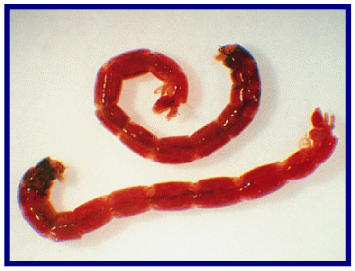
APPENDIX A

TOXICITY TEST REPORT

Fort McClellan Baseline Ecological Risk Assessment (BERA): Sediment and Soil Toxicity, and Bioaccumulation Evaluation for Baby Bains Gap Road Ranges

Project No. 800486

October 2006 Sampling Event



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Submitted: February 2007

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Prepared for: **EMAX Engineering**
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Submitted: **February 7, 2007**

Data Quality Assurance:

- ✓ Nautilus Environmental is a State-certified laboratory under the California Department of Health Services – Environmental Laboratory Accreditation Program (ELAP), Certificate No. 1802.
- ✓ All test results included in this report have met internal Quality Assurance requirements, as well as all minimum acceptability criteria for test controls under appropriate protocol requirements. Any test data discrepancies or protocol deviations have been noted in the summary report pages.
- ✓ All data have been reviewed and verified.

Results Verified By: _____
Chris Stransky, California Operations Manager,
Nautilus Environmental

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1.0 INTRODUCTION

In October 2006, sediment and soil samples were collected from Fort McClellan, located in northeastern Alabama, by Shaw Environmental and Infrastructure, Inc. (Shaw). Samples were collected in support of a Baseline Ecological Risk Assessment (BERA) for a site identified as Baby Bains Gap Road Ranges. Sediment and soil samples were submitted to Nautilus Environmental (Nautilus), located in San Diego, CA, for chronic toxicity testing, bioaccumulation exposures, and grain size analysis (sediments only). A final report of grain size analyses was issued by Nautilus to EMAX Engineering (EMAX) on November 1, 2006, and therefore, is not reported herein. Samples for this project were also shipped to EMAX by Shaw for chemical analysis, the results of which have been provided to Shaw under separate cover from EMAX. Chronic toxicity of sediments was evaluated using freshwater midge fly larvae, *Chironomus tentans*. Chronic toxicity of soils was evaluated using rye grass, *Lolium perenne*, and earthworms, *Eisenia fetida*. Bioaccumulation exposures were performed using *C. tentans* and *E. fetida* for sediment and soil samples, respectively. Tissues were submitted to EMAX for chemical analysis and results will be provided by EMAX under separate cover. Toxicity and bioaccumulation tests were conducted following methods published by the American Society for Testing and Materials (ASTM) (1999 and 2000), and the United States Environmental Protection Agency (USEPA) (1996 and 2000). Testing was conducted at Nautilus under contract through EMAX.

2.0 MATERIALS AND METHODS

2.1 Sample Collection and Transport

Sediment and soil samples were collected by Shaw personnel under the direction of Mr. Steve Moran (Project Manager), Mr. Randy McBride, and Mr. Richard Prann. Following collection, sediments were double bagged in polyethylene bags and sealed to minimize headspace. Upon completion of the collection effort, bags were placed in ice chests with wet ice, and transported to Nautilus by overnight delivery service. Appropriate chain-of-custody (COC) procedures were employed throughout collection and transport; copies of COC forms are provided in Appendix E.

Samples were collected between October 6 and 10, 2006. A total of thirteen sediments and ten soils were collected and tested. Sample IDs and collection dates, along with test initiation dates for all samples are provided in Table 1.

Table 1. Sample Collection and Test Initiation Dates

Sample ID	Date Collected	Test Initiation Dates				
		Chronic Toxicity			Bioaccumulation	
		C. tentans	*E. fetida*	*L. perenne*	*C. tentans*	*E. fetida*
SY0001	10/6/06	NT	10/13/06	11/9/06	NT	10/13/06
SY0002	10/10/06	NT	10/13/06	11/9/06	NT	10/13/06
SY0004	10/6/06	NT	10/13/06	11/9/06	NT	10/13/06
SY0005	10/7/06	NT	10/13/06	11/9/06	NT	10/13/06
SY0006	10/7/06	NT	10/13/06	11/9/06	NT	10/13/06
SY0007	10/10/06	NT	10/13/06	11/9/06	NT	10/13/06
SY0008	10/10/06	NT	10/13/06	11/9/06	NT	10/13/06
SY0009	10/6/06	NT	10/13/06	11/9/06	NT	10/13/06
SY0010	10/7/06	NT	10/13/06	11/9/06	NT	10/13/06
SY0011 (Ref)	10/6/06	NT	10/13/06	11/9/06	NT	10/13/06
SY1001	10/6/06	10/13/06	NT	NT	10/11/06	NT
SY1002	10/6/06	10/13/06	NT	NT	10/11/06	NT
SY1004	10/6/06	10/13/06	NT	NT	10/11/06	NT
SY1005	10/7/06	10/13/06	NT	NT	10/13/06	NT
SY1006	10/6/06	10/13/06	NT	NT	10/12/06	NT
SY1007	10/7/06	10/13/06	NT	NT	10/13/06	NT
SY1008	10/8/06	10/13/06	NT	NT	10/17/06	NT
SY1009	10/7/06	10/13/06	NT	NT	10/17/06	NT
SY1010	10/10/06	10/13/06	NT	NT	10/18/06	NT
SY1011	10/8/06	10/13/06	NT	NT	10/19/06	NT
SY1013	10/7/06	10/13/06	NT	NT	10/19/06	NT
SY1014	10/7/06	10/13/06	NT	NT	10/19/06	NT
SY1015 (Ref)	10/8/06	10/13/06	NT	NT	10/20/06	NT

NT = not tested

2.2 Sample Receipt

Samples were received at Nautilus on October 10 and 12, 2006. Upon arrival, coolers were opened and their contents verified. Temperature was measured in one sample for each cooler received and recorded in a bound sample receipt logbook. Interstitial pore water was collected from sediments for measurements of ammonia and pH. Interstitial water generally consisted of a sub-sample of the surface water overlying the sediment collected from each site. During shipment, sediments quickly settle, often leaving a layer of interstitial water on the sediment surface. When surface water was not available, sediments were centrifuged to provide sufficient interstitial water for the measurements specified. All samples then were placed in a cold room maintained at 4°C until test initiation.

2.3 Organism Procurement and Handling

The test organisms used in this study included freshwater midge fly larvae, *C. tentans,* rye grass *L. perenne,* and earthworms, *E. fetida*.

C. tentans were cultured and provided by Aquatic Biosystems in Fort Collins, CO. Depending on the type of test performed (chronic toxicity or bioaccumulation), *C. tentans* in one of two developmental stages were used: un-hatched *C. tentans* egg cases were used to initiate the bioaccumulation tests, while second to third instar *C. tentans* larvae were used to initiate the 10-day chronic tests. *C. tentans* were shipped to Nautilus in insulated ice chests via overnight delivery service. The second and third instar larvae arrived in 500-ml plastic bottles filled with culture water and unbleached paper towels as a substrate. Egg cases were also delivered in 500-ml plastic bottles with culture water, but without substrate. Upon arrival at the laboratory, organism receipt information was recorded, animal condition noted, and physical parameters including pH, dissolved oxygen (DO), conductivity, and temperature were measured.

Cultured *E. fetida* were obtained from Williams' Worm Farm located in Lakeside, CA; although cultured, it is not possible to determine a precise age of the earthworms due to the batch culturing process used. Adult (based on size) *E. fetida* were delivered to Nautilus via same day courier service in a mesh bag containing a mixture of moist peat and coconut husk shavings. Upon arrival at the laboratory, organism receipt information was recorded, and animal condition noted. Prior to test initiation, a subset of earthworms was frozen to preserve a pre-exposure tissue sample should there be any

post-exposure concern about the laboratory conditions or potential exposures of organisms prior to the assays that might compromise interpretation of bioaccumulation data.

All test animals were held at 23 ± 1°C until testing was initiated. During the acclimation period, the animals were observed for any indications of stress or significant mortality. Mortalities were monitored and recorded in animal holding logbooks. Mortality was considered significant if greater than ten percent of the organisms died during the holding and acclimation period.

Perennial rye grass seed was supplied by Main Street Seed and Supply located in Bay City, MI. Rye grass seed was delivered in a plastic bag and was stored in a cool, dry place prior to test initiation.

2.4 Chronic Toxicity Tests and Bioaccumulation Exposures

10-Day *C. tentans* Larval Survival and Growth Test

Tests were conducted according to USEPA (2000), "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates (EPA/600/R-99/064)", and ASTM (2000), "Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates (E1688-00a)." A summary of test conditions for the *C. tentans* larval survival and growth test is provided in Table 2, and described in detail the following section.

Table 2. Test Conditions and QA/QC Summary for the *C. tentans* 10-Day Chronic Toxicity Test

Test organism	*C. tentans* (midge fly) larvae
Test organism source	Aquatic Biosystems
Test duration	10 days
Overlying water renewal	None
Feeding	1 ml of a mixture of ground Tetramin® flakes (4 g per 100 ml Culligan) per chamber every 2 to 3 days
Test chambers	1-L glass jars
Sediment volume	2 cm (approx. 150 ml)
Overlying water volume	800 ml
Test temperature	23 ± 1°C
Dilution water	Moderately hard Culligan-filtered tap water
Number of organisms/chamber	10
Number of replicates	5
Photoperiod	16 hours light/8 hours dark
Aeration	Delivered through 1-ml glass pipettes at a rate of 2-3 bubbles per second
Water Quality Measurements	Daily temperature, DO, conductivity, and pH in overlying water.
Test Protocol	EPA-600/R-99/064, ASTM E1688-00a
Test acceptability criteria for controls	Mean survival ≥ 70%; ≥ 0.48 mg AFDW [a] per organism

[a] AFDW = Ash-free dry weight.

Organisms were exposed to test sediments for 10 days to determine the effects of site sediment on survival and growth. The test was conducted in an environmental chamber maintained at 23 ± 1ºC under a 16-hour (light): 8-hour (dark) light cycle. Test chambers consisted of 1-L glass jars supplied with continuous aeration at a rate of approximately two to three bubbles per second. The experimental design consisted of five replicate jars per site arranged in a pre-determined random order in the environmental chamber. An additional replicate was included for each site as a surrogate chamber for daily water quality measurements.

For test initiation, two cm of sediment was placed in each chamber followed by approximately 800 ml of Culligan-filtered water (Culligan). Culligan was obtained from a city water line connected to a regularly exchanged series of activated carbon and resin filters. A sediment control was conducted concurrent to the test sediments to ensure that organisms were not impacted by stressors other than contamination in the test material. The sediment control consisted of fine beach sand collected from La Jolla, California that was washed thoroughly with de-ionized water prior to use. Sediments were allowed to settle and the system was allowed to equilibrate for 24 hours prior to the addition of test organisms. Initial water quality parameters were measured and then ten midge fly larvae were added to each test chamber after confirmation by two technicians that the correct number of test organisms was segregated and in healthy condition.

Temperature, DO, pH, and conductivity were monitored daily in the surrogate replicate test chamber for each site. Sub-samples of overlying water for ammonia analysis were collected from each surrogate at the beginning and end of the test period. Each test chamber was examined daily to ensure proper airflow. Abnormal conditions or unusual animal behavior, if observed, were also noted at this time. Examples of unusual behavior include failure to bury, erratic or slow movements, and slow response to stimulation.

A source of food was provided during the test by adding 1 ml of a mixture of ground Tetramin® flakes (4 g per 100 ml Culligan) per chamber every 2 to 3 days during the testing period. The feeding regime was suspended if the presence of excess food was observed on the sediment surface in several test chambers.

At the end of 10 days, sediment in the test chambers was sieved to recover the surviving animals. The number of surviving animals in each replicate was recorded. Surviving animals were placed on a tared weigh boat and dried at 60°C for 24 hours. The dry weight of each replicate was then recorded using a Mettler AE240 digital balance to the nearest 0.01 mg. Weigh boats were then placed in a muffle furnace at 600°C for 24 hours to burn off organic material present. The weigh boats then were reweighed and subtracted from the initial dry weight to obtain an ash-free dry weight (AFDW); this loss upon ashing is representative of the organic mass of *C. tentans*. AFDW is recorded for this species, because the mass of inorganic sediment remaining in the gut of *C. tentans* is known to vary substantially depending on sediment composition and grain size, and may impact magnitude and variability of growth data.

A water only reference toxicant test using copper was conducted as a QA/QC measure to determine the relative sensitivity of the organisms used for this test series relative to that performed previously at Nautilus.

C. tentans Bioaccumulation Test

Tests were conducted according to USEPA (2000), "Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates (EPA/600/R-99/06)," and ASTM (2000), "Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates (E1688-00a)." A summary of test conditions for the *C. tentans* bioaccumulation test is contained in Table 3.

Table 3. Test Conditions and QA/QC Summary for the *C. tentans* Bioaccumulation Test

Test organisms	*C. tentans* (midge fly) larvae
Test organism source	Aquatic Biosystems
Test duration	21 days
Depuration Period	20 to 24 hours
Overlying water renewal	Flow-through
Feeding	Tetramin® (daily on days 1-21) and *Selenastrum* algae suspension (daily on days 1-4)
Test chambers	27-L plastic trays
Sediment volume	1 L per replicate
Overlying water volume	~10 L per replicate
Number of replicates	4
Test temperature	23 ± 1°C
Dilution water	Moderately hard Culligan-filtered tap water
Organisms per replicate	4 egg cases (replicates A & B), 3 egg cases (replicates C & D)
Photoperiod	16 hours light/8 hours dark
Aeration	Continuous
Water Quality Measurements	Daily temperature, DO, conductivity, and pH in overlying water. Total ammonia on days 0, 7, 14, and 21.
Test Protocol	EPA-600/R-99/064
Test acceptability criteria	Test organisms should burrow in test sediments; DO maintained above 2.5 mg/L.; Water quality parameters should not vary more than 50% during the test.

Organisms were exposed to test sediments to evaluate bioaccumulation of potential constituents of concern in tissues. Test chambers consisted of shallow, 27-L plastic trays (38 cm width x 56 cm length x 13 cm depth) filled with 1.5 cm of sediment (approximately 1 L sediment per replicate). The experimental design consisted of four replicate trays (A-D) per site. Test positions were not randomized. Sediments and

approximately 10 L overlying Culligan water were distributed to test chambers, and were then allowed to equilibrate for 24 hours prior to the addition of test organisms. All test chambers were maintained on a flow-through system delivering a volume of water equivalent to approximately two full water changes per day. Aeration was delivered to each test chamber through two glass pipettes at a rate of approximately 2 to 3 bubbles per second in order to maintain adequate DO levels and provide water circulation. All tests were conducted in an environmental chamber maintained at 23 ± 1ºC under a 16 hour (light):8 hour (dark) illumination cycle. The control sediment tested concurrently consisted of formulated sediment composed of 70 percent washed beach sand, 20 percent Kaolin clay, and 10 percent peat moss.

At test initiation, four *C. tentans* egg cases were added to replicates A & B, and three egg cases were added to replicates C & D. Each egg case contained approximately 400-500 *C. tentans* eggs. The number of cases added was estimated to be sufficient to provide adequate biomass for chemical analysis at test termination with a target recovery of 20 g wet weight per site.

The *C. tentans* life cycle is comprised of several distinct stages including egg, larva, pupa, and free-flying adult stages. At the pupa stage of development, the *C. tentans* leave the sediment and enter the water column. In order to maximize both sediment exposure and tissue recovery, test termination was commenced when the first few larvae reached the pupa stage of development. The goal was to ensure that the majority of the larvae had reached their maximum size, but had not yet transformed into the pupa stage. Due to the fixed feeding and temperature regime, this point in development was reached on or around Day 21 of the test period for all sites. To be consistent in methodology, all sites were ended on Day 21 of the test period.

Temperature, DO, pH, and conductivity were monitored daily in all replicate test chambers. Sub-samples of overlying water were collected from each site every seventh day during the test period for total ammonia analysis. Each test chamber was examined daily to ensure proper aeration and water flow rate. A source of food to each replicate was provided during the test by adding 1 ml of a mixture of ground Tetramin® (4 g per

100 ml Culligan) per egg case per day. During the first four days of the test period, a 3-ml suspension of green algae (*Selenastrum*) was also added daily as a food source for newly hatched larvae.

At test termination, sediment was sorted to extract the surviving larvae. *C. tentans* were gently rinsed with Culligan water to remove debris. Recovered organisms from each replicate then were placed into clean aquaria filled with Culligan water and allowed to depurate overnight. The following day, a second cleaning of the animals was performed to remove any excess debris. All replicates from a single site were then combined into one food-grade Ziploc plastic bag and immediately placed in a freezer at a temperature of approximately -20°C. The larvae were held frozen at Nautilus until testing for all sites was terminated. All samples were shipped to EMAX Engineering on November 13, 2006 for chemical analysis.

Rye Grass Seedling Germination and Growth Test

Rye grass seeds were used to determine plant viability in test soils. Seedling germination and growth tests were conducted in accordance with the ASTM (1998) protocol, “Standard Guide for Conducting Terrestrial Plant Toxicity Tests (E1963-98.” A summary of test conditions is outlined in Table 4.

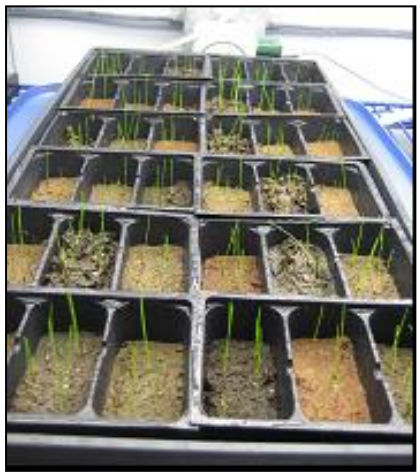
Table 4. Test Conditions and QA/QC Summary for the Rye Grass Seed Germination and Growth Chronic Toxicity Test

Test species	*L. perenne* (rye grass)
Test organism source	Main Street Seed and Supply, Bay City, MI
Test duration	15 days
Nutrients Added	None
Test chambers	120-ml plastic seedling pots
Soil volume	2 cm deep (approx. 100 g per replicate)
Watering Regime	3 times daily with moderately hard Culligan-filtered tap water
Test temperature	26 ± 2°C
Number of seeds/chamber	10
Number of replicates	5
Photoperiod	16 hours light/8 hours dark
Test Protocol	ASTM E 1963-98
Test acceptability criterion for controls	Mean germination $\geq$ 75%

In preparation for testing, all soil samples were sieved through a 2.0-mm mesh screen to remove large debris, and then were thoroughly homogenized prior to distribution into each replicate test chamber. No nutrient amendments were added to the soils. Test chambers consisted of individual plastic potting chambers with drainage holes. Each individual pot measured 9 cm long, 2.5 cm wide, and 6 cm deep and was located in one of two seedling starter trays, each containing 36 (6 rows x 6 columns) test chambers. Seedling trays had a clear plastic dome cover over the top for the duration of the test to maintain adequate soil moisture and at least 50 percent relative humidity. Five replicates were tested for each soil sample. Each replicate was randomized within a block so that replicates were evenly spaced throughout the trays to ensure consistent exposure to light among replicates.

Each randomized test chamber was filled with test or control soil (E.B. Stone brand topsoil) to approximately 1 cm below the edge of the container to avoid overflow into

neighboring test chambers. Samples then were hydrated to approximately 100 percent water holding capacity using Culligan water. Seeds were visually inspected and selected to exclude any that were damaged, and ten seeds then were distributed into each test chamber and covered with a light layer of the reserved test soil. Finally, each test chamber was lightly watered with Culligan water using a spray bottle.



Initial measurements of soil pH and conductivity were performed by mixing a sub-sample of soil with an equal amount of DI water, shaking thoroughly, and allowing water and soil to separate for 30 minutes. The pH and conductivity then were measured in the overlying water. Air temperature, soil temperature, and relative humidity were measure daily throughout the test using a Springfield® PreciseTemp™ meter. Soils were watered three times daily to maintain constant moisture, and test chambers were rotated twice daily to ensure that all portions of each tray received similar amounts of light. Tests were conducted in an environmental chamber maintained at 26 ± 2°C under a 16 hour (light):8 hour (dark) lighting schedule.

The test was terminated on Day 15 by first removing the trays from the environmental chamber and counting the number of seedlings germinated in each test chamber. Seedlings were carefully separated from the soil by immersing them in a water bath and gently wiping away excess soil and seed casings. Shoot and root lengths for each plant were measured separately to the nearest mm from the transition point between root and shoot at the hypocotyl. The shoots and roots were then separated with a razor blade; all shoots for each replicate were combined on one pre-weighed pan, all roots were combined on a separate pan, and placed into an oven at approximately 70°C for 24 hours. Weights were measured using a Mettler AE240 digital balance and were recorded to the nearest 0.01 mg.

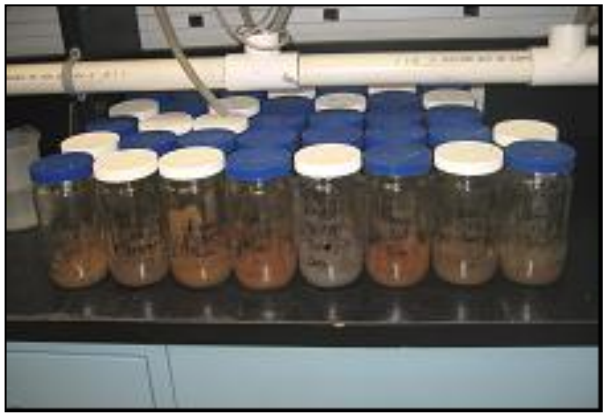
A concurrent reference toxicant test using boron (as boric acid) was also conducted by exposing seeds to sub-samples of control topsoil amended with varying concentrations of boron.

Earthworm Survival, Growth, and Bioaccumulation Test

Earthworm bioassays were conducted in accordance with ASTM (1998), "Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation with the Lumbricid Earthworm *E. fetida* (E1676-97)," and USEPA (1996), "Ecological Effects Test Guidelines, Earthworm Subchronic Toxicity Test (EPA712-C-96-167). A summary of test conditions for the earthworm survival, growth, and bioaccumulation test is contained in Table 5.

Table 5. Test Conditions and QA/QC Summary for the Earthworm Survival, Growth, and Bioaccumulation Test

Test organisms	*E. fetida* (earthworm)
Test organism source	Williams' Worm Farm
Test duration	28 days
Depuration Period	22-24 hours
Feeding	None
Test chambers	1-L glass jars
Soil amount	290 g per replicate
Number of replicates	8
Test temperature	23 ± 1°C
Hydration water	De-ionized water
No. Organism per replicate	10
Photoperiod	Continuous light
Environmental Measurements	Daily temperature; pH, percent moisture, and conductivity on days 0, 14, and 28.
Test Protocol	ASTM E1676-97, and EPA 712-C-96-167
Test acceptability criteria	Mean control survival ≥90%; Test organisms should burrow in test soils; Instantaneous temperature maintained between 20-26°C. Mean test temperature between 23 ± 1°C.



Earthworms were exposed to test soils for 28 days to assess survival, growth, and the potential for bioaccumulation of contaminants from the soil. Test chambers consisted of 1-L glass jars with perforated lids to allow air exchange. The experimental design consisted of eight replicate jars per site arranged in a pre-determined random order. All samples were sieved through a 6.3-mm stainless steel screen prior to testing to remove debris that may interfere with the survival or recovery of test organisms. A sub-sample of sieved test soil (20 g) was set aside for initial moisture fraction determination. Samples were then hydrated to an appropriate moisture level using DI water. Due to the differences in soil composition (texture, structure, and organic content), hydrating soils to a standard level can be problematic. One soil may appear very wet and even have standing water on the surface, while another may appear considerably drier after both being hydrated to the recommended hydration level of 45 percent of its dry weight. To address such differences, an approved alternative protocol method was used where an artificial control soil was hydrated to 45 percent of its dry weight as a standard. All sites then were hydrated to a level approximating the texture and visual appearance of the hydrated artificial soil control.

After hydration of test soils, a 20-g sub-sample was collected for determination of initial soil moisture content, pH, and conductivity. The soils were thoroughly homogenized prior to distribution to each replicate chamber. A soil control was conducted concurrently with the test soils to ensure that organisms were not impacted by stresses other than contamination in the test material. The control consisted of a formulated soil mixture comprised of 70 percent rinsed beach sand, 20 percent Kaolin clay, 10 percent peat moss, and 0.4 percent calcium carbonate ($CaCO_3$) by weight. All ingredients (with the exception of $CaCO_3$) were washed with DI water, dried, and sieved prior to preparing soil. The artificial soil then was hydrated to 45 percent of its dry weight by adding DI water.

Each replicate test chamber received 290 g of control, test, or reference soil. The test chambers were placed in an environmental chamber maintained at 23 ± 1ºC under a continuous light regime. Soils were allowed to settle and equilibrate for 24 hours prior to

the addition of test organisms. Ten earthworms were added to each test chamber after confirmation by two technicians that the correct number of test organisms was segregated and in healthy condition. The worms were not fed during the test period.

Temperature was monitored daily in a surrogate cup filled with water placed directly adjacent to the test chambers. Abnormal conditions or unusual animal behavior, if observed, were also noted at this time. Examples of unusual behavior include failure to bury, erratic or slow movements, and slow response to stimulation.

Earthworm survival was assessed on both day 14 and at the end of the exposure on day 28. A measure of survival at 14 days was accomplished by emptying the contents of four replicate jars (one at a time) into a clean plastic tray and gently sorting with gloved hands to locate the worms. The number of surviving worms was recorded, and all were placed back in the same replicate jar with soil to continue for the remainder of the 28-day test period. A 20 g sub-sample of soil was collected from a composite of the four replicates for each sample and control to measure the soil moisture content, pH, and conductivity. After placing the replicates back into the environmental chamber, all replicates were hydrated with an additional small amount (3-4 ml) of DI water in order to ensure adequate moisture content for the remainder of the test period.

At the 28-day test termination point, each of the 8 replicates were emptied (one at a time) into a clean plastic tray and gently sorted with gloved hands to locate the worms. The number of surviving worms in each replicate and their composite wet weight were recorded. Dead worms were removed and discarded. A 20-g sub-sample of soil was collected from a composite of the eight replicates for each sample and control tested to measure the final soil moisture content, pH, and conductivity. The surviving worms were washed with DI water to remove any soil and placed in a clean 1-L glass jar with moist paper towels to depurate overnight. The next day, worms were removed from the depuration jars, rinsed again with DI water, placed in labeled plastic food-grade Ziploc bags, and immediately placed in a freezer at a temperature of approximately -20°C. Frozen worms were shipped to EMAX via overnight delivery service on November 13, 2006 for chemical analysis of the tissues.

A concurrent 14-day survival reference toxicant test was conducted using 2-Chloroacetamide added to control soil as a QA/QC measure to evaluate the relative sensitivity of the organisms used for this test series relative to those performed previously at Nautilus and values obtained from other studies in the literature.

2.5 Statistical Analyses

Statistical analyses were performed using GraphPad Prism software, Version 4.0. A One-Way Analysis of Variance (ANOVA) or Kruskall-Wallis analysis was performed to determine if significant differences existed among sites for mean survival, growth, and germination endpoints. Multiple comparison procedures using unpaired one-tailed t-tests or Mann-Whitney U tests were used to assess differences between individual sites and the reference site. The method used was based on specific assumptions met by the data. Prior to the analysis, differences in variance were evaluated using Bartlett's Test or F-test. Survival and germination data, expressed as proportions, were arcsine square-root transformed prior to analysis to normalize the distribution of the data and satisfy statistical assumptions for analysis. Growth data were not transformed prior to analysis. For all analyses, $\alpha = 0.05$ was used.

Depending on assumptions met by the data, Linear Regression, Trimmed Spearman-Karber, or Linear Interpolation analysis were used to calculate the median lethal concentration (LC_{50}) values for reference toxicant tests using the Comprehensive Environmental Toxicity Information System (CETIS), Version 1.025b or ToxCalc Comprehensive Toxicity Data Analysis and Database Software, Version 5.0.

3.0 RESULTS

3.1 10-Day *C. tentans* Larval Survival and Growth Test

Survival and growth data (summaries and raw bench sheets) are provided in Appendix A-1. Results from daily water quality measurements are included in Appendix B-1.

Mean survival in the sediment control and reference site (SY1015) was 92 and 80 percent, respectively. Average survival of midge larvae exposed to the test sediments ranged from 80 to 96 percent (Figure 1a, Appendix A-1). The one-way ANOVA indicated no significant difference in survival among sites (Appendix D-1). Evaluation using t-tests further determined that there were no statistically significant reductions in survival between each of the test sites and the reference (Appendix D-4).

Mean AFDW per organism was 1.45 mg and 1.69 mg for the sediment control and reference site, respectively. Mean AFDW per organism among the test sediments ranged from 1.29 mg to 1.67 mg (Figure 1b, Appendix A-1). A Kruskall-Wallis test did not detect an overall significant reduction in growth among all sediments (Appendix D-1). Individual t-tests did, however, detect significant reductions in growth in sediment from Sites SY1002 and SY1005 when comparing data from each site to those for the reference site (Appendix D-4). Reductions in growth identified were slight at only 11 and 15 percent for Sites SY1002 and SY1005, respectively. The least mean growth was actually observed in sediment from Site SY1004; however, greater variability among replicates for this sample lowered the power to detect a statistically significant effect in this sample.

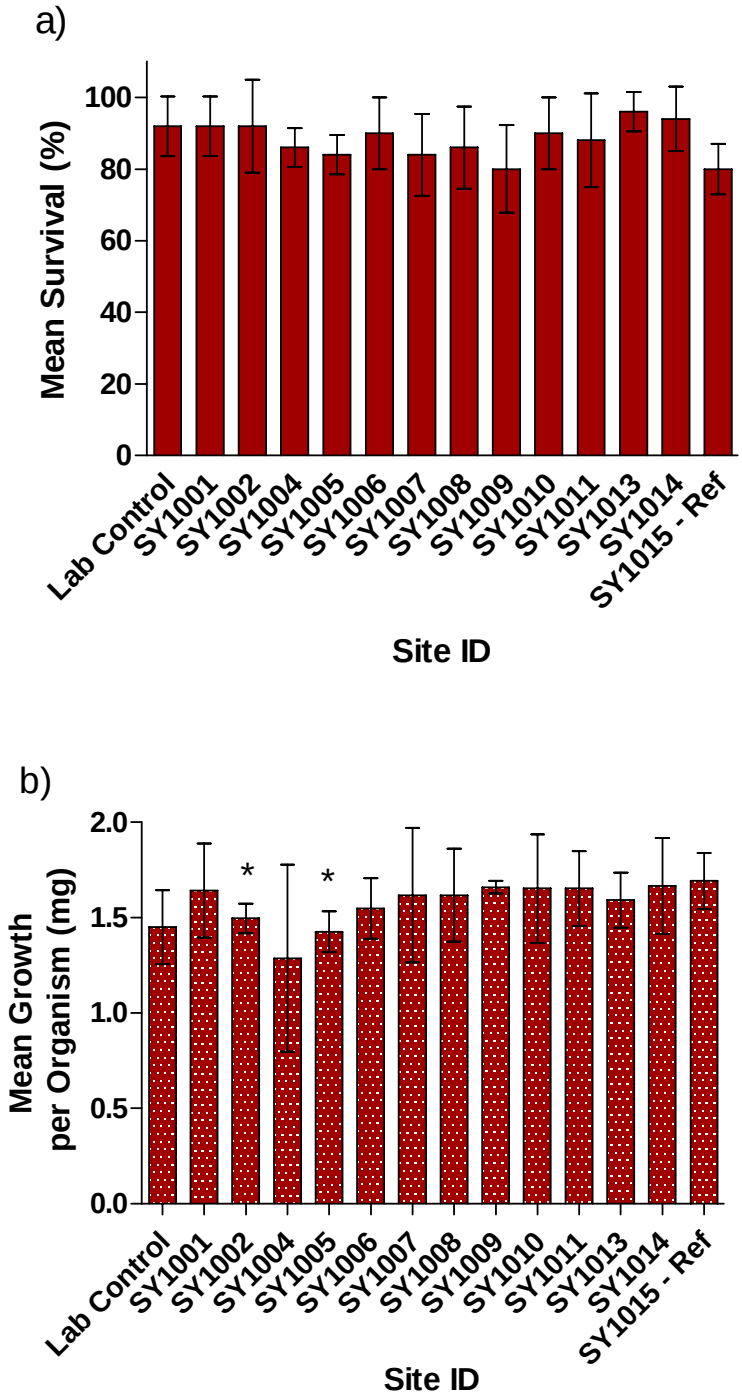


Figure 1. Summary of *C. tentans* survival (a) and growth (b) results for the 10-day toxicity test (n=5, ± SD). *An asterisk indicates a statistically significant reduction relative to the reference site.

3.2 *C. tentans* Bioaccumulation Test

A summary of *C. tentans* tissue recovery at the end of the 21-day bioaccumulation exposure is provided in Appendix A-2. A summary of water quality results is provided in Appendix B-2.

Recovery of *C. tentans* was limited to providing sufficient weight for chemical analysis. Once a sufficient amount of tissue was recovered, collection efforts were terminated, thus recovery of *C. tentans*, is not necessarily related to survival. Upon termination of the tests at Day 21 and cleaning to remove the bulk of the organic debris, all sites yielded greater than the 20 g of tissue. After the depuration period and a final more extensive cleaning of the midge larvae, tissue weights among sites decreased by 17 to 40 percent, with final weights ranging from 16.5 to 23.6 g. This decrease in weight was due both to the evacuation of the gut by the *C. tentans* larvae and the removal of additional excess debris. The midge larvae appeared healthy at the end of the exposure period in all samples tested based on visual color and activity. Normal activity, including burrowing and the creation of mucus tubes with the posterior portion of the body remaining in the tube, was observed throughout the test. Larval *C. tentans* venture out onto the sediment surface only to search for food or when disturbed.

Tissue analysis results were reported to Shaw directly by EMAX under separate cover.

3.3 Rye Grass Seedling Germination and Growth Test

A summary of results for germination and growth of rye grass, as well as raw data are provided in Appendix A-3. Temperature, pH, and conductivity measurements associated with this test are presented in Appendix B-3.

Mean germination of rye grass seeds was 94 and 90 percent in the control and reference site, respectively. Germination of rye grass seeds exposed to the site soils ranged from 80 to 94 percent among all of the sites tested (Figure 2a). A one-way ANOVA detected no statistically significant difference in germination among any of the sites (Appendix D-2).

Mean shoot length was 90 and 87 mm for plants grown in the lab control and the reference soil, respectively. The mean shoot length in soil among all test sites ranged from 64 to 101 mm (Figure 2b). A one-way ANOVA detected a statistically significant

difference in shoot growth among sites (Appendix D-2). Individual t-tests identified significant reductions in shoot growth relative to the reference in soil from Sites SY0002 and SY0007 (Appendix D-4), both with a mean shoot length of 78 mm. This difference, however, is only a 10.3 percent decrease from the reference, and given the amount of variability inherent in the growth of seedlings, this result may not be biologically significant. Shoot growth in Site SY0009 was also significantly reduced (Appendix D-4) with a mean shoot length of 64 mm, a 26.4 percent reduction from that in the reference site.

The mean length of roots was 108 mm and 64 mm in the lab control and reference soil, respectively. It was observed that the clay content in test soils, including the reference site, had an effect on root growth compared to the topsoil control, which was much less compacted. The roots in the lab control were able to grow much longer than in the more densely packed soils of the test sites. Nevertheless, all statistical comparisons were made to the reference site, so the accelerated root growth in the control soil did not affect statistical comparisons. A one-way ANOVA did detect a significant difference in root growth among sites (Appendix D-2). Individual comparison t-tests indicated that four sites (SY0002, SY0004, SY0009, and SY0010) had significantly reduced root growth when compared to the reference site (Appendix D-4). These sites produced mean root lengths of 51 mm, 46 mm, 2.9 mm, and 36 mm, respectively (Figure 2c), and were 20, 28, 96, and 44 percent less than the mean root length in the reference soil. Root growth in Site SY0009 was severely inhibited; the roots barely protruded from the seed and did not penetrate the soil.

Individual differences in shoot and root dry weight are shown in Figures 2d and 2e (provided for comparison purposes). However, as required in the test protocol, data are discussed in terms of total weight only. A one-way ANOVA detected a significant difference in total weight among sites (Appendix D-2). Individual comparison t-tests indicated that four sites (SY0004, SY0006, SY0009, and SY0010) had significantly reduced total weight when compared to the reference (Appendix D-4). The mean total dry weight of these sites was 4.76 mg, 5.36 mg, 3.02 mg, and 4.56 mg, respectively, compared to a mean dry weight of 6.75 mg for the reference site. These weights represented 30, 21, 55, and 32 percent decreases in total dry weight from the reference, respectively.

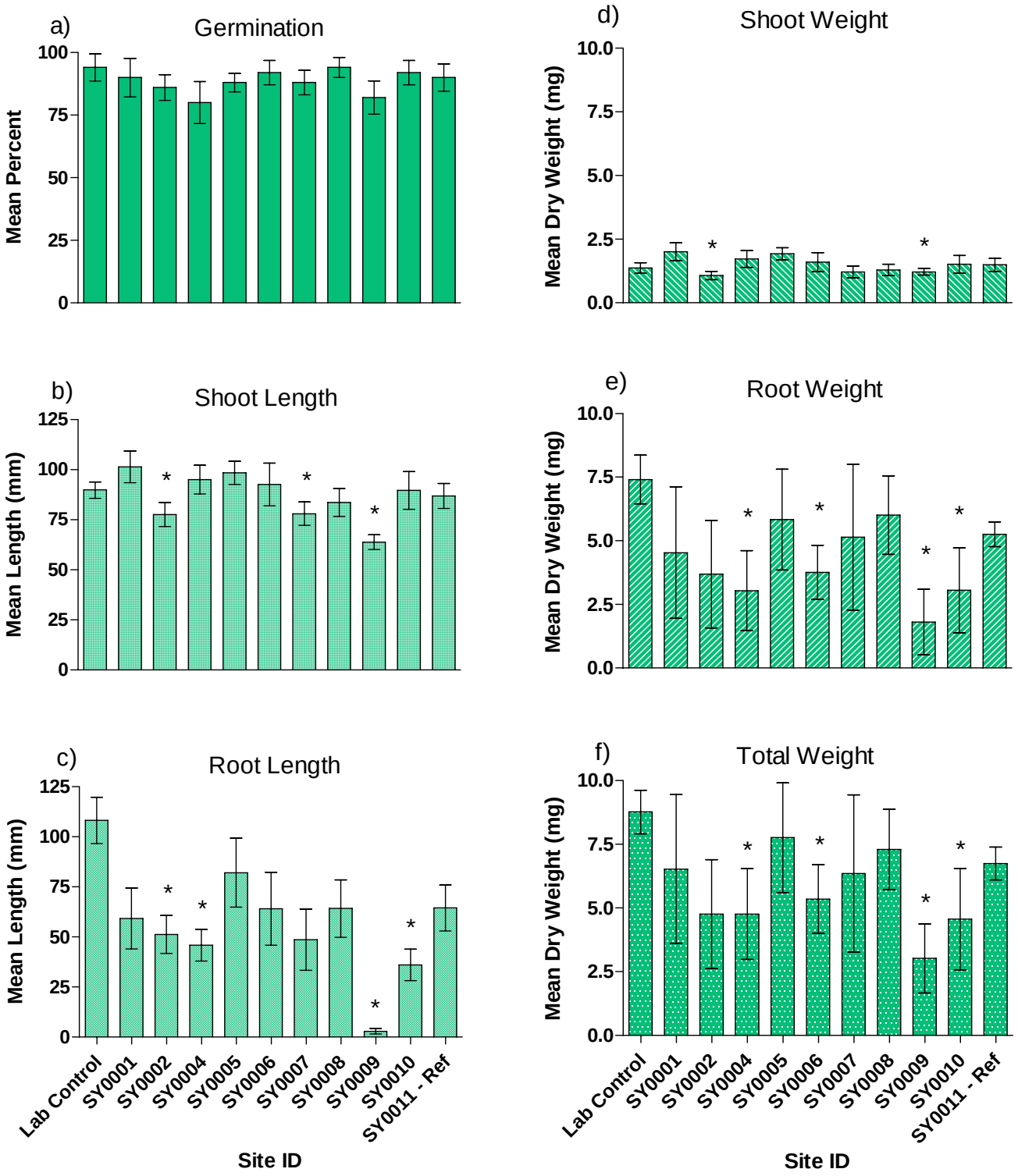


Figure 2. Summary of rye grass results for germination (a), shoot length (b), root length (c), shoot weight, (d), root weight (e), and total weight (f) for the 15-day terrestrial plant toxicity test (n=5, ± SD). *An asterisk indicates a statistically significant reduction relative to the reference site.

3.4 Earthworm Survival, Growth, and Bioaccumulation Test

Survival, growth, and tissue recovery data are presented in Appendix A-4. A summary of environmental quality parameters recorded is provided in Appendix B-4.

Mean survival among all sites and the control at 14 and 28 days ranged from 98 to 100 percent and 93 to 98 percent, respectively (Figure 3a, Appendix A-4). A Kruskall-Wallis test found no significant difference in survival among sites (Appendix D-3). Evaluation using individual comparison t-tests also found no statistically significant reductions in survival among sites when compared to the reference soil (Appendix D-4).

The 28-day exposure period for this project resulted in a mean loss of weight for all sites tested, including the control. This is because earthworms act as a sieve as they continuously move through the soil ingesting and processing available organic content, and weight gain or loss, therefore, is highly dependent upon the organic content of the soil samples tested. For soils with low organic content, weight loss can be used as an endpoint, assuming an appropriate reference soil with similar organic content is available for comparison.

Mean weight loss per organism was 105 mg and 67 mg in the soil control and reference site, respectively. The average weight loss per organism among the test soils ranged from 68 mg to 143 mg (Figure 3b, Appendix A-4). A Kruskall-Wallis test did not detect an overall significant difference in weight loss among the worms across sites (Appendix D-3). In addition, individual comparison t-tests did not detect significant decreases in weight at any individual site when compared to the reference soil (Appendix D-4).

Despite the general decrease in weight of the worms over the 28-day test exposure, the amount of tissue recovered at test termination was adequate for the required chemical analyses. The worms appeared healthy at the end of the exposure period in all samples tested based on visual color and activity. Activity included burrowing ability and reaction to stimuli.

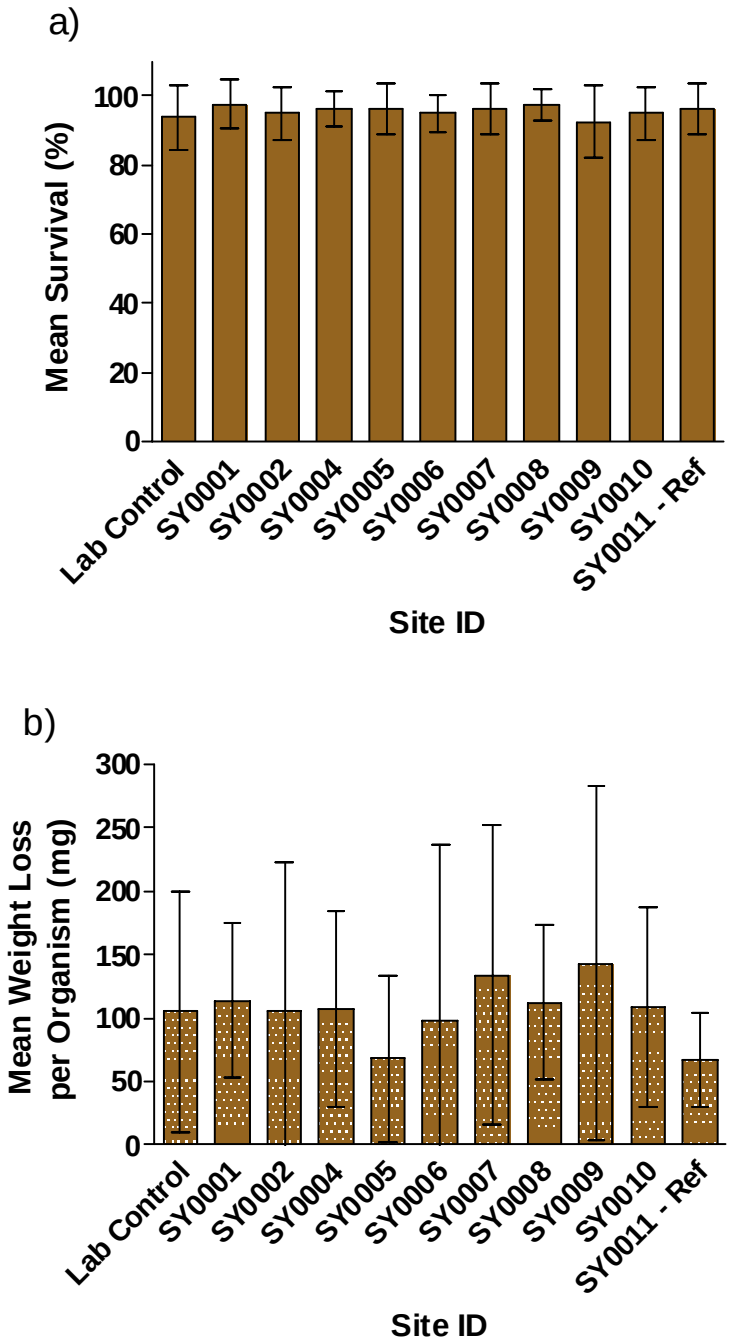


Figure 3. Summary of earthworm survival (a) and weight loss (b) results for the 28-Day toxicity and bioaccumulation test. (n=8, ± SD)

4.0 QA/QC

4.1 10-Day *C. tentans* Larval Survival and Growth Test

Mean survival in the control and reference samples exceeded the recommended USEPA control acceptability criterion of 70 percent. In addition, all water quality measurements recorded during the 10-day exposure were within the range defined as acceptable by the test protocol.

Total ammonia levels in interstitial water ranged from <0.1 to 1.5 mg/L. Total ammonia in overlying water on Day 0 ranged from 0.7 to 15.0 mg/L. Total ammonia in overlying water on Day 10 ranged from <0.1 to 1.3 mg/L. Levels of total ammonia for pore water and overlying water of all test sites were well below those reported to be toxic to *C. tentans*. Schubauer-Berigan et al. (1995) reported 96-hour LC_{50} values of 82 to 370 mg/L total ammonia for *C. tentans* depending on water hardness. USEPA (2000) reported a 96-hour LC_{50} value of approximately 82 mg/L following a water only exposure at a pH of 8.60.

No abnormal conditions or behaviors were observed throughout the duration of the test.

Reference toxicant results for *C. tentans* are provided in Appendix C-1. Mean control survival for the reference toxicant test was 100 percent. The 96-hour copper LC_{50} obtained in our laboratory with *C. tentans* for this test series was 417 μg/L with 95 percent confidence limits of 314 to 526 μg/L copper. This value is within laboratory control chart limits of ± 2 standard deviations from the mean of the last 8 reference toxicant tests performed in this laboratory. Results indicate that the sensitivity of *C. tentans* used for this study was comparable to that of organisms historically tested at Nautilus.

3.2 *C. tentans* Bioaccumulation Test

Water quality and minimum tissue recovery requirements were met for this test.

Total ammonia levels in interstitial water ranged from <0.1 to 1.5 mg/L. Total ammonia in overlying water across all 21 days of the test period ranged from <0.1 to 1.34 mg/L. None of these levels approached those reported to be toxic to *C. tentans*. See previous citations in the 10-day survival and growth results section for *C. tentans*

3.3 Rye Grass Seedling Germination and Growth Test

A deviation for several samples with regard to a holding time goal did occur for this test. The test reported herein was initiated up to 34 days after sample collection for four of ten samples, 6 days greater than the holding time goal of 28 days. The initial rye grass seedling test was initiated within holding time on October 16, 2006. During this first round of testing, however, germination and growth of the rye grass was quite variable, with replicates within the same sample ranging from 0 to 80 percent germination. Despite meeting control acceptability criteria, results for this test series were not deemed acceptable for reporting purposes due to this wide range of variability.

To address the potential cause of variability among replicates, internal trials were performed to evaluate moisture effects on germination success for this species prior to re-initiating the test. Results of these trials suggested that soil moisture consistency relating to both watering frequency and level were primary factors in the germination success rate of the seeds. Of particular note was the variety of moisture holding capacities that the soils provided, and effects that drying between watering might have on the germination process, particularly given the high clay content of some of the soils.

The second round of seedling tests reported herein was initiated on November 9, 2006 using an increased watering frequency schedule, as well as providing continuous enclosure of the seedling beds to decrease the amount of moisture loss to evaporation (during the first test, covers were removed upon emergence, as described in the ASTM protocol). Germination was much greater, and variability much lower during this test series relative to those in the initial round.

In addition, Sites SY0006 and SY0010 had initial pH levels slightly below the specified range of 6.0-7.5. The initial pH of Site SY0006 was 5.49, and SY0010 had a pH of 5.72. Because these values were only slightly below 6.0, and to maintain consistency across all samples (i.e. avoid introducing variability unnecessarily), it was our professional judgment not to adjust pH in any sample prior to testing. In support of this, a regression analysis showed no correlation between pH and toxicity. Initial and final pH values are presented in Appendix B-2. A summary of r^2 and p-values for the regression analysis are available in Appendix Table D-2a.

Reference toxicant results for rye grass are provided in Appendix C-2. Mean percent germination in the control for the reference toxicant test was 96 percent. Germination

was affected only at the highest concentration of boron (as boric acid), 640 mg/kg, and the EC_{50} for the germination endpoint was greater than 640 mg/kg. Growth was significantly affected as low as 40 mg/kg, with visible effects apparent in the 160, 320, and 640 mg/kg concentrations. In all three of these concentrations, not only were length and weight impaired, but pigment was also lacking; in the two highest concentrations, seedlings were completely white. The EC_{50} for total mean length was 229 mg/kg, and 158 mg/kg for total dry weight. We currently lack sufficient data to produce a meaningful control chart of historical averages. However, the observed dose-response indicates that the rye grass was sensitive to the toxicant and test methods were performed appropriately.

3.4 Earthworm Survival, Growth, and Bioaccumulation Test

The earthworm survival, growth, and bioaccumulation tests met all applicable control, water quality, and reference toxicant acceptability criteria.

Reference toxicant results for *E. fetida* are provided in Appendix C-3. Mean control survival for the reference toxicant test was 97 percent. The 96-hour LC_{50} for 2-Chloroacetimide obtained in our laboratory for this test series was 16.7 mg/kg. This value is within laboratory control chart limits of ± 2 standard deviations from the mean of the last 8 reference toxicant tests performed in this laboratory. Results indicate that *E. fetida* used for this study were healthy and sensitivity was comparable to that of organisms historically tested.

5.0 REFERENCES

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APPENDIX B

HABITAT ASSESSMENT FIELD DATA SHEETS

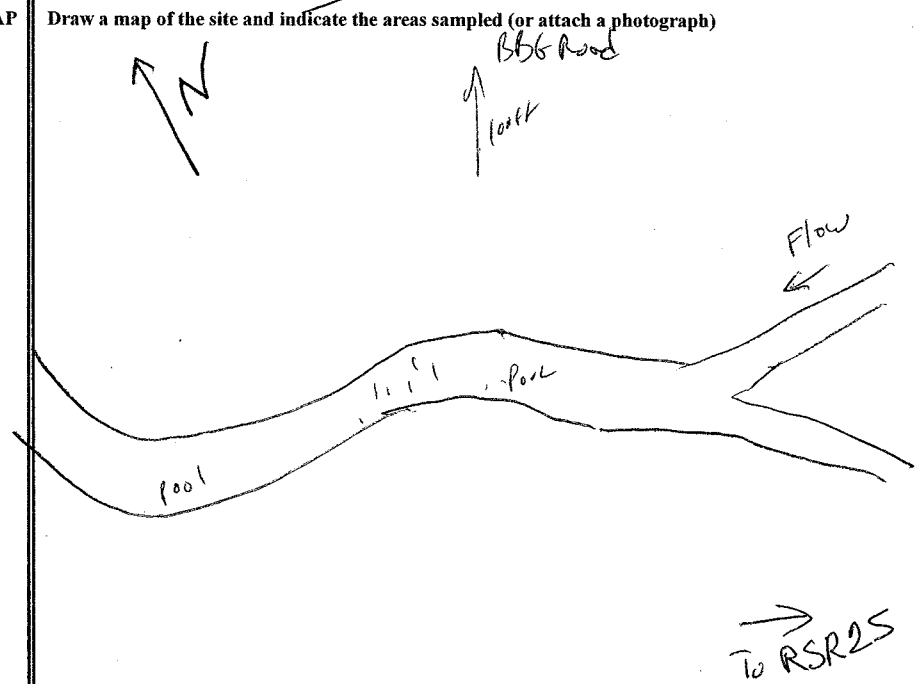
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION BERA-SD05	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Prann		
FORM COMPLETED BY	DATE 10/8/06 TIME 1600 AM (PM)	REASON FOR SURVEY

WEATHER CONDITIONS	**Now**	**Past 24 hours**	**Has there been a heavy rain in the last 7 days?** ☐ Yes ☒ No
	☐ storm (heavy rain)	☐	**Air Temperature** ~70 °C
	☐ rain (steady rain)	☐	**Other**_____
	☐ showers (intermittent)	☐	
	___%☐ %cloud cover	☐ ___%	
	☒ clear/sunny	☒	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION	**Stream Subsystem** ☒ Perennial ☐ Intermittent ☐ Tidal **Stream Origin** ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☐ Mixture of origins ☐ Swamp and bog ☐ Other_____	**Stream Type** ☒ Coldwater ☐ Warmwater **Catchment Area**_____km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ☒ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ☒ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Mixed Deciduous (Maple, Sycamore, Tulip, Beech)
INSTREAM FEATURES	**Estimated Reach Length** 30 m **Estimated Stream Width** 2 m **Sampling Reach Area** 60 m² **Area in km² (m²x1000)** _____ km² **Estimated Stream Depth** 0.2-0.6 m **Surface Velocity (at thalweg)** 0.2 m/sec **Canopy Cover** ☒ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** 0.5 m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle 15 % ❑ Run 25 % ❑ Pool 60 % **Channelized** ❑ Yes ☒ No **Dam Present** ❑ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** _____ m² **Density of LWD** _____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** None **Portion of the reach with aquatic vegetation** _____ %
WATER QUALITY	**Temperature** _____ °C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other _____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other _____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other _____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ☒ Sand ❑ Relict shells ❑ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		20	Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	10			
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 (6)	5 4 3	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)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble 80 % ☐ Snags_____% ☐ Vegetated Banks_____% ☐ Sand 20 % ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☑ kick-net ☑ Other Clam by hand **How were the samples collected?** ☑ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble 6 ☐ Snags_____ ☐ Vegetated Banks_____ ☐ Sand 2 ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

Frogs present

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PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION BERA-5004
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT N 33°42' 18.9" LONG N 85°46' 18.1"	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS Dan Dch, Rich Prann	
FORM COMPLETED BY Dan Dch	DATE 10/8/06 TIME 14:15 (AM) PM — REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
❑	storm (heavy rain)	❑
❑	rain (steady rain)	❑
❑	showers (intermittent)	❑
15 %❑	%cloud cover	❑ ____%
☒	clear/sunny	❑

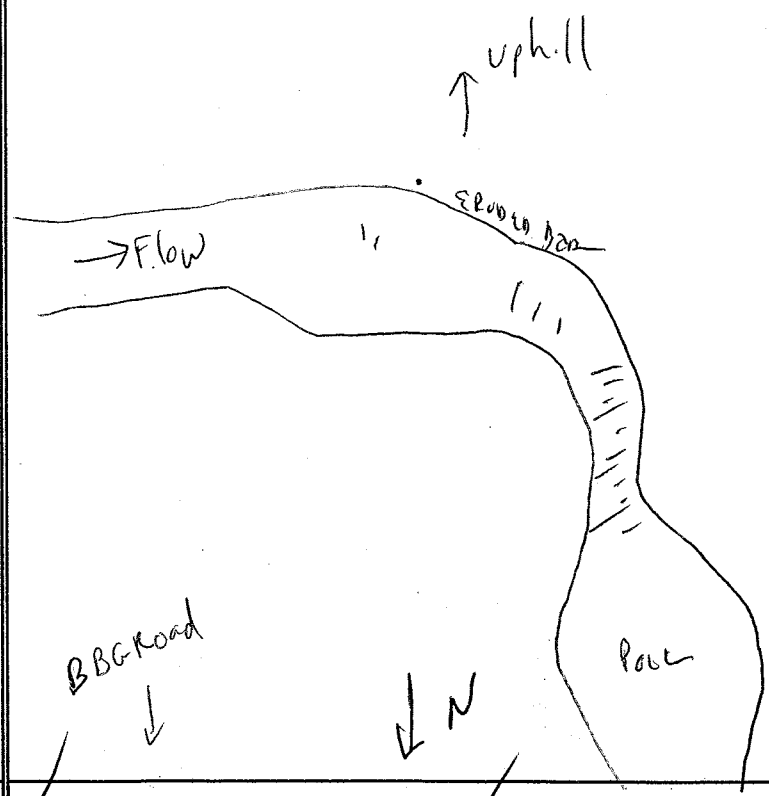
Has there been a heavy rain in the last 7 days? ❑ Yes ☒ No

Air Temperature ~70 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ❑ Intermittent ❑ Tidal

Stream Type
☒ Coldwater ❑ Warmwater

Stream Origin
❑ Glacial
❑ Non-glacial montane
❑ Swamp and bog
❑ Spring-fed
❑ Mixture of origins
❑ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Oak Maple
INSTREAM FEATURES	**Estimated Reach Length** 30 m **Estimated Stream Width** 1.5 m **Sampling Reach Area** 45 m² **Area in km² (m²x1000)** ~~0.2-0.4~~ km² **Estimated Stream Depth** 0.2-0.5 m **Surface Velocity (at thalweg)** _____ m/sec **Canopy Cover** ❑ Partly open ☒ Partly shaded ❑ Shaded **High Water Mark** _____ m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle _____ % ❑ Run _____ % ❑ Pool _____ % **Channelized** ❑ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** _____ m² **Density of LWD** _____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** None **Portion of the reach with aquatic vegetation** _____ %
WATER QUALITY	**Temperature** _____ °C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other _____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other _____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other _____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ☒ Sand ❑ Relict shells ❑ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble 70 % ☐ Snags 10 % ☐ Vegetated Banks_____% ☐ Sand 20 % ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☒ kick-net ☐ Other Clam by Hand **How were the samples collected?** ☒ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble 5 ☐ Snags 1 ☐ Vegetated Banks_____ ☐ Sand 2 ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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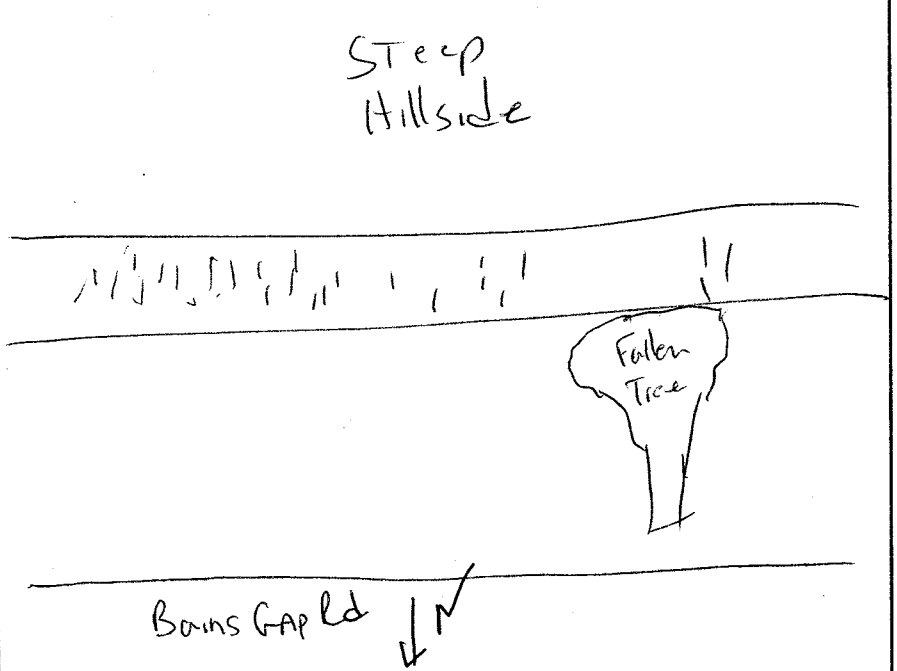
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION BERA-SED-REF	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT N 33°42'58.0" LONG W85°43'32.8"	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Doh, Rich Prann		
FORM COMPLETED BY Dan Doh	DATE 10/8/06 TIME 8:35 (AM) PM	REASON FOR SURVEY

WEATHER CONDITIONS	**Now**	**Past 24 hours**	**Has there been a heavy rain in the last 7 days?** ❑ Yes ❑ No
	❑ storm (heavy rain)	❑	**Air Temperature** ~68 °C
	❑ rain (steady rain)	❑	
	❑ showers (intermittent)	❑	**Other**_____
	____%❑ %cloud cover	❑ ____%	
	☒ clear/sunny	❑	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ❑ Intermittent ❑ Tidal	**Stream Type** ❑ Coldwater ❑ Warmwater
	Stream Origin ❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ❑ Mixture of origins ❑ Other_____	**Catchment Area**_____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Mixed Deciduous (Beech, Tulip, Sycamore)
INSTREAM FEATURES	**Estimated Reach Length** 40 m **Estimated Stream Width** 3 m **Sampling Reach Area** 120 m² **Area in km² (m²x1000)** _____ km² **Estimated Stream Depth** 0.2 m **Surface Velocity (at thalweg)** 0.5 m/sec **Canopy Cover** ☒ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** 0.7 m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle 90 % ❑ Run _____ % ❑ Pool _____ % **Channelized** ❑ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** _____ m² **Density of LWD** _____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ☒ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** Rooted to Rocks very little **Portion of the reach with aquatic vegetation** _____ %
WATER QUALITY	**Temperature** _____ °C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other _____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other _____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other _____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble 85 % ☐ Snags 5 % ☐ Vegetated Banks_____% ☐ Sand 10 % ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☒ kick-net ☒ Other Clam by hand **How were the samples collected?** ☒ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble 6 ☐ Snags_____ ☐ Vegetated Banks_____ ☐ Sand 10 1 ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	(2)	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	(1)	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	(1)	(2)	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	(2)	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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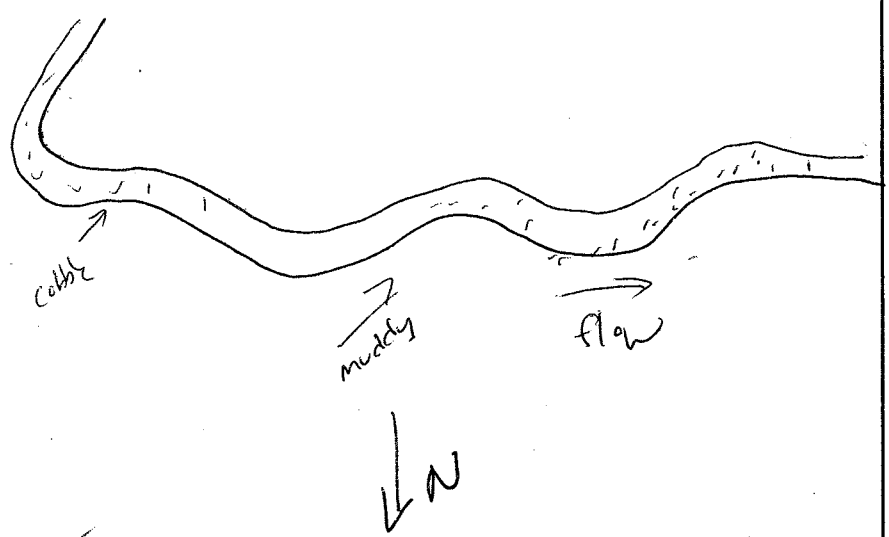
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION HR-79Q - SD05	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours** ❑ storm (heavy rain) ❑ ❑ rain (steady rain) ❑ ❑ showers (intermittent) ❑ ____%❑ %cloud cover ❑____% ☒ clear/sunny ❑ **Has there been a heavy rain in the last 7 days?** ❑ Yes ☒ No **Air Temperature** ~75 °C **Other**_____
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)** 
STREAM CHARACTERIZATION	**Stream Subsystem** ☒ Perennial ❑ Intermittent ❑ Tidal **Stream Origin** ❑ Glacial ❑ Spring-fed ❑ Non-glacial montane ❑ Mixture of origins ❑ Swamp and bog ❑ Other_____ **Stream Type** ❑ Coldwater ❑ Warmwater **Catchment Area**_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Deciduous (maple
INSTREAM FEATURES	**Estimated Reach Length** 50 m **Estimated Stream Width** 1 m **Sampling Reach Area** 50 m² **Area in km² (m²x1000)** _____ km² **Estimated Stream Depth** 0.2 m **Surface Velocity (at thalweg)** 0.2 m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ☒ Shaded mostly **High Water Mark** 0.5 m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle 55 % ❑ Run 45 % ❑ Pool 10 % **Channelized** ❑ Yes ☒ No **Dam Present** ❑ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** _____ m² 3m **Density of LWD** _____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☒ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** Lungwort **Portion of the reach with aquatic vegetation** <5 %
WATER QUALITY	**Temperature** _____ ⁰C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other _____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other _____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other _____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ☒ Sand ❑ Relict shells ❑ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	10	Muck-Mud	black, very fine organic (FPOM)	60
Gravel	2-64 mm (0.1"-2.5")	10			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	30			
Clay	< 0.004 mm (slick)	30			

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble_____% ☐ Snags_____% ☐ Vegetated Banks_____% ☐ Sand_____% ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☐ kick-net ☐ Other _____ **How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble_____ ☐ Snags_____ ☐ Vegetated Banks_____ ☐ Sand_____ ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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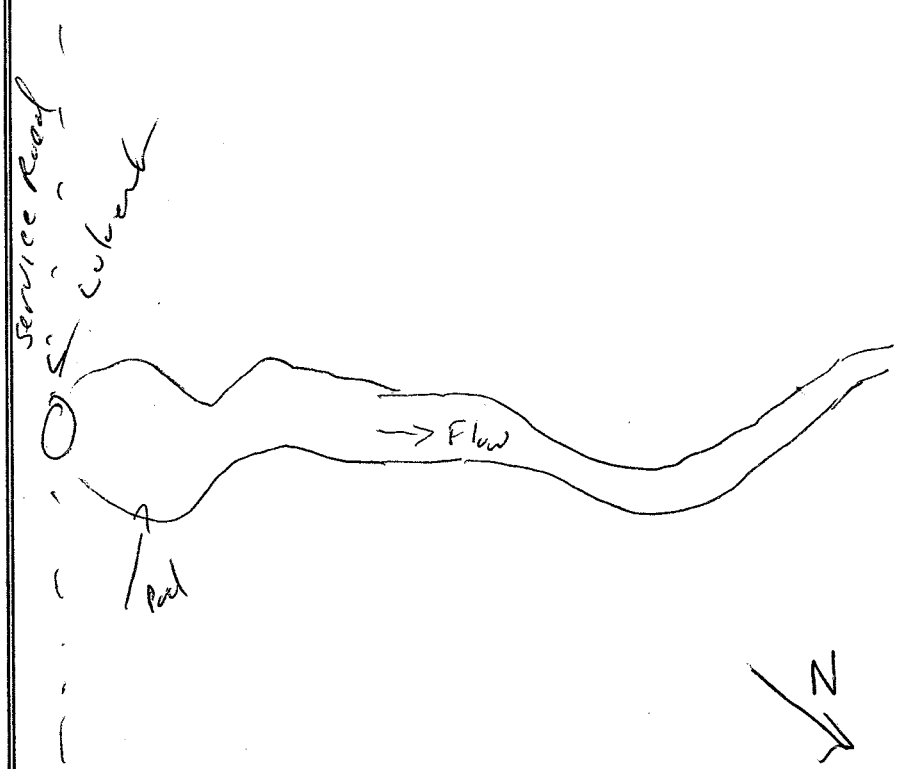
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION BBGL-BERA-SD03	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Krom		
FORM COMPLETED BY Dan Duh	DATE 10/7/06 TIME 1500 AM (PM)	REASON FOR SURVEY

WEATHER CONDITIONS	**Now**	**Past 24 hours**	**Has there been a heavy rain in the last 7 days?** ☐ Yes ☑ No
	☐ storm (heavy rain)	☐	**Air Temperature** 70s °C
	☐ rain (steady rain)	☐	**Other** _____
	☐ showers (intermittent)	☐	
	____% ☐ %cloud cover	☐ ____%	
	☑ clear/sunny	☐	

SITE LOCATION/MAP **Draw a map of the site and indicate the areas sampled (or attach a photograph)**



STREAM CHARACTERIZATION	**Stream Subsystem** ☑ Perennial ☐ Intermittent ☐ Tidal	**Stream Type** ☑ Coldwater ☐ Warmwater
	Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☐ Mixture of origins ☐ Other_____	**Catchment Area** _____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ~~❑ Trees~~ ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Mixed Dec + Pine (Sycamore, Hickory Tulip)
INSTREAM FEATURES	**Estimated Reach Length** 20 m **Estimated Stream Width** 1 m **Sampling Reach Area** 20 m² **Area in km² (m²x1000)** 0.0 km² **Estimated Stream Depth** 0.1-0.5 m **Surface Velocity (at thalweg)** _____ m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** _____ m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle _____ % ❑ Run _____ % ❑ Pool _____ % **Channelized** ❑ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** _____ m² MINIMAL **Density of LWD** _____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** None **Portion of the reach with aquatic vegetation** _____ %
WATER QUALITY	**Temperature** _____ °C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other _____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other _____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other _____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ☒ Sand (some) ❑ Relict shells ❑ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	90 Leaf litter
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	40			
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	1			
Clay	< 0.004 mm (slick)	10			

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 (7) 6	5 4 3	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)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble 60 % ☐ Snags_____% ☐ Vegetated Banks 20 % ☐ Sand 20 % ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☑ kick-net ☐ Other CPOM by hand **How were the samples collected?** ☑ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble 4 ☐ Snags 2 ☐ Vegetated Banks 4 ☐ Sand_____ ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION HR79Q - SD03	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Pramp		
FORM COMPLETED BY Dan Duh	DATE 10/7/06 TIME ~~13:40~~ AM (PM)	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
❑	storm (heavy rain)	❑
❑	rain (steady rain)	❑
❑	showers (intermittent)	❑
____%❑	%cloud cover	❑ ____%
❑	clear/sunny	❑

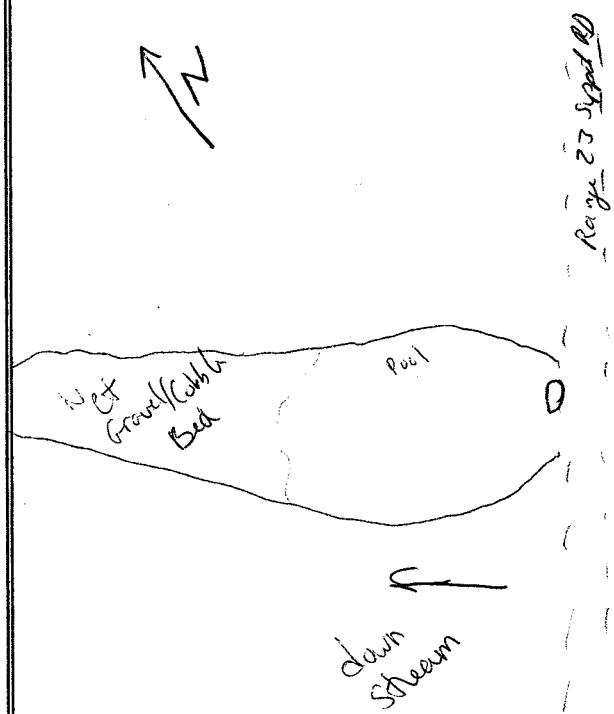
Has there been a heavy rain in the last 7 days? ❑ Yes ❑ No

Air Temperature_____ ^{0} C

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☒ Intermittent ❑ Tidal
Pool flowing

Stream Type
☒ Coldwater ❑ Warmwater

Stream Origin
❑ Glacial ❑ Spring-fed
❑ Non-glacial montane ❑ Mixture of origins
❑ Swamp and bog ❑ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☑ Forest ☐ Commercial ☑ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other _____ ☐ Residential **Local Watershed NPS Pollution** ☑ No evidence ☐ Some potential sources ☐ Obvious sources Road - dirt **Local Watershed Erosion** ☐ None ☑ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** Mixed Deciduous (Hickory, Oak, Sycamore)
INSTREAM FEATURES	**Estimated Reach Length** 8 m **Estimated Stream Width** 3 m **Sampling Reach Area** 24 m² **Area in km² (m²x1000)** ~~0.3-0.8~~ km² **Estimated Stream Depth** 0.3-0.8 m **Surface Velocity (at thalweg)** 0 m/sec **Canopy Cover** Mostly ☐ Partly open ☐ Partly shaded ☑ Shaded **High Water Mark** 0.5 m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle ____ % ☐ Run ____ % ☐ Pool 100 % **Channelized** ☐ Yes ☑ No **Dam Present** ☑ Yes ☐ No Culvert above
LARGE WOODY DEBRIS	**LWD** ____ m² None **Density of LWD** ____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** None **Portion of the reach with aquatic vegetation** ____ %
WATER QUALITY	**Temperature** ____ °C **Specific Conductance** ____ **Dissolved Oxygen** ____ **pH** ____ **Turbidity** ____ **WQ Instrument Used** ____ **Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other ____ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other ____
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand Some ☐ Relict shells ☐ Other ____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	50	Muck-Mud	black, very fine organic (FPOM)	15
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	10			
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 (7) 6	5 4 3	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)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble 70 % ☐ Snags 10 % ☐ Vegetated Banks_____% ☐ Sand 20 % ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☒ kick-net ☐ Other CPOM by hand **How were the samples collected?** ☒ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☒ Cobble 4 ☒ Snags 2 ☐ Vegetated Banks_____ ☒ Sand 2 ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION HR-79Q-SD01	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Prann		
FORM COMPLETED BY Dan Duh	DATE 10/7/06 TIME 1025 (AM) PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
❑	storm (heavy rain)	❑
❑	rain (steady rain)	❑
❑	showers (intermittent)	❑
____%❑	%cloud cover	❑____%
☒	clear/sunny	❑

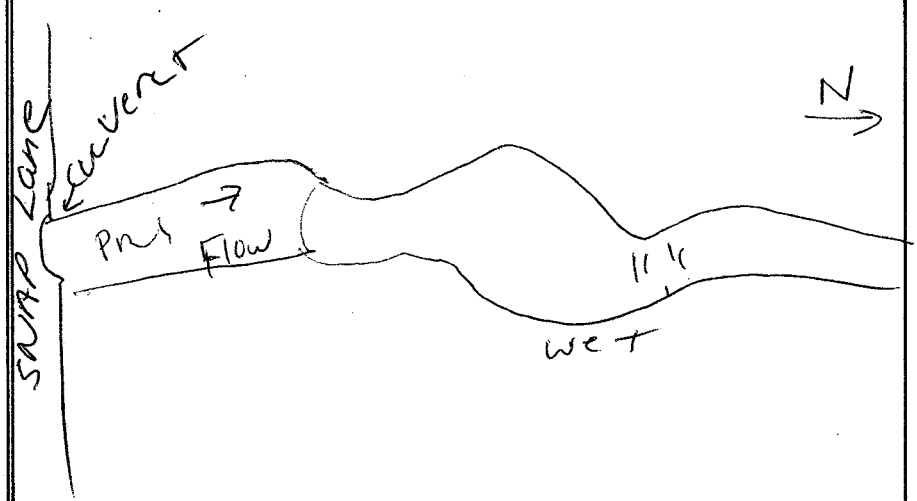
Has there been a heavy rain in the last 7 days? ❑ Yes ☒ No

Air Temperature ~70s °C

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ❑ Intermittent ❑ Tidal

Stream Type
☒ Coldwater ❑ Warmwater

Stream Origin
❑ Glacial
❑ Non-glacial montane
❑ Swamp and bog
❑ Spring-fed
❑ Mixture of origins
❑ Other_____

Catchment Area_____km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous Little grass **dominant species present** OAK, mixed deciduous
INSTREAM FEATURES	**Estimated Reach Length** 30 m **Estimated Stream Width** 1.5 m **Sampling Reach Area** 45 m^2 **Area in km^2 (m^2x1000)** 0. km^2 **Estimated Stream Depth** 0.5 m **Surface Velocity (at thalweg)** 0-0.2 m/sec **Canopy Cover** ❑ Partly open ☒ Partly shaded ❑ Shaded **High Water Mark** 0.5 m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle 20 % ❑ Run 30 % ❑ Pool 50 % **Channelized** ❑ Yes ☒ No **Dam Present** ❑ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** _____ m^2 little **Density of LWD** _____ m^2/km^2 **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** None **Portion of the reach with aquatic vegetation** _____%
WATER QUALITY	**Temperature** _____ ^{0} C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other _____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other _____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other _____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** None ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	30			
Cobble	64-256 mm (2.5"-10")	35	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	5	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble_____% ☐ Snags_____% ☐ Vegetated Banks_____% ☐ Sand_____% ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☒ kick-net ☐ Other CPOM by hand **How were the samples collected?** ☒ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble_____ ☐ Snags_____ ☐ Vegetated Banks 2 ☐ Sand_____ ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	(0)	1	2	3	4	Slimes	(0)	1	2	3	4
Filamentous Algae	(0)	1	2	3	4	Macroinvertebrates	0	1	2	(3)	4
Macrophytes	0	(1)	2	3	4	Fish	0	1	2	(3)	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	(2)	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

Salamanders present

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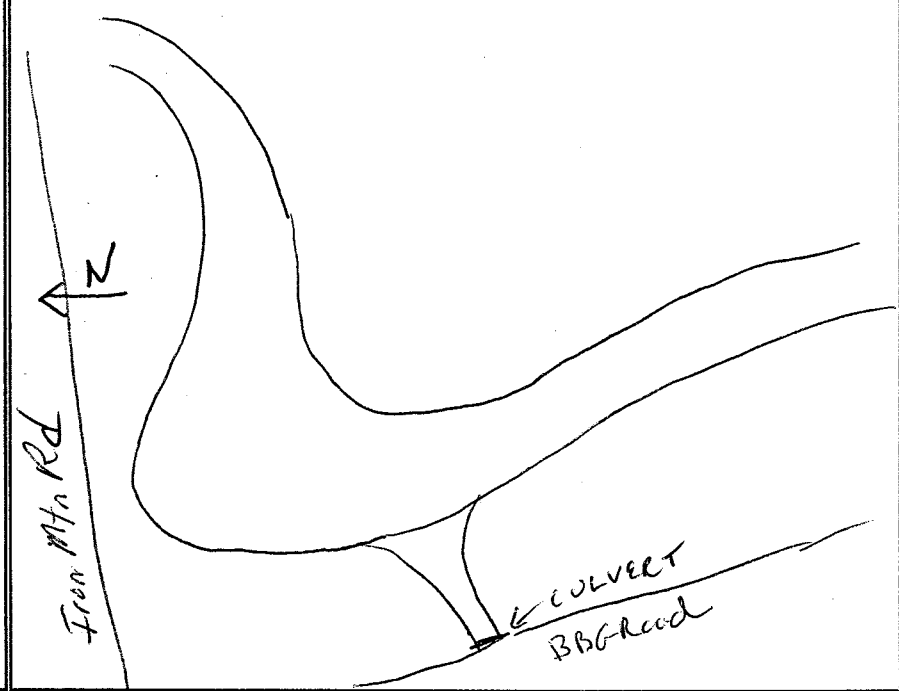
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION HR83-SD01	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Prann		
FORM COMPLETED BY Dan Duh	DATE 10/7/06 TIME 0905 (AM) PM	REASON FOR SURVEY

WEATHER CONDITIONS	**Now**	**Past 24 hours**	**Has there been a heavy rain in the last 7 days?** ❑ Yes ❑ No
	❑ storm (heavy rain)	❑	**Air Temperature** ~65 °C
	❑ rain (steady rain)	❑	
	❑ showers (intermittent)	❑	**Other**_____
	____%❑ %cloud cover	❑ ____%	
	☒ clear/sunny	❑	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☒ Intermittent ❑ Tidal
Pool Flow

Stream Type
☒ Coldwater ❑ Warmwater

Stream Origin
❑ Glacial ❑ Spring-fed
❑ Non-glacial montane ☒ Mixture of origins
❑ Swamp and bog ❑ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☒ Other Road ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☒ Some potential sources ☐ Obvious sources Roadbed **Local Watershed Erosion** ☐ None ☒ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** Pine, oak,
INSTREAM FEATURES	**Estimated Reach Length** 20 m **Estimated Stream Width** 3 m **Sampling Reach Area** 60 m^2 **Area in km^2 (m^2x1000)** _____ km^2 **Estimated Stream Depth** _____ m **Surface Velocity (at thalweg)** 0 m/sec **Canopy Cover** ☐ Partly open ☒ Partly shaded ☐ Shaded **High Water Mark** 0.5 m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle _____ % ☐ Run _____ % ☐ Pool _____ % **Channelized** ☐ Yes ☐ No **Dam Present** ☐ Yes ☐ No
LARGE WOODY DEBRIS	**LWD** _____ m^2 MINIMAL **Density of LWD** _____ m^2/km^2 **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** None **Portion of the reach with aquatic vegetation** _____ %
WATER QUALITY	**Temperature** _____ ^{0}C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other _____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other _____ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ **Oils** ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☐ Other Sand **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	10
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	80	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	10			
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble_____% ☐ Snags_____% ☐ Vegetated Banks_____% ☐ Sand_____% ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☒ kick-net ☐ Other Clam by hand **How were the samples collected?** ☒ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble 4 ☐ Snags_____ ☐ Vegetated Banks_____ ☐ Sand 2 ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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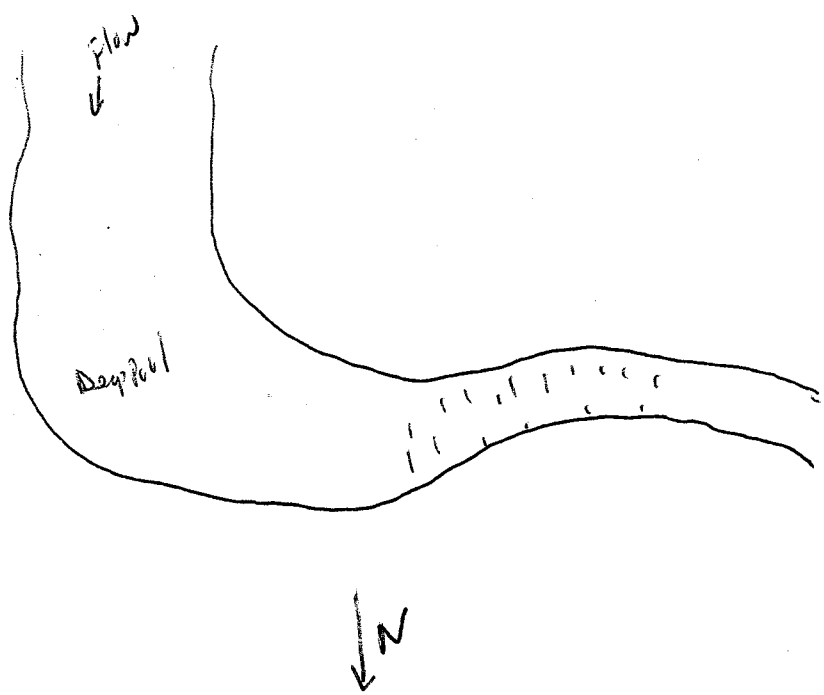
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Ingram Creek	LOCATION BBGR-BERA-SED01	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Prann		
FORM COMPLETED BY Dan Duh	DATE 10/7/06 TIME 750 (AM) PM	REASON FOR SURVEY

WEATHER CONDITIONS	**Now**	**Past 24 hours**	**Has there been a heavy rain in the last 7 days?** ☐ Yes ☒ No
	☐ storm (heavy rain)	☐	**Air Temperature** 60 °C
	☐ rain (steady rain)	☐	
	☐ showers (intermittent)	☐	**Other**_____
	____%☐ %cloud cover	☐ ____%	
	☒ clear/sunny	☐	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial ☐ Spring-fed
☐ Non-glacial montane ☒ Mixture of origins
☐ Swamp and bog ☐ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Maple
INSTREAM FEATURES	**Estimated Reach Length** 30 m **Estimated Stream Width** 3 m **Sampling Reach Area** 90 m^2 **Area in km^2 (m^2x1000)** ~~0.2-0.6~~ km^2 **Estimated Stream Depth** 0.2-0.6 m **Surface Velocity** 0.1-0.3 m/sec **(at thalweg)** **Canopy Cover** ❑ Partly open ❑ Partly shaded ☒ Shaded MOSTLY **High Water Mark** 0.5 m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle 40 % ❑ Run 20 % ❑ Pool 40 % **Channelized** ❑ Yes ☒ No **Dam Present** ❑ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** _____ m^2 MINIMAL **Density of LWD** _____ m^2/km^2 **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** NONE **Portion of the reach with aquatic vegetation** _____ %
WATER QUALITY	**Temperature** _____ ^{0}C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other _____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other _____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other _____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ☒ Sand Some ❑ Relict shells ❑ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	25
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	60	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	25			
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble 75 % ☐ Snags_____% ☐ Vegetated Banks_____% ☐ Sand 25 % ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☑ kick-net ☐ Other com hybrid **How were the samples collected?** ☑ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble 6 ☐ Snags 2 ☐ Vegetated Banks_____ ☐ Sand 4 ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME S. Br. of Caine Cr.	LOCATION FTA-163-SD02	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT N33° 42' 10.1" LONG W85° 46' 46.8"	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Prann		
FORM COMPLETED BY Dan Duh	DATE 10/06/06 TIME 1515 AM (PM)	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____%☐	%cloud cover	☐ ____%
☒	clear/sunny	☐

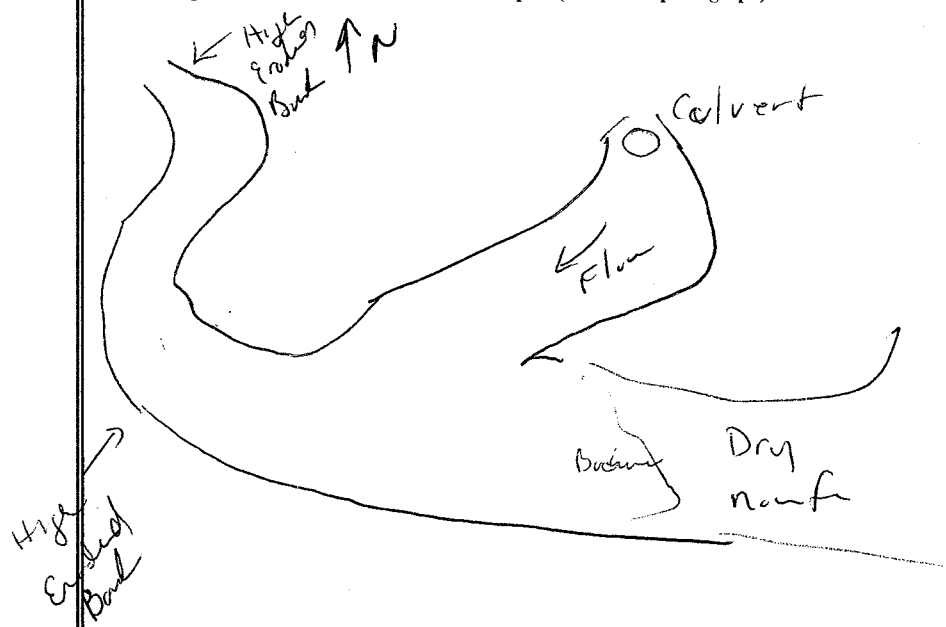
Has there been a heavy rain in the last 7 days? ☐ Yes ☐ No

Air Temperature ~76 °C

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other_____

Catchment Area_____km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ☒ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ☒ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Oak, Maple, Tulip
INSTREAM FEATURES	**Estimated Reach Length** 30 m **Estimated Stream Width** 4 m **Sampling Reach Area** 120 m² **Area in km² (m²x1000)** ~~0.2-0.6~~ km² **Estimated Stream Depth** 0.2-0.6 m **Surface Velocity (at thalweg)** 0.1 m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ☒ Shaded Mostly **High Water Mark** 3 m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle ____ % ❑ Run 50 % ❑ Pool 50 % **Channelized** ❑ Yes ☒ No **Dam Present** ☒ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** _____ m² MINIMAL **Density of LWD** _____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** NONE **Portion of the reach with aquatic vegetation** _____ %
WATER QUALITY	**Temperature** _____ ⁰C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other _____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other _____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other _____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ☒ Sand ❑ Relict shells ❑ Other _____ near creekbank **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	0
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	60	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	20			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble_____% ☐ Snags_____% ☐ Vegetated Banks_____% ☐ Sand_____% ☐ Submerged Macrophytes_____% ☐ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☐ kick-net ☐ Other _____ **How were the samples collected?** ☐ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble_____ ☐ Snags_____ ☐ Vegetated Banks_____ ☐ Sand_____ ☐ Submerged Macrophytes_____ ☐ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Trib to S. Br. of Cane Cr	LOCATION BERA - S02	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Prann		
FORM COMPLETED BY Dan Duh	DATE 10/06/06 TIME 13:15 AM (PM)	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
85 % ☒	%cloud cover	☐ ____%
☐	clear/sunny	☐

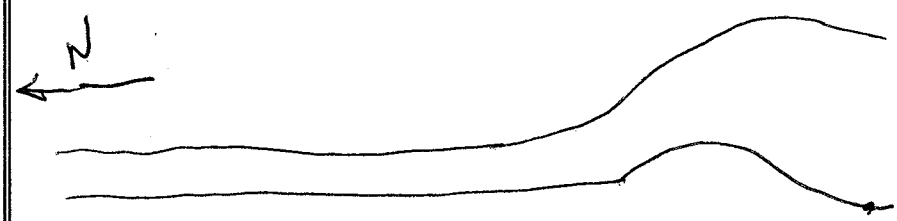
Has there been a heavy rain in the last 7 days? ☐ Yes ☐ No upper 6-7 days ago

Air Temperature 60s °C

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☒ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☒ Spring-fed
☐ Mixture of origins
☐ Other_____

Catchment Area_____km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other _____ ☐ Residential **Local Watershed NPS Pollution** ☒ No evidence ☐ Some potential sources ☐ Obvious sources **Local Watershed Erosion** ☒ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** Pine, Maple
INSTREAM FEATURES	**Estimated Reach Length** 30 m **Estimated Stream Width** ≤1 m **Sampling Reach Area** ≤30 m² **Area in km² (m²x1000)** <0 km² **Estimated Stream Depth** <0.2 m **Surface Velocity (at thalweg)** 0.3 m/sec **Canopy Cover** ☐ Partly open ☐ Partly shaded ☒ Shaded mostly **High Water Mark** 0.2 m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle 50 % ☐ Run 25 % ☐ Pool 25 % **Channelized** ☐ Yes ☒ No **Dam Present** ☐ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** Ø m² **Density of LWD** _____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** minimal periphyton **Portion of the reach with aquatic vegetation** _____ %
WATER QUALITY	**Temperature** _____ °C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other _____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other _____ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ **Oils** ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☐ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	10
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	25	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	50			
Sand	0.06-2mm (gritty)	25	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble 60 % ☐ Snags 20 % ☐ Vegetated Banks____% ☐ Sand 20 % ☐ Submerged Macrophytes 2 % ☐ Other ( )____%
SAMPLE COLLECTION	**Gear used** ☒ D-frame ☐ kick-net ☐ Other CPOM by hand **How were the samples collected?** ☒ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble 6 ☐ Snags 2 ☐ Vegetated Banks____ ☐ Sand 2 ☐ Submerged Macrophytes____ ☐ Other ( )____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0 1 (2) 3 4	Slimes	(0) 1 2 3 4
Filamentous Algae	(0) 1 2 3 4	Macroinvertebrates	~~(0)~~ (1) 2 3 4
Macrophytes	(0) 1 2 3 4	Fish	(0) 1 2 3 4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	(0) 1 2 3 4	Anisoptera	(0) 1 2 3 4	Chironomidae	(0) 1 2 3 4
Hydrozoa	(0) 1 2 3 4	Zygoptera	(0) 1 2 3 4	Ephemeroptera	(0) 1 2 3 4
Platyhelminthes	(0) 1 2 3 4	Hemiptera	(0) 1 2 3 4	Trichoptera	(0) 1 2 3 4
Turbellaria	(0) 1 2 3 4	Coleoptera	(0) 1 2 3 4	Other	0 1 2 3 4
Hirudinea	(0) 1 2 3 4	Lepidoptera	(0) 1 2 3 4		
Oligochaeta	(0) 1 2 3 4	Sialidae	(0) 1 2 3 4		
Isopoda	(0) 1 2 3 4	Corydalidae	(0) 1 2 3 4		
Amphipoda	(0) 1 2 3 4	Tipulidae	(0) 1 2 3 4		
Decapoda	0 (1) 2 3 4	Empididae	(0) 1 2 3 4		
Gastropoda	0 (1) 2 3 4	Simuliidae	(0) 1 2 3 4		
Bivalvia	(0) 1 2 3 4	Tabinidae	(0) 1 2 3 4		
		Culcidae	(0) 1 2 3 4		

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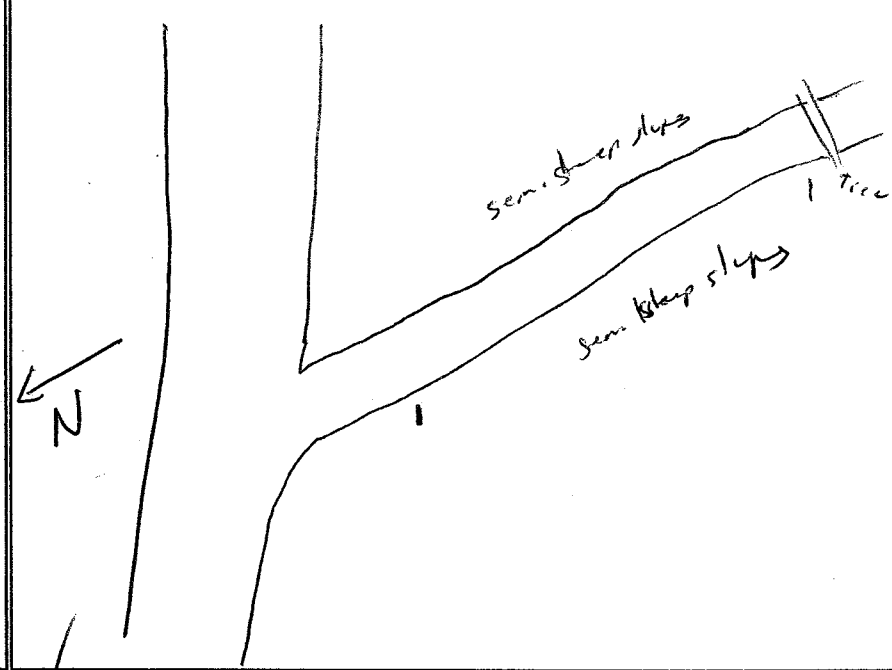
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Trib. to S. Brot Cane Cr.	LOCATION HR 7YQ	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Prann		
FORM COMPLETED BY Dan Duh	DATE 10/06/06 TIME 10:25 AM PM	REASON FOR SURVEY

WEATHER CONDITIONS	**Now**	**Past 24 hours**	**Has there been a heavy rain in the last 7 days?** ☒ Yes ☐ No Dam pour 6-7 days ago
	☐ storm (heavy rain)	☐	
	☐ rain (steady rain)	☐	**Air Temperature** ~70 °C
	☐ showers (intermittent)	☐	
	90 % ☒ %cloud cover	☐ ____%	**Other**_____
	☐ clear/sunny	☐	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION	**Stream Subsystem** ☒ Perennial ☐ Intermittent ☐ Tidal	**Stream Type** ☒ Coldwater ☐ Warmwater
	Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☒ Spring-fed ☐ Mixture of origins ☐ Other_____	**Catchment Area**_____km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other _____ ☐ Residential **Local Watershed NPS Pollution** ☒ No evidence ☐ Some potential sources ☐ Obvious sources **Local Watershed Erosion** ☒ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** Mixed Decid, Maple, Pine
INSTREAM FEATURES	**Estimated Reach Length** 30 m **Estimated Stream Width** 1-2 m **Sampling Reach Area** 45 m² **Area in km² (m²x1000)** ~~0.1-0.3~~ km² **Estimated Stream Depth** 0.1-0.3 m **Surface Velocity (at thalweg)** 0.4 m/sec **Canopy Cover** ☐ Partly open ☐ Partly shaded ☒ Shaded MOSTLY **High Water Mark** 0.5 m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle 95 % ☐ Run 45 % ☐ Pool 10 % **Channelized** ☒ Yes ☐ No **Dam Present** ☐ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** _____ m² MINOR **Density of LWD** _____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** Periphyton **Portion of the reach with aquatic vegetation** 10 %
WATER QUALITY	**Temperature** _____ °C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other _____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other _____ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ **Oils** ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand Some ☐ Relict shells ☐ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	10
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	40			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)	*			

* Some sporadic clay in spots.

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT N43 42 21.3 LONG W85°46' 59.6"	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble 40 % ☐ Snags 10 % ☐ Vegetated Banks____% ☐ Sand 10 % ☐ Submerged Macrophytes 5 % ☐ Other ( )____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☒ kick-net ☐ Other CPOM by Hand **How were the samples collected?** ☒ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble____ ☐ Snags____ ☐ Vegetated Banks____ ☐ Sand____ ☐ Submerged Macrophytes____ ☐ Other ( )____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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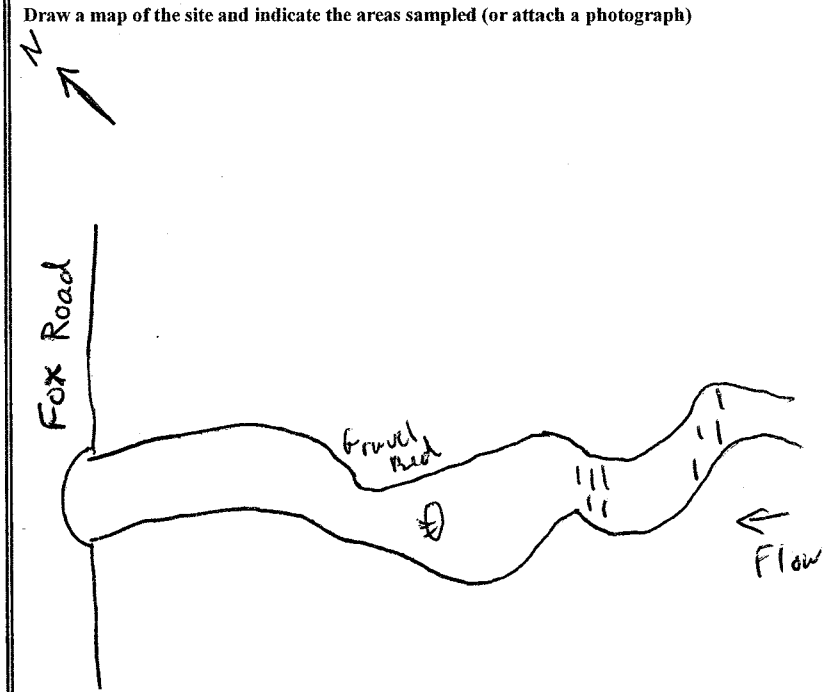
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME S. Br. of Cane Creek	LOCATION CWM-183-SD02	
STATION # CWM-183-SD02 RIVERMILE_____	STREAM CLASS	
LAT N 33°42'27.7" LONG W85°47'10.5"	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dan Duh, Rich Pramm		
FORM COMPLETED BY Dan Duh	DATE 10/6/06 TIME 0840 (AM) PM	REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ storm (heavy rain) ☐ ☐ rain (steady rain) ☐ ☐ showers (intermittent) ☐ 90 % ☒ %cloud cover ☐ ____% ☐ clear/sunny ☐ **Has there been a heavy rain in the last 7 days?** ☐ Yes ~~☐ No~~ Down pour 6-7 days ago **Air Temperature** ~70 °C **Other**_____
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)**



STREAM CHARACTERIZATION	**Stream Subsystem** ☐ Perennial ☐ Intermittent ☐ Tidal **Stream Type** ☒ Coldwater ☐ Warmwater **Stream Origin** ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☐ Mixture of origins ☐ Swamp and bog ☐ Other_____ **Catchment Area**_____km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ❑ Commercial ☒ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ☒ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** Pine
INSTREAM FEATURES	**Estimated Reach Length** 30 m **Estimated Stream Width** 4 m **Sampling Reach Area** 120 m² **Area in km² (m²x1000)** _____ km² **Estimated Stream Depth** .1-.3 m **Surface Velocity (at thalweg)** 0.3 m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ☒ Shaded mostly **High Water Mark** 1 m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle 60 % ❑ Run 35 % ❑ Pool 5 % **Channelized** ❑ Yes ☒ No **Dam Present** ❑ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** Ø m² **Density of LWD** _____ m²/km² **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ☒ Attached Algae **dominant species present** Filamentous Algae **Portion of the reach with aquatic vegetation** _____ %
WATER QUALITY	**Temperature** _____ ⁰C **Specific Conductance** _____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** YSI 556 **Water Odors** ☒ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other _____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ☒ None ❑ Other _____ **Turbidity (if not measured)** ☒ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other _____ **Oils** ☒ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ☒ Sand Slight ❑ Relict shells ❑ Other _____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		60	Detritus	sticks, wood, coarse plant materials (CPOM)	2
Boulder	> 256 mm (10")	10			
Cobble	64-256 mm (2.5"-10")	10	Muck-Mud	black, very fine organic (FPOM)	2
Gravel	2-64 mm (0.1"-2.5")	10			
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	0			
Clay	< 0.004 mm (slick)	0			

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% 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).	40-70% 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).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
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 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
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 bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	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)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
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.	Width of riparian zone <6 meters: little or no riparian 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	5 4 3	2 1 0

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		LOT NUMBER
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Cobble____% ☐ Snags 0 % ☐ Vegetated Banks____% ☐ Sand____% ☐ Submerged Macrophytes 0 % ☐ Other ( )____%
SAMPLE COLLECTION	**Gear used** ☐ D-frame ☒ kick-net ☐ Other CPOM by hand **How were the samples collected?** ☒ wading ☐ from bank ☐ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ☐ Cobble 2 ☐ Snags 0 ☐ Vegetated Banks 0 ☐ Sand 2 ☐ Submerged Macrophytes 0 ☐ Other ( )____
GENERAL COMMENTS	CPOM collected from 6 separate stations

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

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