall, but not y for colonization high end of scale		suited for full itzation poten uate habitat for tenance of po- ence of addition trate in the for all, but not ye olonization (no end of scale).	ull habitat; habitat availability less the for populations; itional form of yet prepared (may rate at		nabitat ity less than ; substrate y disturbed o	r	Less than 10% habitat; lack of obvious; substr or lacking.	habitat is ate unstable	
SCORE						E STATE OF		製		
2. Pool Substrate Characterizati on	Mixture of substrate materials, with gravel and clay; m			; mud may be dominant; e root mats and merged vegetation		bottom:	or clay or sar little or no ro submerged on.	nd ot	Hard-pan clay no root mat or	
SCORE	NO TO	8 117 16		5 140 (8)	SPANIS	(MA)			REMER	
3. Pool Variability	Even mix of	large-shallow,	Maj	ority of pools few shallow	large-deep;	Shallow	pools much to than deep p	nore ools.	Majority of po shallow or poo	
SCORE	20 29	18 17 16		5 14 213	12:11:4	16 3/9	8/16/76		15.74.76	TO DE

4. Sediment Deposition  Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	WO 198-18 27-16			
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE				
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	2001 0 1 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			[[]] [[]][[]][][][][][][][][][][][][][]
Channel increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16		0 9 8 7 66	
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE .				
(LB) SCORE	Riphelic Comment			
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE	<b>医生产性的 医生产性 医</b>	THE WATER SHEET		AT 32 00 22
SCORE	BEAL BOX SERVED HAVE	<b>(2012)</b>	是特殊的	<b>一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个</b>
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian	Wight Bank 10 9 Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
score				
(LB)		6		

									CARBON CO.	
STREAM NAME	: Sinkin	P Fork			LOCATIO	N: L	npir Chu	rch Ro	nod	
STATION #: CL	2200016	MILE:			BASIN/W	ATERSH	ED: LZ+	e Rive	-	
LAT.:	LONG.:				COUNTY	chn	Lo- uses	7.5 TOPO:		
DATE: OF TO	6/03TIME	2-65	П	AM DROW					math	
TYPE SAMPLE:	P-CHEM	Macroinver	tebrate	O FISH O	BACTA	LGAE		11-11-11-	( FEZEN GEEN	
WEATHER:	Now	Past 24 hours  Heavy rain  Steady rain  Intermitter  Clear/sunr	n n nt show	E H	as there be	en a heav	y rain in the last C. Inches rai		4 hours in.	
P-Chem: Temp(		4		%Saturati	on	pH(	S.U.)	Cond	☐ Grab	
INSTREAM W FEATURES:	ATERSHED			ATERSHED I		ES:				
Range of Depth ft Sur Average Velocity ft/s Discharge cfs Oil			rface Mep Min Wells	ing	Land Ose.	Construction Communication Com	nercial rial	☐ Forest ☐ Pasture/Gra ☐ Silviculture ☐ Urban Rund		
Hydraulic Struct  Dams Bi Island W  Other	ridge Abutments			Stream Flow: Dry High	Pooled		Normal ntial		pe:   D Intermittent	
Riparian Vegeta Dominate Type: Trees OSh OGrasses OHe Number of strate	rubs erbaceous	. Tree/Shrub	Taxa	Canopy Cove  Fully Expo  Partially E  Partially S  Fully Shad	osed (0-25% exposed (25 haded (50-	-50%) 75%)	Channel Alter Dredging Channeliza (OFull @Part	tion		
Substrate QEst	. DP.C.	Riffl	eal	2%	Rı	m_7 3	> %	Pool_	5_%	
Silt/Clay (<0.0	6 mm)					10		5	0	
Sand (0.06 - 2			0			10		5	0	
Gravel (2-64 m			10			40				
Cobble (64 – 2			30			30				
Boulders (>250 Bedrock	o mm)	- (	20	-		1.0	-			
5 2 2 3 3 5 5			-		Condition	- Catana				
Habitat Parameter	Optin	nel		Suboptima		on Category  Marginal			Poor	
1. Epifaunal Substrate/ Available Cover	Greater than 50 substrate favor epifaunal color fish cover; mix submerged log banks, cobble stable habitat a to allow full copotential (i.e., that are not ne not transient).	0% of nable for nization and tof snags, s, undercut or other and at stage olonization logs/snags w fall and	well-s coloni adequi maint preser substr newfa for co	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).				Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.		
SCORE	EVEN DE M				D. Hht.				77 12 Hips 712	
2. Pool Substrate Characterizati on	materials, with gravel and firm sand prevalent; root mats and submerged		clay; some subm	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		bottom;	or clay or sand little or no root submerged on.	Hard-pan c no root mai	lay or bedrock; t or vegetation.	
SCORE	SCORE 20, 19 18 17 16		4.15		26113	10.3.19		RESPO		
3. Pool Variability	Even mix of la large-deep, sm small-deep poo	all-shallow,	Majo very	rity of pools la few shallow.	rge-deep;	Shallow prevalen	pools much more t than deep pool	Majority of shallow or	f pools small- pools absent.	
SCORE	20 - 19 118	3 J 7 J 6	i i	14 13	2 3 1 1 3 3	10 239				
7.7.5.770.	是法律問題是命令政策學所	<b>了到的外部的大型工作工作的中</b>	POPPER D	大学であった。大学では本語は大		SOUR BUILDING		THE RESIDENCE OF THE PARTY OF T	THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN TW	

Deposition islands or point bars and less than 20% of the bottom affected by sediment deposition.		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
SCORE						
5. Channel Flow Status Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.		Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
SCORE	20 9 18 7 16					
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
CODE	120 3 191 18 193 1916		Finteen Book - 20	<b>医松唇</b> (多数相对形象)		
7. Channel Sinuosity  The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
SCORE	rated in these areas.		30 7 3			
8.Bank Stability (score each bank) Note: determine left or right side by facing	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of banl has erosional scars.		
SCORE	Francisco de la companya del companya del companya de la companya	2 7 9 1				
SCORE						
(RB)  9. Vegetative Protection (score each bank)  Secore each bank)  More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.		remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE	THE RESIDENCE OF THE PROPERTY OF THE PARTY O					
(LB) SCORE	Right and 10	<b>和中国市场的企业中共和国的特别的企业中国市场</b>				
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.		Width of riparian zone 6 12 meters; human activities have impacted zone a great deal.	meters: little or no riparian		
SCORE (LB)	isaatmic (0 am 4/4					
SCORE (RB)	Right Bank 10	8 7 6	4 3	2 = (1) = 0		

Part of the last o		-	OWC	rudiont ou	Cam L	rata DIIC	CL		
STREAM NAM	ME: Kittle	e Rive			BASIN/WATERSHED: Little River				
STATION #: C	CLR 2000	09 MIL	E:		BASIN/WATERSHED: Little RVO				
LAT.: LONG.:					COUNTY: Christian USGS 7.5 TOPO:				
DATE: 05/	15/03 TIME:	1:35	PM F	TAM ORIPM					
TYPE SAMPL	E: P-CHEM	Macroin	vertebrat	te OFISH O	BACT/	LALGAE			
WEATHER: Cloudy / Sprinkle		Past 24 hor Heavy r Steady r Intermit	ain rain tent sho	D	Yes Air Temp	D No	y rain in the las	111111111111111111111111111111111111111	4 hoursin.
P-Chem: Temp	p(°C)	D.O. (mg/l)		%Saturation	on	pH(S	S.U.)	_ Cond	☐ Grab
INSTREAM FEATURES: Stream Width Range of Dept Average Veloc Discharge Est. Reach Len	h	_ft Pre _ft OS _ft/s OI _cfs OC	CAL W dominar Surface ! Deep Min Dil Wells and Dis	ning s	EATUR Land Use	Constr	ercial ial	☐ Forest ☐ Pasture/Gra ☐ Silviculture ☐ Urban Runo	
Hydraulic Stru  Dams  Dams  Island  Other	Bridge Abutmen	ts			Pooled	□ Low id or Torrer	☐ Normal		pe: Intermittent ral Seep
Riparian Veget Dominate Type Trees S G Grasses F Number of stra	hrubs Herbaceous	m. Tree/Shru		Canopy Cover ☐ Fully Export ☐ Fully Export ☐ Partially Shade	sed (0=25 cposed (2 naded (50	5-50%) -75%)	Channel Alter Dredging Channeliza Channeliza Full OPart	ation (al)	***
Substrate DEs	st. QP.C.	Rif	fle_/(	fle 10% Ri		un 70	%	Pool	10 %
Silt/Clay (<0.0						V		V -	
Sand (0.06 - 2	C.W.S.F.				V				
Gravel (2-64 )									
Cobble (64 –	COLUMN VI	1					· V		
Boulders (>25 Bedrock	oo mm)				V				
			-						
Habitat Parameter	Opti	and :	_		Conditio	n Category			
rarameter					Suboptimal Marginal		arginal		Poor
I. Epifaunal Substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).		30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).		habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.			
SCORE	20 × 19 = 18	17	15	SOBORCES		到6年2月(4)/亚			0.2145105
2. Pool Substrate Characterizati on	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.		Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		All mud or clay or sand bottom; little or no root mat; no submerged vegetation.			ay or bedrock; or vegetation.	
SCORE	20[] (19] (18	17	15	14 13 - 12		-10 (9) 3 1 as		5.4 3	2 11 0 =
3. Pool Variability	Even mix of la large-deep, sm small-deep poo	all-shallow,		Majority of pools large-deep; very few shallow.		Shallow pools much more prevalent than deep pools.			
SCORE	20 19 18	3 17 16	16	(15) H4 = 15 < 12 PH = 1		10 9	8 . 7 . 6	1 10 1 10 18	2::10.0
			the second named in	THE RESERVE AND ADDRESS OF THE PARTY OF THE				THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER, THE OW	The second secon

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islands or point bars and less than 20% of the bottom affected by		formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
	ob 19 18 17 16		no ey la 17 ey			
5. Channel Flow Status  Water reaches base of both lower banks, and minimal amount of channel		Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
CORE	substrate is exposed.	FIRSH BARAN	10 P 8 1 1			
6. Channel Alteration  Channelization or dredging absent or minimal; stream with normal pattern.		Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.		and disrupted. Instream habitat greatly altered or removed entirely.		
	20 19 18 17 16	TAKE (E) THE PERSON NAMED IN	9 8 7 6	<b>一种一种一种一种一种一种一种一种一种一种一种一种一种一种一种一种一种一种一种</b>		
The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream lengtl 2 to 1 times longer than i it was in a straight line.	Channel straight; waterway has been channelized for a long distance.		
	rated in these areas.		10 9 8 7			
B.Bank Stability (score each bank)  Note: determine left or right side by facing			areas of erosion; high	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing, 60-100% of bar has erosional scars.		
SCORE (LB)	15-A Bank : 10+1 - 9	8 101 7 6				
SCORE	Riol (Sant-10)	8 1 6		Less than 50% of the		
(RB)  9. Vegetative Protection (score each bank)  More than 90% of the streambank surface immediate riparian covered by native vegetation, including understory shrubs, nonwoody macroph vegetative disruptic through grazing or minimal or not evice almost all plants all grow naturally.		vegetation, but one class of plants is not well-represente disruption evident but not affecting full plant growth potential to any great extent more than one-half of the potential plant stubble heig remaining.	patches of bare soil or closely cropped vegetation common; le than one-half of the	streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE (LB)	Len Bank 10 9	4 - 3 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 -				
SCORE (RB)	Right Bank 10 9	8 7 6	3 14	e 6- Width of riparian zone <		
10. Ripariar Vegetative Zone Width (score each bank ripariar zone)	Width of riparian zone meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have no	impacted zone only minimally.	18 Width of riparian zon- 12 meters; human activities have impact zone a great deal.	meters: little or no riparia		
SCORE (LB)	Left Bank 10	) - <b>3</b> 7- 5				
SCORE	Right Bank 10	8 7 6	5 4			

Total Score

Low Gradient Stream Data Sheet STREAM NAME: CLL 2000 09 LOCATION: STATION# LITTLE PUET MILE BASIN/WATERSHED: USGS 7.5 TOPO: LONG .: LAT .: DAM THE INVESTIGATORS BOKA, DATE: 09/06/03 TIME: 1:10 TYPE SAMPLE: P-CHEM Macroinvertebrate FISH BACT ALGAE Has there been a heavy rain in the last 7 days? Past 24 hours WEATHER: Now ØYes □ No ☐ Heavy rain Air Temperature C. Inches rainfall in past 24 hours ☐ Steady rain O % Cloud Cover ☐ Intermittent showers 0 Clear/sunny ☐ Grab Cond. %Saturation\_ pH(S.U.)\_ D.O. (mg/l)\_ P-Chem: Temp(°C)\_ INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: Stream Width ft ☐ Construction O Forest ☐ Surface Mining Range of Depth ft ☐ Fasture/Grazing ☐ Commercial Deep Mining Average Velocity ft/s Oil Wells ☐ Industrial O Silviculture Discharge cfs Urban Runoff/Storm Sewers O Row Crops ☐ Land Disposal Est. Reach Length Stream Type: Stream Flow: Hydraulic Structures:

Dams Rridge Abutments

Island Waterfalls ☐ Pooled ☐ Low ☐ (Normal Perennial Intermittent O Dry O High O Very Rapid or Torrential ☐ Ephemeral ☐ Seep Other Channel Alterations; Dom. Tree/Shrub Taxa Canopy Cover: Riparian Vegetation: ☐ Fully Exposed (0-25%) ☐ Dredging Dominate Type: Partially Exposed (25-50%) Channelization Frees Shrubs Partially Shaded (50-75%) (OFull OPartial) ☐ Grasses ☐ Herbaceous ☐ Fully Shaded (75-100%) Number of strata Pool 9% Substrate DEst. DP.C. Riffle 20% Silt/Clay (<0.06 mm) Sand (0.06 - 2 mm) Gravel (2-64 mm) Cobble (64 - 256 mm) Boulders (>256 mm) Bedrock Habitat Condition Category Poor Marginal Optima! Suboptimal Parameter Less than 10% stable Greater than 50% of 10-30% mix of stable 30-50% mix of stable habitat; habitat; lack of habitat is well-suited for full habitat; habitat substrate favorable for availability less than desirable; substrate Epifaunal Substrate/ Available Cover epifaunal colonization and fish cover; mix of snags, obvious; substrate unstable colonization potential; or lacking. adequate habitat for maintenance of populations; presence of additional submerged logs, undercut banks, cobble or other frequently disturbed or removed substrate in the form of newfall, but not yet prepared for colonization (may rate at stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and high end of scale). not transient). 45 Jan 19: 2 Think SCORE 20 19 18 Hard-pan clay or bedrock; All mud or clay or sand Mixture of soft sand, mud, or Mixture of substrate 2. Pool no root mat or vegetation. materials, with gravel and firm sand prevalent; root clay; mud may be dominant; bottom; little or no root mat; no submerged Substrate Characterizati some root mats and submerged vegetation vegetation. mats and submerged on vegetation common. present. A4 13 12 11 8 10 9 8 75 6 20 19 18 17 16 SCORE

Majority of pools large-deep;

35 14 13 12 11

very few shallow.

Even mix of large-shallow, large-deep, small-shallow,

small-deep pools present.

20 19 18 17 16

3. Pool

SCORE

Variability

Shallow pools much more

prevalent than deep pools.

10

Majority of pools smallshallow or pools absent.

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			The same about more of the same and the same of the sa	OA S THE RESIDENCE AND ADDRESS OF THE PARTY
6. Sadiment De osition	Laborate the second of the sec	(A)	to the transport of the constant of the consta	Heavy deposits of fine naterial, increased bar development; 80% of the pottom changing frequently; pod's almost absent due to substantial sediment deposition.
33C)SE		1	( valent	0 1 2 2 0
5. t. Burnel Flor Slatus	We receive the of both	1	I is 25-71% of the	Very little water in channel and mostly present as a adding pools."
SC ORE	as according to the second		to the state of th	4 7 2 1 0
6. Channel Alternation	Chauch and credging at the am with recent the control of the credging with recent the control of the credging at the credging	A Tolerand M	are stion may be	Hanks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SC DRE			A Company of Company o	1.4-9-9-1200
7. Champel Simusity	this are another than if	-0.4	in the street in the street in the street in length that if a street in the	Themsel straight; waterway has been channelized for a lang distance.
	ing to start the light to the l			
SCORE	The state of the s	i i i i i i i i i i i i i i i i i i i	A Committee of the comm	1 1 3 7 1 0
Staldny (score	Linux 1 cenf	1000	. The same able, the	Unstable; many eroded
by acing downsteam.  SC 148 (L. SC 128 (R.II)  9. degetative  Protection (SC 14 each bank)	The second of th		bare of the bare o	
S. 7822 (L.). S. C. C. (P. C. C.). Properties Variables Zone Walth (solve each	The state of the s		Part of 201	2 0 on the financian zone <6 on the financian zone vittes.
be a reparian ze of SCO (E) SCO (E) SCO (E) (C)	The part of the second			

Total sore

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Low Gradient Stream Data Sheet LOCATION: S.R. 91 Sineno fork STREAM NAME: STATION# CLL 2000 10 BASIN/WATERSHED: MILE: LONG .: DATE: 5,20,03 TIME: MAM PM INVESTIGATORS: ☐ Macroinvertebrate ☐ FISH ☐ BACT. ☐ ALGAE TYPE SAMPLE: O P-CHEM Has there been a heavy rain in the last 7 days? Past 24 hours WEATHER: Now Yes DNo Heavy rain Air Temperature 17 °C. Inches rainfal! in past 24 hours Steady rain 100 % Cloud Cover (Intermittent showers Clear/sunny ☐ Grab pH(S.U.) Cond. %Saturation\_ D.O. (mg/l)\_ P-Chem: Temp(°C)\_ **INSTREAM WATERSHED** LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: ft Stream Width O Exrest ☐ Surface Mining Construction Range of Depth ft Deep Mining O Commercial E-Pasture/Grazing ft/s Average Velocity ☐ Silviculture Oil Wells O Industrial Discharge cfs ☐ Urban Runoff/Storm Sewers C Land Disposal E Row Crops Est. Reach Length Stream Type: Stream Flow Hydraulic Structures:

Dams Bridge Abutments
Island Waterfalls O Dry D Pooled D Low D Normal D Ephemeral D Seep U Very Rapid or Torrential ☐ High Other Canopy Cover Channel Alterations: Dom. Tree/Shrub Taxa Riparian Vegetation: ☐ Fully Exposed (0-25%) Dominate Type: C) Dredging 05/1 **EKChannelization** Trees O Shrubs C) Partially Exposed (25-50%) Partially Shaded (50-75%) Grasses Herbaceous (OFull OPartial) ☐ Fully Shaded (75-100%) Number of strata Pool \_O % Substrate DEst. DP.C. Riffle 17 Run 70 Silt/Clay (<0.06 mm) Sand (0.06 - 2 mm) Gravel (2-64 mm) Cobble (64 - 256 mm) Boulders (>256 mm) Bedrock

Habitat	Condition Category									
Parameter	Optimal	Suboptimal	Marginal	Poor  Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.						
l. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.							
SCORE	20 : 19 : 18 : 17 : 16	_ 15 14 115 M (N=5	国际原产的 计算机	3 2 1 0						
2. Pool Substrate Characterizati on	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mad or clay or sand bottom; l'ttle or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.						
SCORE	20 19 18 17 16	16 10 15 12 15 12 15 T	10 9 8-120,76	1.5.4.3.2 38.0						
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small- shallow or pools absent.						
SCORE	20 19 18 17 16	15 14 13 10 11 15 15 15 15 15 15 15 15 15 15 15 15	10 9 8 27 16	5 4 3 2 15 0						

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4. Sediment Deposition  Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
SCORE	20 19 18 17 16		Custon 8			
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channe and mostly present as standing pools.		
SCORE	26 19 18 17 16	15 34 12 2 1	10 dual 9 6	5 4 5 2 1 6		
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
SCORE	500 - 0 - 8 - 15 - 16-	15 14 15 (12)	0 9 8 7 6	- S & A - 2   F 0		
. Channel increase the stream length increase the stream length it to 4 times longer than if		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a		
SCORE		E 65 (4 - 18 - 12 T)	0 2 8 7 68	1 3 22 1 70.		
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
SCORE	Left Bank - 10	11.11.7.11.6	SE ME 35			
SCORE	Right Bank 10 - 9 -	6 /		Reviolation Con-		
(RB) 9. Vegetative Protection (score each bank)	egetative More than 90% of the streambank surfaces and immediate riparian zone 70-90% of the streambank surfaces and vegetation, but one		50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE	Den Bank 10 to 9	87. 77 6				
SCORE		Mark States States	3 - 3			
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian	Right Bank 10 9  Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-			
SCORE	COB 12 0	7. 6		2 6 < 0		
(LB) SCORE	Left Bank 10 9	1.8 - 1 - 6				

Total Score

Low Gradient Street Date has

omp v	Sinking	The same of the sa	THE BALL OF COLUMN SALES	THE PERSON NAMED IN COLUMN	**************************************	O I D	incetor	
STREAM NAME			Staff Colombia - Cartier American					
STATION #: CLL2000 10 MILE:				COUNTY CAPTED A LEG RIVER COUNTY CAPTED SUSSES 7.5 TOPO:				
LAT:	LONG.:							
DATE: 09 65	The state of		AM PRN	ANVEST	GALDRA.	3 May 5	ohn, der, M	nott, k
	DP-CHEM DOM	Section of the second section is a second	The second section is a second second		decide married and	arriver (seedigheroes; marie		nda
WEATHER:	0 0 F	24 hours leavy rain teady rain itermittent sho lear/sumny		Air Temper	2 No rature 32	act in the last 7	days?	orsin
P-Chem: Temp(	PC) D.O.	(mg/l)	1 %Satura	tion)	pH(s.t	1)	Cond	_ Grab
INSTREAM W FEATURES: Stream Width	ATERSHED		VATERSHED ni Surrounding		CES:	Commission of an especially	il.mpr	
Range of Depth Average Velocity Discharge Est. Reach Leng	y ft/s c/s	Surface Deep M Oil Well Land Di	iniu !		Chiconstruct Chiconstruct Chiconstructure Chiconstructure Chiconstructure Chiconstructure	eal :	☐ Forest ☐ Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Storm Sewer	
Hydraulic Struct  Dams Bi Island W  Other	ridge Abutments			C Powed	Dia t		Stream Type: Perennial U Ephemeral	
Riparian Vegeta Dominate Type: Circes Sh Grasses He Number of strate	rubs 546 A	e/Shrib Taxa		Fig. at (25 Started (50- ade (15-10)	7596) (196)	Channel Afters Dredging Channelizate Druft Partis	ion	
Substrate DEst	DP.C.	Riffle / /	Te		Uni	No.	Pool O	_%
Silt/Clay (<0.00								
Sand $(0.06-2)$		10	2	1	£1			
Gravel (2-64 m		35	2	1				
Cobble (64 – 2		3	30		income and the second			
Boulders (>256	6 mm)	5	6		our marks			
Bedrock	The same of the sa	dara keminanan anaga	par plane or a received constraint	VALUE OF THE PROPERTY.	CHARLES A CHARLE ST	ton party deploy at Atlanta	a designation of the second	-
Habitat			-		T Ch. gor		n	
Parameter	Optimal	DESCRIPTION CONTRACTOR	THE PROPERTY AND ADDRESS OF THE PARTY AND ADDR	202 Later (1942) (1951) English (1951)	American Autorian and	oginal	Poor	
l. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable epifaunal colonizat fish cover; mix of s submerged logs, un banks, cobble or of stable habitat and a to allow full colonization and the substrate field of the substrate o	for well ion and colo nags, derout main her tstage sub- zation sees for colo to the colo t	10% mix of stall-suited for full nization potent patron for meaning of popence of additionable in the for full, but not yet construction in a card of scale).	tial;  pulations,  coll  ra of  representations  representations	habitat, but	ress than	Less than 10% s habitat; lack of l obvious; substra or lacking.	nabitat is
SCORE	20 15 18		<b>国际企业</b>		and the	山地區	to the second	
2. Pool Substrate Characterizati on	Mixture of substrat materials, with grav firm sand prevalent mats and subrurge vegetation common	rel and clay rest som d sub	ture of soft san g muli me often e root mals va- pargen vaperar ent	e's in cant.	bottom; ir trac no side or go fact	ne arried	Hard-pan clay o	
SCORE	4201 19 at 8 g l		5 144 h 34		JC a J			2, 47 10
3. Pool Variability	Even mix of large-slarge-deep, small-sl small-deep pools pr	shallow, Maj	c. Ty (* pools l * les sur sw	lu ceri	Sharawas	cls much more	Majority of pools	ls small- s absent.
SCORE	202 9 18	图 以有、题			# (p) V	1 7 70	4.4.23 5	210 0

islands or point bars and less than 20% of the bottom affected by sediment deposition.		Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar, development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
SCORE	market in the contract of the					
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
SCORE						
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
SCORE	1200120121818181818181	- 0 - W - 50 (E-11)	ROWERS OF W	<b>国家国际公司的国家</b>		
7. Channel Sinuosity  The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.		The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a		
SCORE	20 - 16 18 2 FEBRE					
8.Bank Stability (score each bank) Note: determine left or right side by facing		Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
SCORE						
SCORE						
(RB)  9. Vegetative Protection (score each bank)  Streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.		70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
SCORE			Tak diskas de			
SCORE				是非多数的		
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities hav impacted zone only minimally.	Width of riparian zone 6 12 meters; human activities have impacted zone a great deal.	meters: little or no riparian		
SCORE (LB)	et pant, sau et 201					
SCORE (RB)	Righ Bank 10. 1 91	8 7 6	N 4 5 - 4 7 3 3	12) 1 0.		

	- TE - COMP - 164	NAME AND ADDRESS OF THE OWNER, TH	Serie o	CANAL SOME AND ADDRESS OF THE OWNER, THE OWN	ELECTRONIC SPRINGER (1945)	IMBITATION TO THE	THE RESIDENCE IN STREET	The state of the s	
STREAM NAME:	Sinkr	o Fork			- in the second			somple	
STATION#: CL	120001	MILE:			BASIN/W	ATERSH	ED: ditt	te Rive	2
LAT	LONG.				COUNTY	dina	TOA USGS	7.5 TOPO:	
DATE:5/20	TIME	1530	D	AM EPM	PAVESTI	GATORS:	PB MD	Jul	
TYPE SAMPLE:	O P-CHEM	1 Macroinve	tebrate	The state of the s	Annual Control of the Control		. (		
WEATHER: Sprinkling	000	Past 24 hours  Heavy rais  Stendy rais  Intermitte  Clear/sun	n n nt shov	K	Yes L	No ature	rain in the las		24 hours in.
P-Chem: Temp(°C	D)1	D.O. (rig/l)		%Saturati	on	pH(3	.U.	Cond	Grab
FEATURES: Stream Width Range of Depth Average Velocity  Fig. 12 Dec				ing		Construction Communication Com	elcial	☐ Forest ☐ Pasture/Gr	e
Est Reach Lengt	h	□ La	nd Dis	posal		E Row C	tups	Urban Ru	noff/Storm Sewers
Hydraulic Structt	dge Abutments	s		Stream Flow Dry D High D	Pooled				ype: al D Intermittent eral D Seep
Riparian Vegetation: Dom. Tree/Shrub Dominate Type:  Trees				C) Fully Exposed (0-25%) E) Partially Exposed (25-50%) L) Partially Shaded (50-75%) L) Fully Shaded (75-100%)			Channel Alterations: ☐ Dredging ☐ Channelization (☐Full ☐Partial)		
Substrate □Est.	DP.C.	Riff	le 5	6/0		m 22	0/6	Pool_	75 %
Silt/Clay (<0.06	mm)							1	
Sand (0.06-21	mm)	3	/	/					
Gravel (2-64 mi	The second second	1	/				N.		
Cobble (64 – 25			/	/		~		<u> </u>	
Boulders (>256	mm)		/_						
Bedrock		ALTERNATION OF THE RESIDENCE	R PHARM BUILD	NOSTROPERIUM ANAROUS I	La co de la composita de la co	and according from a 1 to 1 states to the contract of the cont			
Habitat					Section of the learning by	n Category			
Parameter	Opti	M(S) [ memorialism income behave	-	Suboptims	E)	Delight Section 2015	(arginal		Poor
1. Epifaunal Substrate/ Available Cover	substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and		color adeq main prese subst newf	30-50% mix of stable habitat, well-surted for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).		10-50%, mix of stable bursant, babitat availability less than depray by substrate frequency disturbed or remove.		habitat; la	10% stable tick of habitat is substrate unstable 5.
SCORE	not transient).	Accessed to the local division in the last of the last	(8)	13 (3)a	學科藝	110 1/47	ng tip S	0 000	33.00 (13.03)
2. Pool Substrate Characterizati on	ubstrate materials, with gravel and firm sand prevalent; root mats and submerged si		clay, some subr	Mixture of soft sand, much, or clay, mud may be dominant; some rold must and submerged vegetation present		All author clay or sand bottom, little or no root may no submerged vegetation.		Hard-pan no root m	clay or bedrock; at or vegetation.
SCORE	20 : 19 1	8 17 16	1241	5 14 13		4104 114 115	11/7	62 1,250,4	3/12/11-0
3. Pool Variability	Even mix of l large-deep, sr small-deep po	nall-shallow,		ority of pools li fr v shallow	arga deep;		pools much m than deep po		of pools small- or pools absent.
SCORE	20 19 1	8 - 7 16		4 13-	12 115	NAME /			8 2 1 0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
SCORE	20 19 18 17 16	到10×10×10×10×10×10×10×10×10×10×10×10×10×1	0 9 9		
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
SCORE	20 19 17 16	5 (a (9 (2 1))	OD 0 8 7 6	3 4 3 2 1 0	
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
SCORE	20 19 (18) 121-16	15 14 13 12 11	10 29 8 7 6		
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	20 19 18 17, 16	15 44 15 12 11	W = 9 - (8) - 7 - 6	5 4 3 2 1 0	
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE (LB)	Left Bank 10 a 9	1 8 (2) 6 - 4	5 7 18		
SCORE (RB)	Right(Betra 10	No. 18 Page 18	3 4 3		
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation, disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE (LB)	Left Bank 10 2 9	7 7 6	5. 4 6)		
SCORE (RB)	Right Bank 10 9	8 7 6			
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.	
SCORE (LB)	Left Bank 110 Ltd 9 v	3, 8 1, 17 , 16		2-5-10	
SCORE (RB)	Right Bánk 10 79	8 7 6	3 4 (3)	2 1 1 0	

Total Score

- MERILANESE - IE	and the second	NAME OF STREET	METHODA	BOOK COMMISSION OF COMMISSION OF	PARCED PORTER BUTCHES	# HT TO BY A TOTAL BUILD TO A FAIL (	COLUMN TENNER DE LE COLUMN DE L	Participation of the Participa		
STREAM NAME:	Sinkin	p fork	out.	~	LOCATIO	Mi: Hur	68-	iongle b	ehand old	
STATION#: CE	1/2008	MILE:			BASIN/W	ni anama na mai a			<b>Jaco</b>	
AT.:	LONG.:				COUNTY	Chill	LEVY USGS	7.5 TOPO:		
YPE SAMPLE:	DP-CHEM CO	Macroinverte	Mille-P				Mar, G	John Kon	Mott	
WEATHER:		ast 24 hours	OI ALLO	The second secon	to the same of the	the management of the last in the	rain in the las	a 7 days?	*1	
WEATHER.	0 0	Heavy rain Steady rain Intermittent Clear/sunny		Æ	Zives C	No acure	°C Inches	ainfall in past 24	hoursin.	
P-Chem: Temp(°	C)D.	O. (mg/l)		%Saturat	ion	pH@	.U.)	Cond	Grab	
INSTREAM WA	ATERSHED f	Predom		ATERSHED Spreamding		ES:				
Range of Depth Average Velocity Discharge Est. Reach Lengt	,f	t	Wells	ing		Constitution of Constitution o	onsial rut	☐ Forest ☐ Pasture/Gra ☐ Silviculture ☐ Urban Runo		
Hydraulic Struch  Dams  Bro	idge Abutments			Stream Flow Dry C D High D	l Posted		Mermal Hal		DE:  Intermittent ral Seep	
Riparian Vegetat Dominate Type: Trees O Shr O Grasses O Her Number of strata	ubs rbaccous	Tree/Shrub T	axa.	Canopy Cov Cl Fully Exp St Partially S Cl Partially S Cl Fully Sha	osed (0-259 Exprised (25 Snaded (50- dea (75-160	-50%) 75%) 96)	Channel Al U Dredging 20 Channeli (U.Full 982a	zation riul)		
Substrate OEst.	CP.C.	RIMe	5	(G) (G		art and a	- No And alternative and	Pool_9	0 %	
Silt/Clay (<0.06	mm)									
Sand $(0.06-2)$	-							0	2.5	
Gravel (2-64 m			>				Ú	)		
Cobble (64 – 2:		0	0			- 20			0	
Boulders (>256	mm)	5	0	and the second	12		40			
Bedrock		2.	0	annother at Autom C Stronger.	M. M. C. B. C. B. P. S. B.	an interest at the same	NAME OF THE OWNER OF THE OWNER.	10		
Habitat				many in Assemble to seattless	even more more	n Calegor	Philippin towns as agr		Desar	
Parameter	Optim	al	estamber fes	Subjection	A.L.	A promise in the contract of t	arginal	PARTITION OF THE PARTY OF THE P	Poor	
1. Epifaunal Substrate/ Available Cover	faunal substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags) for colonization for colonization potential (i.e., logs/snags)		30-50%, mix of stable habitat; well-author for full colonization potential adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet or spaned for colonization (may see a high end of susse).		10-509, me. of stable whether, torical real lab 197 less than destructe; substrate frequency distribute of emoved.		Less than I habitat, lac ubvicus; su or lacking.	0% stable k of habitat is bstrate unstable		
SCORE	20 17 3			14171			The same			
2. Pool Substrate Characterizati on	Mixture of subs materials, with firm sand preva mats and subme vegetation com	gravel and lent; root erged	clay;	are effect sen mud may be root mays an enjed vegetal	iominaus i	ochora	of play or same of each no roo remerged		elay or bedrock; t or vegetation.	
SCORE	20',  9 318	17 76	11		12-14-58	(A) A)	1.544.00	的情态		
3. Pool Variability	Even mix of lar large-deep, sma small-deep poo	Il-shalley,	Majo	rity of pools t few shallow	secondary;	Shallow	oools much to than deep po	ore Majority of shallow or	f pools small- pools absent.	
SCORE	20 19 18						TI PERMIT		3,62,115,0	

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	100-100-018-178-16	ALCO STATE OF STATE O	的多数新史表面的	I O YES TRANSPORT
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or rifle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16		10 22 3 8 - 7 - 6	S A 3 2 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	200 197 18 1 17 1 16 8		10 9 8 7 6	HEALT STATES OF
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 10 12 31	10 (9) 8: 7 -6	5-4-3-52-61-03
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional sears.
SCORE	Left Bank 3.10 2 923			原数据与12年10月系
(LB) SCORE		B131.7774387		
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE	nen bank food so ba	8 3 5 5 6 6	1735	
SCORE	Riph Bank 10	70000000000000000000000000000000000000		TELLER BLANT THE BEST OF THE SECOND S
10. Riparian Vegetative Zone Width (score each bank riparian	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	Left Banksell Flac 974	6 7 7 7 8		
SCORE (RB)	Right Bank 10 9		3 4 3	2 1 0

Total Score

NOTES/COMMENTS:

78

-	THE PERSON NAMED IN COLUMN TWO	A HITCH COMPANY COMMUNICATION	MANAGEMENT AND ASSESSMENT OF THE PARTY OF TH	MAN STREET, WHEN BEING SET	PRESENTATION AND ADDRESS OF THE	MUNICIPAL ETHICS SEEDS THE	minglish sales (Ballette		
TREAM NAME:	Kittle	fiver		LUCATIO	The second secon	) - p -m	-		
	2200012			BASINA	ATERSIL	o Nitt	e kno		
AT.:	LONG.:			COUNTY CARS SECT. USGS 7.5 TOPO:					
DATE: 05/15	OS TIME. 3-2	romvertebrat	LAM PMPM	INVESTIG	GATURY.				
Portly cloudy (no.		वरप्रविधा	A.S.	Yes L	No m			4 hours in.	
	D.O. (	7 g/1)	%Satura C	))	pHcS	11.5	Cond	Grab	
INSTREAM WA FEATURES: Stream Width Range of Depth Average Velocity Discharge	fififi/scfs		1)61	Lend Use:	O Constitution	eactal rei	O Forest O Pesture/Gra O Silviculture		
Est. Reach Length  Hydraulie Structu  Dams St Bric  Island Wa	res: dge Abutments	La Darid Dr.	Stream Flos. Dry Cl gold-Figh Cl	Tribled	Time.	. Nemal	Stream Ty Perennia		
Riparian Vegetati Dominate Type: DA Trees: Shri Grasses Her	on: Dom. Tree		J Parisity P J Parisity P (E) Earnesty S J Butly Soci	stal (0-259) ix 1 sed (25) haded (50) fen (75-100)	-50% 1 233% 1	Channel All Liveuging CAC hanneli (DFull) All a	zation		
Substrate DEst.	OP.C.	Riffle C	TO THE WAS NOT THE	Ru	n_ 11	256	Pool_	10%	
Silt/Clay (<0.06				-	fra		/		
Sand (0.06 – 2 r					1000				
Gravel (2-64 mr			÷ = = = ==============================						
Cobble (64 – 25								/	
Boulders (>256	mm)				o seam		<u></u>		
Bedrock	Marine Co.	THE PROPERTY OF THE PARTY OF TH	1997 (BELIEVE VIEW OR PROFESSIONAL TO			- 1 yes 4 Jan 1 Kilkston (1997)	ON UMBERSON STREET		
Habitat Parameter	Optimal		Johnner	W Bushellowers	N CARREST	anglasi		Poor	
1. Epitaunal Substrate/ Available Cover	Greater than 50% of substrate favorable epifaunal colonizati fish cover; mix of si submerged logs, unbanks, cobble or otsable habitat and at to allow full coloniz potential (i.e., logs) that are not new fall not transient).	30 well on and rags aco ferent per triage acion new strags for	Object of strain and of the first of the fir	al, all antes;  to of or	talent i	m of stable about ty cos than m strate y vistorbed or	habitat; la obvious; s or lacking	10% stable ck of habitat is ubstrate unstable	
SCORE	20 10 18 1	7.6	Lia di	4.4	ii. L		10.4	1000年	
2. Poel Substrate Characterizati on	Mixture of substrate materials, with grav firm sand prevalent mats and submerge vegetation common	el and clay	or no of sufficient of such a superior contracts and such as s	an rant;	baten.	day or can in a tripe too atomorged		clay or bedrock; at or vegetation.	
SCORE	20 19 18 1	16	4 19.	FIT	11	3 11 12	5 5 A	3 2 1 0	
3. Pool Variability	Even mix of large-s large-deep, small-sl small-deep pools pr	nailow, yer	CHACLICAS			pools much n thou deep po		of pools small- r pools absent.	
			A STATE OF THE PARTY AND ADDRESS.			1.4	OF THE PERSON NAMED IN	A CONTRACTOR OF THE PROPERTY OF THE PARTY OF	

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools preyalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 - 19 - 18 17 - 16	2012 141 15 32 20 15	The Operation	
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 (19) 48: 17 16	AP IS IV. I	10 9 8 7 6	3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 219 18 17 16	- 16 (C) 462 80 T	10 29 8 7 6	
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	5 14 13 12 11 -	10. 29 8 77 6	5 4 3 2 T 0
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	LemBank 10	8 7 7 6 1		12 7 41 0
SCORE	Right Bank 10 9	8-11-16-1		
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Left Bank 10 9		(3) 63	
SCORE		8 7 6		
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian zone)	Right Bank 10 9 Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	Left-Bank 10 9	8 *** 5 - 6 -	5 4 3	2 (1) 0
SCORE (RB)	Right Bank 10 29	8 7 7 6	5 4 3	

Total Score

Low Gradiem Stream Data Shoe!

STREAM NAME:	6741p	2 10	Santania.	AND STREET, SEC. P. L. WALLES	LCCA786	N: /	***	Sopec	¥
STATION #: CE						ATERSH		HE Put	
					COUNTY			7.5 TOPO:	
LAT.:	LONG.:				114 114				00
YPE SAMPLE	P-CHEM	o . ∫ >	ertebrate	CIPISH CI	BACT, CER	LGAE		hatring construction	1/Ime
WEATHER:	0	Past 24 hou  Heavy ra  Steady ra  Intermitt  Clear/su	ain tent show	25	les there be by as C hir Temper 2 24 C	No -76	tean in the last	'7 days?	nours <u>&gt;</u> in.
P-Chem: Temp(%	3)	D.O. (mg/l)_		365 atunad	on	pres	UK	Cond	Grab
INSTREAM WA	TERSHED			ATERSHED I		ES:	an Anna de Para a se de <del>André</del> s e de Propiesta	rice and a result to a second	
Stream Width Range of Depth Average Velocity Discharge Est. Reach Lengt		ft/s DI	Surface More Dil Wells and Dis	fining sing		C) Constitution (C) Con	r).	☐ Forest ☐ Pasture/Grazi ☐ Silviculture ☐ Urban Runof	
Hydraul : Structo  Dams Bri  Island Wa  Other	idge Abutment	S		Straigh Flow Classiff Co	Person!	C Low dor Lan	fil Hermal	Stream Type Perennial D Ephemera	☐ Intermittent
Riparian Vegetat Domina e Type: Trees O Shr O Grasses O Her Number of strata	ubs rbaceous	n. Tree/Shru	b Taxa	Carronally S Carronally S Carron Shar	sed (1) 755 apo. 51 (25 da d 50- da 5- 00	-5390 7594) 334)	Lernel All Ci Dieceling Ci Channeliz (Ci Full Par	tation tist)	
Substrate CIEst.	DP.C.	Ri	file /		138	111	Washington and the same of the	Pool_	%
Silt/Clay (<0.06	-					+ +			
Sand (0.06 - 2)			10			works of			+ ,
Gravel (2-64 m			M	190		- H - 1			
Cobble (64 - 25			20	-					
Boulders (>256	mm)		60:		L.C.				
Bedrock	MARKET STATE OF THE STATE OF	MATERIAL PROPERTY - MICH	NAME OF THE OWNER, OR	materials to the erest states and		MANAGET MASSIVE		MANUFACTURE NAME OF THE OWNER, TH	
Habitut		Local Control				m Chiapus	ing tal		Poor
Parameter	Upt	imal	**************************************	Samplin	erfrancisch Bath Beier		Service of the servic	Auto-market by a series of	
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of suays, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/sn.egs that are not new fall and not transfert).		mitted for fail hizaciera collecti unter localita foi de con esta de listo trate localita foi la collection de la collectio	ist editions at e of presand	hat to generalize	A line due, A districts A disrupted or		% stable of habitat is strate unstable	
SCORE	能測測	8 112 1	(開)			计操业的			
2. Poul Substrace Characterizati on	Mixture of su materials wi firm sand pre mats and sub vegetation co	ibstrate th gravel and evalent, root imerged	d clay	t no miser sor ; much no loc c rounce a m porte il sociali	Parl,	100 1001	i tatuet keep	Hard-pan el	ay or bedrock; or vegetation.
SCORE	20	8,,17. 1			Maria A		11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10 MM	
3. Poul Variability	Even mix of large-deep, s small-deep p	large-shallor	very	crity of pools i few shallow.		Shallow	son's much my	Majority of shallow or p	pools small- pools absent.
SCORI	20 19					legger ,		1	

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently pools almost absent due to substantial sediment deposition.
SCORE			pools prevalent.	
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16			4.27 // 1.00
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 9 49 18 117 1216		intropic grays	
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
	low-lying areas. This parameter is not easily rated in these areas.		/	*
SCORE	20 19 18 17 16	12 5 114 WS 402 LINE	40 9 8 7 6	国家的企业的25°000000000000000000000000000000000000
8.Bank Stability (score each bank)  Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE	Left Bank 3-10.1% 9	8 7 6	是60年4年前23	
(LB) SCORE	Raphite Constitution		的(2015年) 1917年 - 第112年   1912年	
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Cen Bank NO Send			
SCORE (RB)	Right Bank 10 120 And		HOST WILLIAM SE	
10. Riparian Vegetative Zone Width score each bank riparian tone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE LB)	Lent/Bank=40157_295=			2 1 2
CORE RB)	Right Bank 10 19	8 7 6		

Total Score

STREAM NAME	: Little R	Je-		LOCATIO	N: S	£ 1253	-91 bare	Coseur
	21200013					ED: LILL	^	2 8
LAT.:				1	_	S USGS 7.		
DATE: 0910	7/03 TIME: 9:	07 02	ам □рм	INVESTI	GATORS:			Mott
TYPE SAMPLE: WEATHER:	u u m	A hours eavy rain eady rain ermittent shore ear/sunny	Č	las there be	en a heavy No ature	rain in the last 7  _°C. Inches rain		ours in.
P-Chem: Temp(	PC) D.O. (		%Saturat	ion	pH(S	.U.)	Cond	□ Grab
INSTREAM W FEATURES: Stream Width Range of Depth Average Velocity Discharge	ATERSHED	LOCAL W	ATERSHED at Surrounding Mining ning	FEATURE Land Use:		uction C ercial C	D Forest D Pasture/Grazin D Silviculture D Urban Runoff/	g
Hydraulic Struct  Dams Br Island W  Other	ridge Abutments aterfalls		Stream Flow	Pooled		□ Normal	Stream Type: Perennial C Ephemeral	Intermittent
Riparian Vegetation: Dom. Tree/Shrub  Dominate Type: SMCCACC  Trees Shrubs  Grasses Herbaceous  Number of strata			Canopy Cov  Fully Exp  Partially F  Partially S  Fully Shad	osed (0-25% Exposed (25 Shaded (50-	-50%) 75%)	Channel Altera Dredging Channelizati (Drull Partia	ion	
Substrate DEst	. DP.C.	Riffle /	5 %	Ri	m 70	%	Pool 1 5	_%
Silt/Clay (<0.0	6 mm)			30			20	
Sand (0.06 – 2		10			10		80	
Gravel (2-64 m		70			30		65	
Cobble (64 – 2		20			10			
Boulders (>256	5 mm)				20			
Bedrock				100				
Habitat	O-FI		Cubautim		n Categor		T De	or
Parameter  1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags		Suboptimal  -50% mix of stable habitat; ill-suited for full ionization potential; equate habitat for intenance of populations; esence of additional bestrate in the form of wfall, but not yet prepared colonization (may rate at the end of scale).		Marginal  10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		Less than 10% habitat; lack o obvious; subst or lacking.	stable f habitat is
SCORE	The state of the s			Back to		<b>国际生</b> 机		
Substrate materials, with gravel and clay:		ture of soft sand to mud may be do to root mats and the reged vegetations.	lominant;	bottom; l	or clay or sand ittle or no root ubmerged n.	Hard-pan clay newcoot mat or		
SCORE	20 19 18 1		5 4 15	12.013	10 2 9			
3. Pool Variability	Even mix of large-si large-deep, small-sh small-deep pools pro	hallow, Majo	ority of pools la few shallow.	arge-deep;		pools much more than deep pools.		
SCORE	20 - 19 - 18 - 15	16	5 14 413 🕏	12 MI	10 - 9	100.000		2 4100

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 cm 18 c724 is		pools prevalent.	
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16			
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	2052 19 18 17 Jule 4	4635 14 445 4 12 10 10 L		
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 49 48 77 16	-150 44 NG 402 NG	107-9 (8-)17 26c	5 4 ± 35 2 ± 15 0 N
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems: <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE	Left Bank 10 7 9 2	8 7 6		
(LB) SCORE	Right Bank 10			
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Len Bank 110 24 19 430	8 3/10/10/10/6		
RB)	Right Bank 10			
10. Riparian Vegetative Zone Width score each bank riparian cone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE	Sen Banks and Super 98			
CORE RB)	Right Bank 10 9	1 8 7 0 1		2 1 0

Total Score

DOCATION:   COLONTO   COUNTY:   CO			20.11		-	71			-
MILE:   BASIN/WATERSHED	STREAM NAME	Casey CI	æŁ		LOCATIO	ON: 900	aring Sp	rings k	d.
AT: LONG:  DATE: D/ 16   03 TIME:   02   155   DAM BYM INVESTIGATORS   2 B M D D D D D D D D D D D D D D D D D D		7/					~	V	
Construction   Cons					COUNTY	: Tri	e usgs	7.5 TOPO:	
Construction   Cons	DATE: 05/16	/03 TIME: 12:	15	JAM DPM	INVESTI	GATORS:	P.B.M	A Ju	)
Heavy rain   Caregory   Condition Category   Process   Shrubs   Condition Category   Process   Shrubs   Condition Category   Parameter   Optimal   Substrate   Domn   Formal   Domn   Domn   Formal   Domn   Domn	TYPE SAMPLE:	DP-CHEM DM	croinvertebrat	te OFISH O	BACT.	LGAE			
INSTREAM WATERSHED FEATURES: Freadminant Surrounding Land Use: Surface Mining Deep Mining	22 40 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		eavy rain teady rain termittent sho	a	Yes C	No ature 75	°C. Inches rai	13.34	hoursin.
FEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Length    Surface Mining   Construction   Commercial   Comm	P-Chem: Temp(°	PC) D.O.	(mg/l)	%Saturati	ion	pH(S	.U.)	Cond	Grab
Stream Flow:   Dry   Pooled   Low   Normal   Perennial   Intermittent   Dry   Pooled   Low   Normal   Perennial   Intermittent   Dry   Pooled   Low   Normal   Perennial   Intermittent   Dry   Perennial   Dry   Dry   Perennial   Dry   Dry   Perennial   Dry	FEATURES: Stream Width Range of Depth Average Velocity Discharge	ftftft/sft/sft/s	Predomina  Surface  Deep Mi Oil Well	nt Surrounding Mining ining s		Constr	ercial al	Pasture/Graz	
Dams   Bridge Abutments   Dom. Tree/Shrub Taxa   Dom. Tree/Shrub T	Est. Reach Leng	ui							
Dominate Type: QTrees Q Shrubs Grasses U Herbaceous Number of strata  Substrate DEst. QP.C. Riffle 20 % Run 60 % Pool 20 % Substrate DEst. QP.C. Riffle 20 % Run 60 % Pool 20 % Sitl/Clay (<0.06 mm) Sand (0.06 - 2 mm)  Gravel (2-64 mm)  Cobble (64 - 2.56 mm)  Bedrock  Habitat  Condition Category  Parameter  Optimal  Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/mags not transfer).  SCORE  20 19 18 17 16  SCORE  20 19 18 17 16  SCORE  Parially Exposed (0-25%) Parially Exposed (25-50%) Paria	Dams Br	ridge Abutments		□ Dry □	Pooled			Perennial	☐ Intermittent
Silt/Clay (<0.06 mm)  Sand (0.06 – 2 mm)  Gravel (2-64 mm)  Cobble (64 – 256 mm)  Boulders (>256 mm)  Bedrock  Habitat  Parameter  Optimal  Greater than 90% of substrate favorable for epifaunal colonization and fish cover; mix of snage, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization no potential (i.e., logs/snags that are not new fall and not transient).  SCORE  2. Pool Substrate  Candition Category  Suboptimal  Marginal  Poor  Substrate favorable for epifaunal colonization and fish cover; mix of snage, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization on potential; adaptive habitat for maintenance of populations; presence of additional substrate in the form of nemowed.  SCORE  2. Pool Substrate  Characterizati on  All mud or clay or sand bottom; little or no root mat; no submerged vegetation.  SCORE  2. Pool with the form of the firm and prevalent; root mats and submerged vegetation present.  SCORE  3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Majority of pools large-deep; were shallow. small-deep pools present.	Dominate Type:  On Trees			☐ Fully Exposed (0-25%) ☐ Partially Exposed (25-50%) ☐ Partially Shaded (50-75%) ☐ UPull ☐ Partially Shaded (50-75%)			☐ Dredging ☐ Channeliza	ration	
Sand (0.06 – 2 mm)  Gravel (2-64 mm)  Cobble (64 – 256 mm)  Boulders (>256 mm)  Bedrock  Habitat  Condition Category  Parameter  Optimal  Greater than 50% of substrate favorable for epifannal colonization and fish cover; mix of snags, substrate favorable for epifannal colonization and fish cover; mix of snags, substrate favorable for epifannal colonization and fish cover; mix of snags, substrate favorable for epifannal colonization and fish cover; mix of snags, substrate favorable for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).  SCORE  20 19 18 17 16 15 14 13 12 11 10 9 8 6 5 1 1 6 1 1 4 13 12 11 10 9 8 7 1 1 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Substrate □Est	. DP.C.	Riffle 2	0 %	R	m 60	%	Pool	20 %
Gravel (2-64 mm)  Cobble (64 – 256 mm)  Bedrock  Habitat  Condition Category  Parameter  Optimal  Greater than 50% of substrate favorable for epifannal colonization and fish cover; miv of snags, submerged logs, undercut banks, cobble or other stable habitat and at a stage to allow full colonization potential (i.e., logs/snags that are not new fall and transtent).  SCORE  20 10 18 17 16  Wixture of soft sand, mud, or law, materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of soft sand, mud, or law, mud or clay or sand bottom; little or no root mats and submerged vegetation.  SCORE  20 19 18 17 16  SCORE  3. Pool wix of stable habitat; hobitat availability less than desirable; substrate frequently disturbed or removed.  Mixture of soft sand, mud, or law, or sand bottom; little or no root mats and submerged vegetation common.  Mixture of soft sand, mud, or law, or substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation.  SCORE  20 19 18 17 16  SCORE  3. Pool wix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.  Mixture of soft sand, mud, or law, or substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation.  Mixture of soft sand, mud, or law, or obstrate or no root mats and submerged vegetation.  SCORE  20 19 18 17 16  SCORE  3. Pool wix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or law; no submerged vegetation.  SCORE  3. Pool wix of stable habitat; habitat; habitat; habitat availability less than desirable; substrate in the form of newfall and translation; prevently disturbed or removed.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.	Silt/Clay (<0.0	6 mm)							,
Cobble (64 - 256 mm)   Boulders (>256 mm)   Bedrock	Sand (0.06-2	mm)						/	/
Boulders (>256 mm)  Bedrock  Habitat  Parameter  Optimal  Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transtent).  SCORE  20 10 18 17 16  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  SCORE  20 19 18 17 16  SCORE  3 Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Majority of pools large-deep; very few shallow. small-deep pools present.  Condition Category  Marginal  Marginal  Poor  10-30% mix of stable habitat; habitat abaitat; habitat abaitating habitat; h	Gravel (2-64 m	am)	1			/			1
Parameter   Optimal   Suboptimal   Marginal   Poor	Cobble (64 - 2	56 mm)	1			1			
Parameter   Optimal   Suboptimal   Marginal   Poor	Boulders (>256	6 mm)	/						
Parameter Optimal Suboptimal Marginal Poor  1. Epifaunal Substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not transient).  SCORE 76 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 10 10 10 10 10 10 10 10 10 10 10 10	Bedrock								
Parameter Optimal Suboptimal Marginal Poor  1. Epifaunal Substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not transient).  SCORE 76 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 10 10 10 10 10 10 10 10 10 10 10 10	Habitat				Conditio	n Categor	v		
SCORE  20 10 18 17 16  2. Pool Substrate materials, with gravel and Characterizati on Mixture of substrate materials, with gravel and submerged vegetation common.  Mixture of substrate materials, with gravel and submerged vegetation common.  Mixture of substrate materials, with gravel and submerged vegetation common.  SCORE  20 19 18 17 16  15 14 13 12 11  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation common.  Mixture of substrate materials, with gravel and submerged vegetation common.  Mixture of substrate materials, with gravel and submerged vegetation common.  Mixture of substrate materials, with gravel and submerged vegetation common.  Mixture of substrate materials, with gravel and submerged vegetation common.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.  Mixture of substrate materials, with gravel and submerged vegetation.  Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation.  Mixture of soft sand, mud, or clay; or sand bottom; little or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay; or sand bottom; little or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay; or sand bottom; little or no root mat; no submerged vegetation.  SCORE  20 19 18 17 16  15 44 13 12 11  10 9 8 7 6 5 4 3 2 1 6   Mixture of soft sand, mud, or clay; or sand bottom; little or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  SCORE  3. Pool  Variability  Even mix of large-shallow, small-deep pools present.  Majority of pools large-deep; very few shallow.  Score of all the degrated for full availability less than availability less than availabilit	TT-040E3C00 E.S.	Optimal		Suboptima					Poor
2. Pool Substrate Characterization Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  SCORE 20 19 18 17 16 15 14 13 12 (1) 10 9 8 7 6 5 4 3 2 1 0  3. Pool Variability Even mix of large-shallow, small-deep pools present.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat; no submerged vegetation.  Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation.  Mixture of soft sand, mud, or clay or sand bottom; little or no root mat or vegetation.  The provided Hard-pan clay or bedrock; no root mat or vegetation.  SCORE 20 19 18 17 16 15 14 13 12 (1) 10 9 8 7 6 5 4 3 2 1 0  Schallow pools much more prevalent than deep pools.  Shallow or pools absent.	Substrate/ Available	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and high substrate favorable for experience of the favorable for exp		0-50% mix of stable habitat; well-suited for full colonization potential; idequate habitat for maintenance of populations; oresence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at		10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or		habitat; lack obvious; su	of habitat is
Substrate Characterizati on  materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.  clay; mud may be dominant; some root mats and submerged vegetation present.  bottom; little or no root mat or vegetation.  materials, with gravel and firm sand prevalent; root mats and submerged vegetation present.  bottom; little or no root mat or vegetation.  no root mat or vegetation.  no root mat or vegetation.  SCORE  20 2 19 18 17 16 15 14 13 12 (11) 10 9 8 7 6 5 4 3 2 10 0  3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Majority of pools large-deep; Shallow pools much more prevalent than deep pools.  Shallow or pools absent.	SCORE	20 - 19 - 18 - 1	7. 16	5 14 13	12 11:	10 9	8 ()	5 4	3 2 1 0 <sub>1</sub>
3. Pool Variability  Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.  Majority of pools large-deep; Shallow pools much more prevalent than deep pools. Shallow or pools absent.	Substrate Characterizati	rate materials, with gravel and firm sand prevalent; root mats and submerged subme		r; mud may be d ne root mats and merged vegetati	mud may be dominant; root mats and erged vegetation		bottom; little or no root mat; no submerged		lay or bedrock; or vegetation.
Variability large-deep, small-shallow, small-deep pools present. very few shallow. prevalent than deep pools. shallow or pools absent.	SCORE	20 2 19 - 18 - 1	7 16	15 44 13	12 (H)	10 9	18 7 7	5 4	3 2 1 0
SCORE 20 19 18 17 16 15 14 13 (12) 11 10 9 8 7 6 5 4 3 2 1 0	3. Pool Variability	large-deep, small-si	hallow, very		arge-deep;			Majority of shallow or	pools small- pools absent.
	SCORE	20 19 18 1	7 16	15 14 13 (	12)11	40 - 9	8 7 (	5 5 4	3 2 1 0

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eposition	islands or point bars and less than 20% of the bottom affected by sediment deposition.	ormation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
CORE	20 - 19 - 18 - 17 - 16	15 14 15 12 11	10 9:18 (1) 46	6 at 3 2 La 0 2	
. Channel low Status	lawer banks and minimal	channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
CORE	20 : 49 - 18 - 17 / 16	15 14 (13) 12 (11)	10: 9: 8: 7: 6	5 4 31 2 1 6 0 1 3 1 2 1 6 0	
. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
SCORE	20 19 18 17 16	15 14 (3) 12-11	10 9 78 27 6	5 4 3 2 4 0	
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.	
SCORE	720 - 19 18 17 16	15, 14, 13, 12, 11, 15	10. 9 (8) 7 6	5 4 3 2 1 0	
8.Bank Stability (score each bank) Note: determine left or right side by facing	absent or minimal; little potential for future problems. <5% of bank	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
SCORE	Left Bank : 16 9	8 - 6 -	1557 42 63 3	3 2 2 2	
SCORE	Right Bank 10 9	- 1.8 1 (6) 7 · 68 1 · 68		2 -1 -0	
(RB)  9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	patches of bare soil or closely cropped vegetation common; less than one-half of the	Less than 50% of the streambank surfaces covere by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
SCORE	Left Bank 10 9	8 7 6	4 3		
SCORE (RB)	Right Bank 10		\$ 47 Hs	2 1 2 0	
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >1 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not	17. 17. 17. 17. 17. 17. 17. 17. 17. 17.	Width of riparian zone 6 12 meters; human activities have impacted zone a great deal.	meters: little of no riparial	
SCORE (LB)	Ten Bank 10	8			
SCORE (RB)	Right Bank 10	8 -7 -16.	的"克"的" <sub>我们</sub> "。	2707-03	

Total Score

					^			
STREAM NAME: COLEY Creek				BASIN/WATERSHED: LTHE RIVE				
	22000 14			BASIN/WATERSHED: Lite Rive				
LAT.: LONG.:						e USGS 7.		
09/07/	103 TIME: 10	. 170 1	TAN FIRM	DIVESTI	PATOR	Spussell !	Toko Ne	Pina
TYPE SAMPLE:	P-CHEM O Mad	roinvertebra	te OFISH O	BACT. A	LGAE	70.000		/
WEATHER:	Now Past 2	4 hours avy rain ady rain ermittent sho ear/sunny	d	Has there bee	n a heavy No ature 75	rain in the last 7  °C. Inches rain	days? nfall in past 24	hours <u>O</u> in.
P-Chem: Temp(°C	D.O. (i		%Saturat	ion	pH(S	i.U.)	Cond	Grab
INSTREAM WA		LOCAL	VATERSHED int Surrounding	FEATURE				
Stream Width Range of Depth Average Velocity Discharge Est. Reach Lengt	ft/s	□ Surface □ Deep M □ Oil Wel □ Land Di	Mining ining Is	Daile Ost,	Construction Communication Communication Communication Communication Communication Communication Construction Communication Comm	ercial C	D Forest D Pasture/Graz Silviculture Urban Runof	ing NStorm Sewers
Hydraulic Structs  Dams A Bri Island D Wa	idge Abutments		Stream Flow	Pooled	Low for Torrer		Stream Typ Perennial D Ephemen	☐ Intermittent
Riparian Vegetat Dominate Type: Trees Shr Grasses Her Number of strata	rubs rbaceous	Shrub Taxa	Partially	osed (0-25% Exposed (25	-50%) 75%)	Channel Alters ☐ Dredging ☐ Channelizat (☐Full ☐Partis	ion al)	
Substrate OEst.	□P.C.	Riffle 2	e 25% Run		m <-0	50%		5%
Silt/Clay (<0.06	mm)						3	0
Sand (0.06-2	mm)	10	10		10		3	0
Gravel (2-64 m	m)	3	30		30		4	0
Cobble (64 - 25	56 mm)		60		60			
Boulders (>256	mm)							
Bedrock								
Habitat				Conditio	n Categor	гу		
Parameter	Optimal		Suboptim	ıal	1	Marginal		Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization new potential (i.e., logs/snags for		maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).		habitat; habitat availability less than desirable; substrate frequently disturbed o removed.		obvious; sul or lacking.	of habitat is ostrate unstable
SCORE								化山東西區沿
2. Pool Substrate Characterizati on	materials, with gravel and clay; mud n		y; mud may be me root mats an bmerged vegeta	mud may be dominant; bottom; lit mat; no su vegetation			no root mat	lay or bedrock; or vegetation.
SCORE	500 10 18 11	12.85 17.36 12.14 19		12:11	(D)		A PARTY	7-0-2-70
3. Pool Variability	Even mix of large-s large-deep, small-sl small-deep pools pr	hallow, Mallow, ver	ajority of pools ry few shallow.	large-deep; Shallow pools much n		pools much more than deep pools	s. shallow or	pools small- pools absent.
SCORE	20 19 (18) 1	2 16	is 14 1130	(12 - 11 (12)	210 339	14 8 m / E b		
	ALCOHOLD BY THE REAL PROPERTY OF THE PERSON	BOND THE PERSON NAMED IN COLUMN	TO PROGRESS OF THE PARTY OF THE	and the and additional or the second	AND THE PERSON		THE RESERVE OF THE PERSON.	The second second

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20: 19: 18: 02: 126	BILL IN SERVICE SERVIC	pools prevalent.	。 [1] [1] [1] [1] [1] [1] [1] [1] [1] [1]
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 116 20 20 20 20 20 20 20 20 20 20 20 20 20 2	16= U500 P200		
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 9 19 18 17 0 16 1	(49)/14 = 13 × 12 × 11 × 14		BEAUTIES IN CONTRACTOR
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than, if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 10 18 17 16	15-214-30-202-20-4	E076923 82747, 146	5 4 8 30 4 0 4
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Len Bank 370 The 913			6-24-51-61-01-FC
SCORE (RB)				
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	itenBan (1)	8 (0) 1/2		
SCORE	<b>和阿尔兰迪斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯斯</b>			<b>是我没有的</b>
(RB)  10. Riparian Vegetative Zone Width (score each bank riparian zone)	Right Bank 10 9 9 18 Width of riparian zone > 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	iten Bank 10			0.2
SCORE (RB)	Right Bank 109	(a) 1/6	5 4	2 1 1 0

Total Score

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LOCATION: UP Berking STREAM NAME: COSEY Creek STATION #: CLL 2000 BASIN/WATERSHED: MILE: USGS 7.5 TOPO: LONG .: LAT DATE: 05/16/03 TIME: 10145 om MAM DPM INVESTIGATORS: TYPE SAMPLE: DP-CHEM DMacroinvertebrate DFISH DBACT. DALGAE Has there been a heavy rain in the last 7 days? WEATHER: Now Past 24 hours Yes O No 0 ☐ Heavy rain Air Temperature 20 °C. Inches rainfall in past 24 hours 70 % Cloud Cover a ☐ Steady rain Claydy Intermittent showers ☐ Clear/sunny Grab %Saturation\_ pH(S.U.) Cond. D.O. (mg/l) P-Chem: Temp(°C) INSTREAM WATERSHED LOCAL WATERSHED FEATUREES: FEATURES: Predominant Surrounding Land Use: Stream Width ft □ Construction ☐ Forest ☐ Surface Mining Range of Depth ft Pasture/Grazing Deep Mining ☐ Commercial Average Velocity ft/s Oil Wells ☐ Industrial ☐ Silviculture Discharge cfs ☐ Urban Runoff/Storm Sewers Row Crops ☐ Land Disposal Est. Reach Length Stream Type: Stream Flow: Hydraulic Structures: Normal Perennial O Intermittent Dry Dry ☐ Pooled O Low ☐ Dams ☐ Bridge Abutments ☐ Ephemeral ☐ Seep ☐ Very Rapid or Torrential O High Island O Waterfalls Other Canopy Cover: Channel Alterations: Dom. Tree/Shrub Taxa Riparian Vegetation: ☐ Fully Exposed (0-25%) ☐ Dredging Dominate Type: Sycamore Partially Exposed (25-50%)

Partially Shaded (50-75%) Channelization Trees O Shrubs Ash (OFull Partial) ☐ Grasses ☐ Herbaceous ☐ Fully Shaded (75-100%) Number of strata mapples Run 80 Pool Riffle Substrate DEst. DP.C. Silt/Clay (<0.06 mm) Sand (0.06-2 mm) Gravel (2-64 mm) Cobble (64 - 256 mm) Boulders (>256 mm) Bedrock Condition Category Habitat Marginal Poor Optimal Suboptimal Parameter Less than 10% stable 10-30% mix of stable habitat; habitat 30-50% mix of stable habitat; Greater than 50% of habitat; lack of habitat is substrate favorable for well-suited for full Epifaunal colonization potential; adequate habitat for obvious; substrate unstable availability less than epifaunal colonization and fish cover; mix of snags, submerged logs, undercut Substrate/ Available Cover desirable; substrate frequently disturbed or or lacking. maintenance of populations; presence of additional removed. banks, cobble or other stable habitat and at stage substrate in the form of newfall, but not yet prepared for colonization (may rate at to allow full colonization potential (i.e., logs/snags that are not new fall and high end of scale). not transient). 20 19 18 17 16 SCORE Mixture of soft sand, mud, or clay; mud may be dominant; All mud or clay or sand Hard-pan clay or bedrock; Mixture of substrate 2. Pool no root mat or vegetation. materials, with gravel and firm sand prevalent; root bottom; little or no root Substrate mat; no submerged some root mats and Characterizati submerged vegetation vegetation. mats and submerged vegetation common. 10 (9) 8 - 7 - 6 15 14 13 12 JE 20 29 18 17 16 SCORE Majority of pools small-Shallow pools much more Even mix of large-shallow, large-deep, small-shallow, Majority of pools large-deep; 3. Pool prevalent than deep pools. shallow or pools absent. very few shallow. Variability small-deep pools present. 2 1 0 15 14 13 12 11 20 19 18 17 16 SCORE

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4. Sediment Deposition	Little or no enlargement of islands or point bars and	Some new increase in bar formation, mostly from	Moderate deposition of	Heavy deposits of fine
,	less than 20% of the bottom affected by sediment deposition.	gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	920 (19 58 117 <sub>5</sub> 16)		(I) (V) (B) (Z) (A)	是一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个一个
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15-14 (3) 12 10	10 9 8 7 6	3 4 5 3 12 11 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	- 45 14 (13) 12 17	510° 90 - 80° 41° 56	 
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE		(4) 15 12 ct (7)	10 9 8 (7) 6	5 4 23 52 1 104
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	ben Bank - 10	8 7 6	4 73	1 2 1 10 10
SCORE (RB)	Right Band (1997)	8 6	FT's Least (5)	2 - 1 - 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Cent Bank 10 5 9	1 8 av 5 0 6	3	A Line
SCORE (RB)	Right Bank 10 9		ASSESSMENT OF	(5)
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	3 2 6	5 14 3	2 1 (0)
SCORE (RB)	Right Bank 10 9		5 12 mg 3	

Total Score

**克莱斯**斯里尔克斯

was a Same

STREAM NAME: COLON Creek				LOCATION: UP Boldey Road					
STATION #: CRESCOOLS MILE:				1	BASIN/WATERSHED: Little RNO-				
LAT.: LONG.:					COUNTY: TOPP USGS 7.5 TOPO:				
DATE: 99 107	03 TIME	11:00	D	ГАМ ПРМ	INVEST	GATORS	Johnske	L. Russell	Arar
TYPE SAMPLE:	DP-CHEM (	Macroinver	tebrate	OFISH O	BACT.	ALGAE			
WEATHER:		ast 24 hours Heavy rain Steady rain Intermitted Clear/sunn	n n nt shov	Q8	Yes Air Temper	No 78	rain in the last ? _°C. Inches rain	7 days? nfall in past 24	ni_8 aruod
P-Chem: Temp(	°C) D			%Saturati	on	pH(S	3.U.)	Cond	Grab
INSTREAM W FEATURES:		Predo		ATERSHED I		EES:			
Stream Width Range of Depth Average Velocit Discharge Est. Reach Leng	yf	t/s De f/s Doil	ep Mir Wells			Constr Comm Industr	ercial (	☐ Forest ☐ Pasture/Grazi ☐ Silviculture ☐ Urban Runof	
Hydraulic Struct Dams D B Island D W Other	ridge Abutments			Stream Flow Dry High	Pooled		Normal	Stream Type Perennial D Ephemera	☐ Intermittent
Riparian Vegetation: Dom. Tree/Shrub Taxa Dominate Type:  Trees O Shrubs O Grasses O Herbaceous Number of strata		Taxa	Canopy Cover:    Fully Exposed (0-25%)   Partially Exposed (25-   Partially Shaded (50-7)   Fully Shaded (75-100)		5-50%) Channelizati (OFull Partia		tion		
Substrate DEst	DP.C.	Riffl	e/2	0 % R		m 8 C	O% Pool		0 %
Silt/Clay (<0.0			2 -			10		30	
Sand (0.06-2			10	The state of the s		10		30	
Gravel (2-64 m			20			90		20	
Cobble (64 – 2	4.7.10		50		40		ac	)	
Boulders (>25)	o mm)	- 6	20			20			
					-	- 2			
Habitat	Optim	-1	_	Suboptima		n Categor	y Iarginal	D.	oor
Parameter								-	
1. Epifaunal Substrate/ Available Cover	substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags		well-colon adequation main prese subst newfi for co	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).		habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		Less than 109 habitat; lack o obvious; subs or lacking.	
SCORE	English B				Dah				
2. Pool Substrate Characterizati on	materials, with gravel and firm sand prevalent; root mats and submerged subm		Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		All mud or clay or sand bottom; little or no root mat; no submerged vegetation.		Hard-pan cla no root mat o	y or bedrock; r vegetation.	
SCORE	20, 12, 18	12, 16			<b>多</b> 则能	00 50			
3. Pool Variability	Even mix of large-deep, sma small-deep pool	ll-shallow,	Majo very	prity of pools large-deep;		Shallow pools much more prevalent than deep pools.			
SCORE	20 19 18	J7 J6;		5 14 13 4	2 114	(10) 0			\$ 20 miles

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4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently pools almost absent due to substantial sediment deposition.
SCORE	205年7年18年7月16日		pools prevalent.	
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16			
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 4 19 18 17 02162			
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to I times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 97/ 16		10 9 8 7 6	
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30- 60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	FEO BUCKETO FEED	18 18 18 18 18 18 18 18 18 18 18 18 18 1		
SCORE	Right Bank 40			
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	Len Banks (1981)			
SCORE (RB)	HEALTH HOUSE			
(0. Riparian Vegetative Zone Width score each bank riparian zone)	Width of ripa ian zone >18 meters; human activities (i.e., parking iots, roadbeds, clear-cuts, lawns, or crops) have not impacted zon	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
CORE (LB)	Leit Bank and Lang America			12 (1) 0
CORE	Right Bank 1 9	8 7 6	5 1 4 1 13	



		LOW	Gradient Suc				_	_	
TREAM NAME:	Sinknp.	fork		LOCATION	i Kn	nps Chi	ron	food	
TATION#: CRO	200016	MILE:		BASIN/WATERSHED:					
TO A LAND				COLINTY.	Emp	USGS	7.5 TO	PO:	
DATE: 05/ 16/03TIME: 0245 DAM COP				COUNTY.	W	0 8 7		M.A	
DATE: 05/16	P-CHEM DM	4 )	PAM DEISH DI	INVESTIG	GAE	1.5.0	.00,	1.70	- 0
VEATHER:	Now Past	24 hours leavy rain steady rain ntermittent s Clear/sunny	howers	las there been	No nure 20	rain in the last _°C. Inches ra		? n past 24 hours	in
P-Chem: Temp(°C	D.O.			on	_ pH(S	U.)	_ Con	ıd	☐ Grab
INSTREAM WA FEATURES: Stream Width Range of Depth Average Velocity	### TERSHED    ### ### ### ### ### #### #### ########	LOCAL Predomi  Surface Deep Oil W	WATERSHED I mant Surrounding ce Mining Mining	FEATURES Land Use:		action ercial ial	☐ For Pas		
Hydraulic Structu  Dams  Bri  Island  Wa	res: dge Abutments		Stream Flow Dry High	Pooled (	Low or Torrer	□ Normal	2	ream Type: Perennial In Ephemeral I	
Riparian Vegetation: Dominate Type:  Trees Shrubs Grasses Herbaceous Number of strata		☐ Fully Exposed (0-25%) ☐ Partially Exposed (25-50%) ☐ Chi		Channel Alto ☐ Dredging ☐ Channeliz (☐Full ☐Par	ing nelization				
Substrate □Est.		Riffle	5 %	Run_ 25 %		_%		Pool R	%
Silt/Clay (<0.06						. 1		1	
Sand (0.06 - 21			✓ ×		1		<b>V</b>		
Gravel (2-64 m	m)	1			1			1	
Cobble (64 – 25		1			V			1	
Boulders (>256									
Bedrock							1		
Habitat				Conditio	n Catego	гу	=		
Parameter	Optima		Suboptin	al	1	Marginal	1	Poor	
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags) for		30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).		habitat; habitat availability less than desirable; substrate frequently disturbed removed.		ol	ess than 10% st abitat; lack of h bvious; substrat r lacking.	abitat is
SCORE	not transient). 20 - 19 - 18 -	17 (116)	-45 -44 -13	a <b>D</b> Salas	10 (2) (3)		9		
2. Pool Substrate Characterizati on	materials, with gravel and firm sand prevalent; root mats and submerged su		Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.		All mud or clay or sa bottom; little or no ro mat; no submerged vegetation.			Hard-pan clay o to root mat or v	
SCORE	-20 19 18	16	- 18 M - ISI	12 11 %	10		6	16 4 19 1	
3. Pool Variability	Even mix of largelarge-deep, small-deep pools	1-shallow.	Majority of pools very few shallow	large-deep;	Shallov	pools much not than deep po		Majority of poo shallow or pool	ls small- s absent.
SCORE	20 9 18	17 16	35 (14) 313	12 11	10.24	9 7 8 1 7	6	5 4 3	2 1

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			DESCAN	laliable Copy
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment 20-50% of the bottom affected; slight deposition in pools.	bottom affected; sedimen deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	The Walt TE TO	pools prevalent.	
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% o channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 (13) 18 17 16	15 14 18 12 11 c	The American Company of the Company	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	extensive; embankments or shoring structures	Banks shored with gabion of cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	1-15-10-13-(0-11-1	10 2 8 7 6	
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	45 14 13 302 36	10 - 9 - 8 - 7 - 76	
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 110 2 9	8 5 6 3	- 3 4 - 63 5	
SCORE (RB)	Right Bair (0. 179	. A		
9. Vegetative Protection score each pank)	vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
CORE LB)	Left Bank (10 th 9			
CORE		78 7 6		
0. Riparian egetative one Width core each	Width of riparian zone >18 meters; human activities (i.e., parking lots,	Width of riparian zone 12-18 meters; human activities have impacted zone only	Width of riparian zone 6- 12 meters; human activities have impacted	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
CORE	Left Bank 10 9	8 7 6	4 3	2 1 6
CORE (B)	Right Bank 10. 9		5 4 3	

Total Score

NOTES/COMMENTS:

77

		-	- NAP		The Real Property lies			V-1/	
STREAM NAME	: Kity	e Ro	ver	-/	LOCATIO	ON: S	SSR 1	253	
STATION #: C			-		BASIN/WATERSHED: 22-He River				
LAT.:	LONG.:				COUNTY: TOPO USGS 7.5 TOPO:				
DATE: 05/16/03TIME: 16:55 DAM & PA					INVEST	GATOR	7.1	MD	
TYPE SAMPLE:	DP-CHEM	☐ Macroinver	tebrate				, ,		
WEATHER:  Now Past 24 hours  Heavy rain  Steady rain  Intermittent showers  Clear/sunny						No ature 20	rain in the last	st 7 days? rainfall in past 24 hours	s in.
P-Chem: Temp(°	C)1	D.O. (mg/l)		%Saturati	on	pH(S	.U.)	Cond	☐ Grab
INSTREAM W. FEATURES: Stream Width Range of Depth Average Velocity Discharge Est. Reach Lengt	, =	ft Predo ft/s Dec ft/s Oil	minan	posal	Land Use:	Construction Communication Com	ercial ial	☐ Forest ☐ Pasture/Grazing ☐ Silviculture ☐ Urban Runoff/Sto	rm Sewers
Hydraulic Struct	idge Abutments			Stream Flow Dry Thigh	Pooled	□ Low d or Torrer	☐ Normal	Stream Type: Perennial In In In Ephemeral	termittent Seep
Riparian Vegetation: Dom. Tree/Shrub Dominate Type: Sycomore Orrees Shrubs Corasses Herbaceous Number of strata  Box elde				Description of the control of the co			Channel Alt ☐ Dredging ☐ Channeli (☐Full ☐Pa	zation	
Substrate DEst.		Riffl	e O % Ri		in 60	_%	Pool_O	%	
Silt/Clay (<0.06					V		-		
Sand (0.06 – 2					/		~		
Gravel (2-64 m		L			/		1		
Cobble (64 – 2:		V							
Boulders (>256 Bedrock	mm)								
TO 50 5 302 2			1						
Habitat Parameter	Opti	mal	Condition Suboptimal		n Category Marginal		Poor	-	
rarameter									
I. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).		30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).		habitat; habitat availability less than desirable; substrate frequently disturbed or removed.		Less than 10% sta habitat; lack of ha obvious; substrate or lacking.	bitat is	
SCORE	20 3 2 3 0	17, 10		8 494 (13)		10 y		6 2 2 2 2 2 2	
2. Pool Substrate Characterizati on	i materials, with gravel and ifirm sand prevalent; root mats and submerged		Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.						
SCORE	20 49 1	3 17 . 16	9/1	5 44 33-3	2-11	(10)	81.37	6 5-2 3-9	12:0
3. Pool Variability	Even mix of la large-deep, sm small-deep po	all-shallow,		ority of pools la few shallow.	rge-deep;	Shallow prevalent	pools much me than deep pool	Majority of pools a	small- absent.
SCORE	20 19 1	3 17 - 16		5 (14 ) 13	20 id	10. 9	8 7		0

4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (5) 18 17 16	A MARK SET STORY	pools prevalent.	
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 (E9) (18 17 L6	15 14 18 12 11		25 A 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 1 19 18 17 16		10 49 8 97 6	
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	5-34 33 12 1	10.9 8 G ) 6	s 4 0 2 5 1 0 1
8.Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Banks 10 2 1 0 15	2 (8) 7/ 6	4 7.5	120 5 (B) HI (C) 15 (C)
SCORE	Right Bark 40 9	8 7 16		
(RB) 9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE (LB)	ten Bank 10 25 9	7 46		
SCORE		世紀 1925年 - 西西西西北部		
RB)  10. Riparian Vegetative Zone Width score each bank riparian zone)	Right Bank 10 9 Note that the state of the s	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6- 12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE (LB)	Left Bank 10 9	8 1 7 6 1	4 3	2 (1) 0
SCORE (RB)	Right Bank 10 9	8 7 6	3 4 3	

Total Score

# Quality Assurance Project Plan for Biological Baseline Conditions in the Little River Watershed, 2003

Project officer: Dr. David S. White, 561 Emma Drive, Murray, KY 42071.

Phone: (270) 474-2272

Field sampling supervisor: Dr. David S. White, 561 Emma Drive, Murray, KY 42071.

Phone: (270) 474-2272

Laboratory supervisor: Dr. Pinar Balci, 561 Emma Drive, Murray, KY 42071.

Phone: (270) 474-2272

Laboratory used: Hancock Biological Station, 561 Emma Drive, Murray, KY 42071

Waterbody name: Little River, Casey Creek (tributary), Sinking Fork Creek (tributary)

Stream locations: Christian and Trigg counties, Lower Cumberland River Basin

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Any changes to this plan will be submitted to the Kentucky Division of Water (KDOW) in writing.

#### A3: Distribution List

This plan will be distributed to all parties involved in this project, including all personnel involved in fieldwork. A complete listing of these people will be developed and submitted to KDOW. The plan will be distributed to the following individuals, as well.

- Michele Koziol NPS Grant Administrator Kentucky Division of Water (502) 564-3410 ext. 598 (502) 564-0111 (fax)
- Dr. David S. White Director Hancock Biological Station Murray State University (270) 474-2272 (270) 474-0120 (fax)
- Dr. Pinar Balci
   Hancock Biological Station
   Murray State University
   (270) 474-2272
   (270) 474-0120 (fax)
- 4. Dr. Tom Timmons
  Hancock Biological Station
  Murray State University
  (270) 474-2272
  (270) 474-0120 (fax)
- 5. Gary Rice
  Hancock Biological Station
  Murray State University
  (270) 474-2272

(270) 474-0120 (fax)

#### A4: Project/Task Organization

Name:	Project Title/ Responsibility	Telephone Number
Dr. David White	Project QA Manager	(270) 474-2272
Dr. David White	Field Sampling Supervisor	(270) 474-2272
Dr. Pinar Balci	Laboratory Supervisor	(270) 474-2272

#### A5: Problem Definition/Background

The Little River and its tributaries are located in Christian and Trigg counties in western Kentucky. Its watershed is comprised of agricultural land, several small urban areas, and one significant urban area, the city of Hopkinsville (population > 30,000). The Little River receives point source pollution from a wastewater treatment plant in eastern Hopkinsville, and nonpoint source pollution from agricultural and urban runoff.

The purpose of this project is to assess and identify streams in Western Kentucky that are impacted by nonpoint source pollution. Biological baseline conditions in the Little River have been documented in the past by KDOW (1996) and the Center for Reservoir Research (2001).

#### A6: Project/Task Description

The project will involve collection and identification of fish, algae, and macroinvertebrates from 16 sites in summer 2003, during high base flow, and again in fall 2002, during low base flow. Habitat assessments and physicochemical analyses will be conducted to supplement biological data. The 16 sites to be sampled include 9 sites along the Little River, four sites on Casey Creek, and three on Sinking Fork Creek. Casey Creek and Sinking Fork Creek are tributaries of Little River.

The biological data obtained will be used to calculate biological metrics, which will be supplemented by the habitat and physicochemical data. These metrics will be compared to a previous KDOW survey of the same sites. A final report will be submitted to KDOW within two years.

#### A7: Quality Objectives and Criteria

All data will be gathered according to protocols outlined in the KDOW manual "Methods for Assessing Biological Integrity of Surface Waters in Kentucky" (2002).

All of the macroinvertebrate metric scores will be based on a 95<sup>th</sup> percentile calculated for each metric by compiling reference and study site data (Greg Pond, Ecological Support, KDOW). The actual values of each metric will be divided by the calculated 95<sup>th</sup> percentile and multiplied by 100, ranking all streams together, including the reference data, so that comparisons can be made among similar streams (USEPA, 1999) and so that outliers will not adversely effect study site scores.

When calculating fish metrics, different metrics will be used for different ecoregions, as determined by KDOW's analyses of reference data. In order to compare our study data with the reference data, the 95<sup>th</sup> percentile for all reference data within each ecoregion will be calculated. This method will normalize the data so that sites with particularly high values are not weighted as heavily.

Four diatom metrics will be scored and averaged to give the Diatom Biotic Index (DBI) according to "Methods for Assessing Biological Integrity of Surface Waters in Kentucky" (2002).

Biological and habitat data will be entered into the state's Ecological Database System (EDAS) and will be returned to the state for distribution to all participating organizations. Original specimens, slides, datasheets, and bench sheets will be archived at the Hancock Biological Station.

#### A8: Special Training/Certification

All field personnel will be trained in fish, algal, and macroinvertebrate collection techniques according to KDOW sampling protocols. A training session for these sampling protocols will be given by KDOW at the Hancock Biological Station and nearby Ledbetter Creek in late 2002 or early 2003. All personnel involved in sampling will complete this training. Personnel collecting macroinvertebrates are lead by a Ph.D. level stream ecologist with a background in entomolgy. Fish will be identified in the laboratory by a Ph.D. level fisheries biologist.

#### A9: Documents and Records

All data gathered in the field is written in a waterproof field book and entered into spreadsheets upon arrival to Hancock Biological Station. These data are saved on the computer's hard drive and on floppy disk. Information recorded on field data sheets will include: Site name, site description, names of field technicians, date, time, results of physicochemical measurements, numbers of containers of collected specimens, and notes on stream and riparian conditions. Habitat data sheets are kept in a waterproof container

and are stored at the Hancock Biological Station. Digital images of each site are downloaded and saved on computer hard drive and on compact disk (CD).

Upon completion of the biological metrics, biological and habitat data will be entered into the Kentucky's Ecological Database System (EDAS).

#### **B1: Sampling Process Design**

To reduce variability among stations resulting from sampling error, a maximum of four full-coverage (algae + macroinvertebrates + fish) stations are collected per day. The 16 sites to be sampled include 9 sites along the Little River, four sites on Casey Creek, and three on Sinking Fork Creek. Casey Creek and Sinking Fork Creek are tributaries of Little River. All sites are to be sampled once in summer during high base flow and again in fall during low base flow. Locations of the sites to be sampled are as follows:

South Fork LR	36.88174	05 041 65
o de la		-87.34167
South Fork LR	36.84893	-87.37433
Lower Branch LR	36.89947	-87.39161
North Fork LR	36.88908	-87.45583
North Fork LR	36.85292	-87.46967
North Fork LR	36.841000	-87.53022
North Fork LR	36.80178	-87.51382
North Fork LR	36.86183	-87.51936
Little River	36.78336	-87.54604
Sinking Fork	36.91603	-87.57668
Sinking Fork	36.8812	-87.60839
Little River	36.76038	-87.5501
Little River	36.77781	-87.7223
Casey Creek	36.75579	-87.72483
	Lower Branch LR  North Fork LR  North Fork LR  North Fork LR  North Fork LR  Little River  Sinking Fork  Little River  Little River	Lower Branch LR       36.89947         North Fork LR       36.88908         North Fork LR       36.85292         North Fork LR       36.841000         North Fork LR       36.80178         North Fork LR       36.86183         Little River       36.78336         Sinking Fork       36.91603         Sinking Fork       36.76038         Little River       36.77781

CRR2000015	Casey Creek	36.74586	-87.74755
CRR2000016	Sinking fork	36.84078	-87.74045

All site-specific data are recorded on field data sheets at the time of collections. Data include station name and number, date and time (start to finish) of sampling, type of collections made, location of station, name of person recording data, and names of all people sampling at that station. Copies of the data sheets to be used have been provided to MSU by KDOW.

Samples are labeled with station number and location, date and time of collection, name of collector, and type of preservative used.

All available habitat types are sampled during biological collections. Samples are representative of the entire community; therefore, effort is made to recognize and collect all possible habitats (e.g., pools, riffles, banks).

Sample equipment such as nets, seines, grabs, buckets, and artificial substrates are cleaned thoroughly and dried after each use.

All staff involved in collections receive specific training in collection techniques and in the use of computers for data analysis.

Biological samples are preserved at the time of collection using the following preservatives:

- 1. Algae (identification and counting) in 2% buffered glutaraldehyde.
- 2. Fish in 10% formalin buffered with CaCO<sub>3</sub>.
- 3. Macroinvertebrates in 70% ethanol.

All biological samples are recorded in the proper logbooks upon delivery to the Biological Station. The biological data obtained will be used to calculate biological metrics, which will be supplemented by the habitat and physicochemical data. These metrics will be compared to a previous KDOW survey of the same sites.

#### **B2: Sampling Methods**

#### Algae

Algae sampling and analyses follow the Kentucky Division of Water's (KDOW) "Methods for Assessing Biological Integrity of Surface Waters in Kentucky" (2002). Qualitative samples are collected from all available substrates by selective hand picking/scraping. Microhabitats are sampled in roughly the proportion that they occur at each site. All sites are sampled only during low flow periods. In the field, the algal community is qualitatively ranked (1 = lowest, 5 = highest) and recorded based on the following criteria: 1, no algae visible or if present they are in the form of thick blue-green or green algal mats; 3, algae visible on substrates and may include some *Cladophora* or

small floating mats; and 5, algae on substrates appear diverse but not floating mats present.

Wet mount slides (a minimum of three) for non-diatom taxa are examined at 200x and 400x. Taxa present are recorded in a logbook along with estimated relative abundance (abundant, common, rare). In determining abundance, colonial, connubial, or filamentous forms are recorded as units rather than counting the individual cells present. Digital photographs of each taxon are taken and used to create a species archive. All identifications are verified by at least two people knowledgeable in algal identification.

Diatoms are examined using the hydrogen peroxide/potassium dichromate oxidation method for clearing. Cleared diatoms are mounted in Nephrax. A minimum of 300 to 500 valves is identified and the numbers of each taxon recorded on bench data sheets. Digital photographs of each taxon are taken and used to create a species archive. All identifications are verified by at least two people knowledgeable in algal identification.

#### Fish

Fish sampling and analyses follow the Kentucky Division of Water's (KDOW) "Methods for Assessing Biological Integrity of Surface Waters in Kentucky" (2002). All available habitats at each stream site are sampled.

At wadeable sites, the reach length is a minimum of 100 meters and does not exceed 200 meters. Documentation of the sample reach is noted. The sample reach consists of at least two riffles, runs, and pools each. In cases where two riffles, runs, and pools cannot be samples, either one riffle, run, and pool is sampled or the recommended reach length of the stream is sampled. Sampling is done using a seine and a backpack electrofisher. The seine is used for approximately 30-60 minutes from start to finish. The electrofisher is used in areas not efficiently sampled with the seine (e.g., root masses, undercut banks, rock slabs, boulder/cobble substrates, fallen trees, etc.). The electrofisher is used for a least 600 "shocking" seconds to a maximum of 1800 "shocking" seconds of effort.

At headwater sites, the sample reach ranges between 100 and 125 meters in length. The reach consists of riffles, runs, and pools if they are present. Sampling in headwater streams consists of using a backpack electrofisher unit working in an upstream manner. The electrofishing duration within the sample reach is a minimum of 600 "shocking" seconds and a maximum of 1000 "shocking" seconds. In streams with a larger pool habitat, a seine is used to sample the area more efficiently.

Fish are identified to the lowest possible taxonomic unit and verified by at least two people knowledgeable in fish identification. All data are entered into field notebooks. Voucher specimens are saved and preserved in 10% formalin buffered with CaCO<sub>3</sub> and identifications are verified.

#### Macroinvertebrates

Macroinvertebrate sampling and analyses follow the Kentucky Division of Water's (KDOW) "Methods for Assessing Biological Integrity of Surface Waters in Kentucky" (2002). Collections from all methods listed below are composited into one or two wash buckets with No. 30 mesh screen bottoms. Wash buckets are set in shallow water during sampling and picking to keep organisms alive.

- 1. Kicknet Samples: Four 0.25 m<sup>2</sup> kicks are done. The kicknet is placed about mid-riffle, the lead-line is secured against the substrate, and the net is tilted back so that the maximum amount of surface area is in the water without the water flowing over the top of the net. Approximately 0.25 m<sup>2</sup> of substrate is disturbed directly in front of the net. Any large rocks are hand washed into a wash-bucket.
- 2. Sweep Sample: This method involves sampling a variety of habitats using a D-frame net. Each habitat is sampled in three replicates whenever possible.
  - i. Undercut Banks: The principal habitat in undercut banks is submerged roots. Note if undercut banks are present in both riffle and pool areas, each is sampled separately.
  - ii. Marginal Emergent Vegetation Sample (exclusive of *Justicia* beds): A triangular or D-frame kicknet is placed in the vegetation and about 1 meter is swept. Any sticks, leaves, and vegetation are thoroughly washed before discarding.
  - iii. Bedrock or Slabrock Sample: The edge of the D-frame or triangular kicknet is placed flush on the substrate and about 1/3 of a square meter of area in front of the kicknet is sampled.
  - iv. Justicia Beds Sample: Along the edge of the *Justicia* bed, the D-frame or triangular kicknet is worked over about one meter section in a jabbing motion and any *Justicia* stems are thoroughly washed, then discarded.
  - v. Leaf Pack Sample: Small, aged leaf and stick packs from a variety of locations, i.e. riffles, runs and pools, are collected and placed in a wash-bucket and thoroughly rinsed.
- 3. Silt, Sand, and Fine Gravel Sample: This type of material is sampled using two methods.
  - i. Sieving: A number 10 sieve is used to sort out larger invertebrates from silt, sand, and gravel. The sieve is scooped

through each of the substrate types, penetrating the substrate at least five cm. Fine material is rinsed away from the sample. Each substrate type (silt, sand, and gravel) is sampled three times.

- ii. Netting: A fine-mesh Surber Sampler or a fine-mesh bag (300 um), is used to collect an area of about 1/3 square meter in sand and silt depositional areas. All materials are removed from the sampler and placed in a pan for sorting.
- 4. Aufwuchs Sample: This habitat is collected by washing rocks, sticks, leaves, filamentous algae, and moss in a medium to large-sized bucket 1/2 to 2/3 full of water. After sample material is washed and discarded, the elutriate in the bucket is swirled and poured through a Nitex sampler. The sampler is placed in 95% alcohol and let stand from 5 to 15 minutes before sorting.
- 5. Rock Picking Sample: Thirty rocks are selected from the site. Ten rocks each are taken from the riffles, runs, and pools. The sizes of the rocks range from that of a softball to a small dinner plate (10-30 cm). Rocks are placed in a sorting pan, carefully picked, removing all invertebrates and cases, which are placed in a collection jar. Rocks are replaced into the streams.
- 6. Wood Sample: About 20 linear feet of submerged wood ranging in diameter from 5 to 8 cm are selected. Wood is placed into the wash-bucket and rinsed of all surface material. Wood is inspected for burrowing invertebrates. Large diameter logs are hand picked. Well-seasoned wood (log, limb, etc) is exposed to air for 15-20 minutes, because many burrowing types will crawl to the surface.
- 7. Sorting: After the collections have been made, the samples are sorted in the field. All collected material is sorted in a white pan. Sorting is accomplished with the following procedures:
  - i. Place a small amount of water in the pan (no more than a quarter inch.)
  - ii. From the wash buckets, remove about a tablespoon of material and place in the pan.
  - iii. Swirl the material to distribute it evenly throughout the pan.
  - iv. Remove invertebrates from the pan with forceps and place into a collection jar, filled with 95% alcohol.

- 8. Preservation and labeling: Samples are sorted into collection jars containing 95% ethyl alcohol in the field. Samples are transferred to 70% ethyl alcohol solution in the laboratory. Before leaving the site, all invertebrates are placed in the sample jar(s) and all jars are completely filled with 95% alcohol. Completely filling jars reduces damaging movement of the enclosed invertebrates.
- 9. In the field, a label is placed in each collection jar. The label includes the site number, stream name, location, and date sampled. When changing the sample over in the laboratory a permanent label is placed in the collection jar. This label includes the site number, stream name, state, county, locality, date, mile-point, latitude, longitude, and collectors' names.
- 10. Identification: All macroinvertebrates are identified to the lowest possible taxonomic level. In most cases, this is species level. When listing the organism on the Macroinvertebrate Laboratory Data Sheet (MLDS) the family name also is included so that the data can be entered easily into the biological database. A MLDS is completed for each site. After the data from the MLDS have been entered into EDAS, the MLDS is filed under the appropriate segment in the Intensive Survey files.
- 11. One goal of the Intensive Survey program is to establish a voucher specimen of every macroinvertebrate taxon found in Kentucky. Vouchers will be used to verify identifications. Vouchers will be sent to acknowledged experts for verification. The vouchers will be stored in the Macroinvertebrate Laboratory and organized by order. Voucher specimens kept in 70% ethyl alcohol are placed in tightly capped vials. Chironomids, oligochaetes, and other slide-mounted species are kept in slide cabinets. All specimens contain a label that includes order, family, genus, and species, site number; stream name, and date collected.

#### **B3: Sample Handling and Custody**

Macroinvertebrate preservation and labeling: Samples are sorted into collection jars containing 95% ethyl alcohol in the field. Samples are transferred to 70% ethyl alcohol solution in the laboratory. Before leaving the site, all invertebrates are placed in the sample jar(s) and all jars are completely filled with 95% alcohol. Completely filling jars reduces damaging movement of the enclosed invertebrates.

In the field, a label is placed in each collection jar. The label includes site number, stream name, location, and date sampled. When changing the sample over in the laboratory a permanent label is placed in the collection jar. This label includes the site number, stream name, state, county, locality, date, mile-point, latitude, longitude, and collectors' names.

Fish are identified to the lowest possible taxonomic unit and verified by at least two people knowledgeable in fish identification. All data are entered into field notebooks. Voucher specimens are saved and preserved in 10% formalin buffered with CaCO<sub>3</sub> and identifications are verified.

Wet mount slides (a minimum of three) for non-diatom taxa are examined at 200x and 400x. Taxa present are recorded in a logbook along with estimated relative abundance (abundant, common, rare). In determining abundance, colonial, connubial, or filamentous forms are recorded as units rather than counting the individual cells present. Digital photographs of each taxon are taken and used to create a species archive. All identifications are verified by at least two people knowledgeable in algal identification.

Diatoms are examined using the hydrogen peroxide/potassium dichromate oxidation method for clearing. Cleared diatoms are mounted in Nephrax. A minimum of 300 to 500 valves is identified and the numbers of each taxon recorded on bench data sheets. Digital photographs of each taxon are taken and used to create a species archive. All identifications are verified by at least two people knowledgeable in algal identification.

#### **B4: Analytical Methods**

A YSI multiparameter environmental monitoring system will be used to measure dissolved oxygen, temperature, turbidity, oxidation-reduction potential, pH, and conductivity. This instrument is calibrated each day sampling is to occur. A digital flow meter is used to measure discharge. A pH meter and digital titrator will be used in the laboratory to calculate alkalinity. The pH meter will be calibrated for each use.

### **B5: Quality Control**

All algal identifications are verified by at least two people knowledgeable in algal identification. Fish are identified to the lowest possible taxonomic unit and verified by at least two people knowledgeable in fish identification. Macroinvertebrates are identified to the lowest possible taxonomic unit and verified by at least two people knowledgeable in macroinvertebrate identification. Ten percent of samples will be submitted to KDOW for verification.

## **B6: Instrument/Equipment Testing, Inspection, and Maintenance**

All field monitoring equipment will be calibrated in accordance with the manufacturer's user's manuals.

## **B7: Instrument/Equipment Calibration and Frequency**

The YSI and pH meter will be calibrated on each sample date.

## **B8: Inspection/Acceptance of Supplies and Consumables**

Supplies and consumables will be provided and inspected by Hancock Biological Station and the Center for Reservoir Research.

#### **B9: Non-direct Measurements**

Detailed topographic maps (1:150,000) of the sampling area are used to locate sampling sites.

#### **B10: Data Management**

At the end of each day, the Field Sampling Supervisor will check all field data sheets for completeness and accuracy. The sheets are taken to Hancock Biological Station and the data are entered into spreadsheets. All data will be examined and evaluated by the Project Officer.

#### C1: Assessments and Response Actions

The Project Officer will review the biological sampling project on a regular basis and will communicate with KDOW. The Field Sampling Supervisor will train all field workers and require them to periodically review established sampling protocols.

#### C2: Reports to Management

Project officer will submit reports as required by KDOW.

#### D1: Data Review, Verification, and Validation

Data is to be compared to previous KDOW (1996) study of the same sites.

Multi-metric scoring systems will be used to integrate algae, macroinvertebrate, and fish metrics (Fish Index of Biotic Integrity (IBI), Macroinvertebrate Bioassessment Index (MBI), and Diatom Bioassessment Index (DBI) and Non-diatom Scores).

Biological and habitat data will be entered into the Kentucky's Ecological Database System (EDAS).

#### **D2: Verification and Validation Methods**

The Project Officer will regularly review all data resulting from this project and determine whether it is acceptable.

Biological data collected during this project will be compared to two previous studies on the same sites. Ten percent of samples (invertebrates, fish, and algae) will be submitted to KDOW/NPS for verification.

### D3: Reconciliation with User Requirements

Soon after each sampling event, data will be evaluated for completeness, precision, and accuracy. If data are not acceptable, re-sampling will occur. Depending upon the cause of the problem, corrective measures will be made.

#### Literature Cited

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