

APPENDIX C

PLPT STREAM BIOASSESSMENT PROCEDURE

Laboratory Methods for Benthic Macroinvertebrate Processing, Identification, and Data Entry

Appendix	C-1: BMI Laboratory SOP's	
	C-1A: Introduction	C-2
	C-1B: Receiving BMI Samples	C-2
	C-1C: Sorting BMI Samples and QA/QC	C-3
	C-1D: Taxonomic ID and QA/ QC	C-6
	C-1E: References	C-8
Appendix	C-2: BMI Laboratory Forms	
	C-2A: BMI Laboratory Bench Sheet	C-10
	C-2B: SOP- BMI Laboratory Bench Sheet	C-11
	C-2C: Biological Metric Worksheet	C-12
	C-2D: SOP- Biological Metric Worksheet	C-13
	C-2E: Biotic Index Worksheet	C-16
	C-2F: SOP- Biotic Index Worksheet	C-17
Appendix	C-3: SOP: EDAS Database (BMI Data Entry)	C-18
Appendix	C-4: Chain of Custody	
	C-4A: Chain of Custody Form.....	C-23
	C-4B: SOP- Chain of Custody.....	C-24
Appendix	C-5: Standard Taxonomic Effort SOP	C-25

C-1: BMI Laboratory SOP's

BMI samples are sorted, identified, and enumerated in the PLPT – Environmental laboratory by Environmental Specialists and Technicians. The final identification will be determined by an Environmental Specialist. The Project Manager, an Environmental Specialist, has taxonomy and Bioassessment experience since 1989. 'Total count' and proper 'taxonomic identification' of BMI's to the lowest taxonomic level (genus/species) will be conducted when possible, following the Standard Taxonomic Effort (Appendix C-5). The results will assist in assessing water quality, tolerance to pollution of each organism to its environment, and the biological integrity of surface waters. The abundance and type of BMI's are proven indicators of an impaired or healthy aquatic system.

C1-A: INTRODUCTION

This manual offers step-by-step instruction on how to maintain efficiency and accuracy in the PLPT - Environmental BMI lab, from receiving benthic samples through the entire sorting process. Topics covered include receiving samples, sorting, sort QA/QC procedures, Taxonomic identification, Taxonomic identification QA/QC, labeling and record keeping.

Sorting, the removal of benthic macroinvertebrates (aquatic insects, mollusks, worms, etc.) from the surrounding organic and inorganic substrate is the first step in the laboratory processing of a macroinvertebrate sample. It is vital that each sample be sorted accurately and consistently.

C1-B: RECEIVING BMI SAMPLES

BMI samples are collected, stored in %70 Denatured Ethanol, and then brought to the Environmental BMI lab on the same day of collection by PLPT – Environmental Specialists and technicians. After assuring BMI samples have been received in good condition, they are logged into the lab's Logbook and database, and then stored in a "yellow" metal chemical storage cabinet marked "flammable" until they can be processed.

- Shipping containers such as boxes and coolers containing sample jars are staged in the receiving area and contents are checked. Each sample is examined to insure there are no leaks or broken jars, adequate preservative is present in each, and sealed.
- Labels are checked to make sure each jar is properly accounted for. Any discrepancies such as missing jars, extra jars, or conflicting labels are noted and rectified before final storage.
- A list of samples are recorded into the field notebook/ data field sheets, and also recorded into the lab's database, such as project, locations, sampling year, number of samples collected, and processing method for the group of samples.
- Sample jars containing BMI samples are routinely checked for leakage or evaporation by Environmental Staff. Sample jars are replenished with Denatured Ethanol to 2.5 cm above the debris containing the BMI samples, when leakage or evaporation is detected.

Table 1. An example of samples logged into the lab's Logbook and database.

Waterbody	Sampler device	Login Date/ initials	No. Jars	Process Date	Notes
Coal Canyon Ck	Surber sampler	May 7, 2007/ DM	3	Dec. 7, 2007	Jars/ labels checked Ok
Big Canyon Ck	Surber sampler	May 7, 2007/ DM	3	Dec. 8, 2007	Jars/ labels checked Ok
Big Canyon Ck	Surber sampler	May 7, 2007/ DM	3	Dec. 8, 2007	Jars/ labels checked Ok
Rodero Ck	Surber sampler	May 7, 2007/ DM	3	Dec. 9, 2007	Jars/ labels checked Ok
Hardscrabble Ck	Surber sampler	May 7, 2007/ DM	3	Dec. 10, 2007	Jars/ labels checked Ok

1- C: SORTING

1. Equipment

- Dissecting microscope for identifying/ sorting (10x to 40x magnification)
- Compound microscope for looking at identifying features (mentums, claws, ect...)
- Forceps
- One tally counter
- BMI count benchsheet
- Glass or plastic petri dishes
- A pencil, a micron pigment pen, a Sharpie®
- Scissors & scalpel for dissection and identification
- Squirt bottle containing 70% ETOH
- Squirt bottle containing tap water
- Waste container for used ETOH from samples
- 5 gallon waste bucket from substrate and debris material
- 0.5mm screen
- Sorting Petri-dish(es), Labeled Petri-dishes & Vials for BMI's

2. Working With Sample Preservatives

Denatured or Ethyl alcohol (ETOH) will be used for preserving benthic samples. It comes from the supplier at 95% and will be stored in the chemical storage cabinet in the lab. It is diluted to 70% to be used for preserving reference samples, and samples collected in the field. ETOH is flammable and users should be very careful to avoid inhaling the vapors. Wash thoroughly with cool water if contact with skin or eyes does occur. Read the MSDS for ETOH (available in the lab) for further precautions.

3. Preparation for Sorting

- Remove the next available sample from the shelf and begin recording *sort time* on the BMI Laboratory Bench sheet (see Appendix C-2A). Make sure to pick up the entire sample, as there may be more than one jar per sample.
- Check the record sample date, and record on the BMI Laboratory Bench sheet.
- From the jar, pour out the used 70% ETOH from samples into a waste container for ETOH, using a .5mm screen to prevent the loss of any materials. ETOH waste will be stored in the chemical storage cabinet with other lab waste for later proper disposal (incineration).
- Place a 5 gallon bucket near the work bench for discarded sample material.
- Place the sample jar on a workbench along with a dissecting microscope, forceps, etc.
- Prepare petri-dishes for BMI's by labeling each one with known taxa groups for that waterbody (based on prior collections and experience).
- Place the 'sorting' petri-dish on a 'white' paper towel, and on the base of the dissecting microscope for easier viewing and picking of BMI's.
- Add enough water to the contents of the dish to cover the material (usually $\leq \frac{1}{4}$ inches), not so much that macroinvertebrates swirl and float uncontrollably while sorting.
- The bottom of the 'sorting' petri-dish is marked with a black sharpie, equally dividing the bottom with four lines to make picking more efficient (figure 1 below).
- BMI's are picked/ sorted from the material (algae, twigs, substrate, etc) using the lowest magnification (10x) on the microscope.

- Begin sorting by starting from the top of the sorting petri-dish, move from right to left, drop down then left to right, drop down then right to left, drop down then left to right, covering all four areas of the dish until all BMI's are either tallied (counted) on the BMI Laboratory Bench sheet or removed (figure 1).
- Each area is visible for sorting when using the lowest magnification of the microscope. Higher magnification can be used for individual taxonomic identification or picking as necessary. Then return to the lowest magnification to continue sorting.

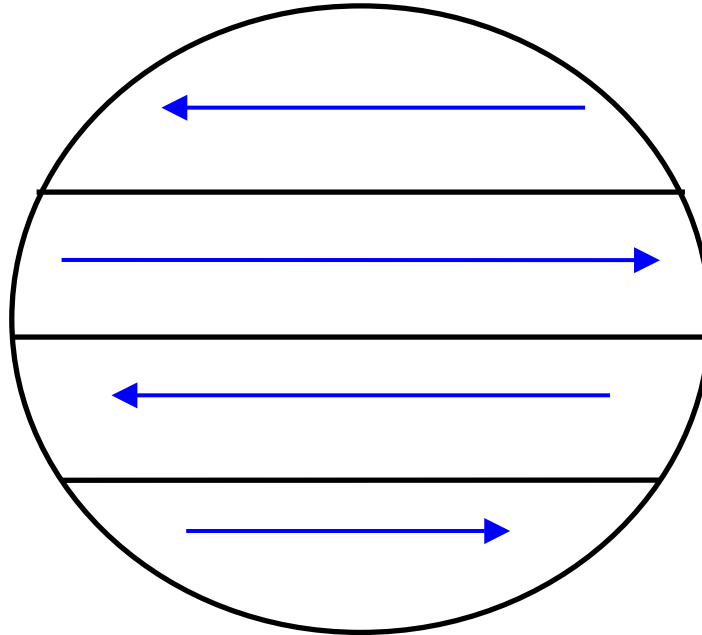


Figure 1. Sorting petri-dish illustration
Petri-dishes are 3" diameter by $\frac{3}{4}$ " high

4. Standard Sorting Procedures

- Using a large forcep, remove large material first, and wash off attached BMI's with tap water from a squirt bottle into a 'sorting' petri-dish.
- With the dissecting microscope, use the forceps to remove all BMI's from the material as illustrated in figure 1. Place BMI's in the appropriate labeled 'taxa' petri dish for further identification. (See Appendix C-5 for "Taxonomic Effort" SOP).
- Next, remove the algae in 'small amounts' at a time.
- Use forceps to spread the algae evenly in the 'sorting' petri-dish with $\leq \frac{1}{4}$ inch of water.
- With the dissecting microscope, remove all benthic invertebrates as above. Do this until all algae are examined and all BMI's are removed.
- Next, remove the remainder material and substrate in small amounts until all BMI's are removed from the sample jar.
- Note that any dish started must be sorted to completion.
- All material waste is discarded in a 5 gallon bucket, to be later disposed as compost.
- Keep count of all "*common*" identifiable taxa on a tally counter. Again placing BMI's in the appropriate (taxa) labeled petri dish for further identification. (See Appendix C-5)

C1- D: Taxonomic Identification Procedures and QA/ QC

1. Taxonomic Level of BMI Identification

The PLPT - Environmental lab will participate with the California Bioassessment Laboratories Network (CAMLnet) to stay up to date with standardized level of taxonomy and recommended QA/QC procedures. The PLPT – Environmental lab will also follow SOP's found in CAMLnet's "Standard Taxonomic Effort" (Appendix C–5).

2. Taxonomic Validation

Since 1981, the Tribe has identified over 70 genera of BMI's on the Truckee River within reservation boundaries. BMI validation of "reference" samples will be periodically conducted by known laboratories to check taxonomic accuracy. The Desert Research Institute (Reno, NV), the Water Pollution Control Lab (CDFG – Rancho Cordova, CA), or EcoAnalyst (Moscow, ID) laboratories will be used by the PLPT to validate reference samples.

3. Labeling and Data Entry for Sorted Samples

- Some BMI's in the last instar and in excellent taxonomic shape will be saved as reference samples in 70% ETOH in properly labeled 20 ml vials.
- When using label paper going into a vial, use only pencil or alcohol-proof pens (micro pigment pens) for writing. Regular ink and marker ink will dissolve in alcohol.
- Take the time to write neatly and make sure all numerals are clear. Be sure to orient labels into each vial so that pre-printed information is facing out. Avoid crushing any macroinvertebrates with a label.
- These samples will be periodically checked by personnel to prevent ETOH from drying out the sample.
- Make sure the pre-printed macroinvertebrate vial labels contain the following information and format:
"NB_LTR 2006" = "Nixon Bridge site, Lower Truckee River, 2007"

<p>Ephemeroptera Baetidae Baetis tricaudatus NIX LTR 2007</p>
--

When sorting, BMI's are placed into their assigned Petri-dish which are labeled by "taxa" (Order/ family/ genus/ or species). Unknown taxa will be set aside for further identification later in the day, or by a contract lab. 10% of BMI's identified by a taxonomists will be checked by a QC-technician, an Environmental Specialist, for accuracy of identifying taxa.

Those BMI's identified and counted with a "counter" during the sorting process while be checked for accuracy using this procedure (below) during the Sorter QA/QC (C1-C).

Set Up and QA/ QC Procedure:

- A different, qualified QC-technician must check the quality of the sort on a sample.
- The QC-technician conducting the QC-check will fill out a QA/QC BMI Final Taxonomic ID Check Sheet (see Figure 3). This begins the "QC time".
- Before beginning a Quality Check on a sorted sample, double check all taxa ID labels on each Petri-dish for accuracy. Any labels that are incorrectly filled out **must** be brought to the attention of the original person conducting the identification and fixed immediately.
- Briefly look over the identified invertebrates to see if there are any obvious 'reject' taxa and retain any rejects removed to show to the original sorter for future reference.

- Wiggins, G.B. Larvae of the North American Caddisfly Genera (Trichoptera). Univ. of Toronto Press, 1996 Second Edition.
- Usinger, R.L. Aquatic Insects of California. Univ. of Calif. Press - Berkeley, 1956.

C-1E References

Harrington, J., Ode, P.R., January 2003. California Bioassessment Laboratories Network: List of Californian Macroinvertebrate Taxa and Standard Taxonomic Effort; California Department of Fish & Game, Water Pollution Control, California Aquatic Bioassessment Laboratory; Rancho Cordova, California.

Lester, G., 2005; "Standard Operating Procedures in the Sorting Lab;" EcoAnalysts, Inc.; 105 East 2nd Street Suite 1; Moscow, Idaho USA 83843

Plotnikoff, R.W., White, J.S., June 1996. Taxonomic Laboratory Protocol for Stream Macroinvertebrates Collected by the Washington State Department of Ecology; Washington State Department of Ecology Environmental Investigations and Laboratory Services Program; Olympia, Washington; Publication No. 96-323.



Figure C-1. PLPT Environmental BMI Laboratory – Nixon, NV

C-2: BMI Laboratory Forms

C-2A: BMI Laboratory Bench Sheet	C-10
C-2B: SOP: BMI Laboratory Bench Sheet	C-11
C-2C: Biological Metric Worksheet	C-12
C-2D: Metric SOP	C-13
C-2E: Biotic Index Worksheet	C-16
C-2F: SOP- Biotic Index Worksheet	C-17

PSBP BMI LABORATORY BENCHSHEET

Sample ID Number: _____
 Date Collected: _____

ID/ Sort Time: Start _____
 ID/ Sort Time: End _____

Taxa	Sample number	#1	#2	#3
Ephemeroptera				
Baetis bicaudatus				
Baetis tricaudatus				
Centroptilum				
Choroterpes				
Heptagenia				
Tricorythodes				
Plecoptera				
Skawla				
Trichoptera				
Cheumatopsyche				
Hydropsyche				
Hydroptila				
Stactobiella				
Oecetis				
Coleoptera				
Heterlimnius				
Optioservus				
Stenelmus				
Zaitzevia				
Lepidoptera				
Petrophilia				
Diptera				
Bezzia				
Cricotopus				
Eukiefferiella				
Larsia				
Pentaneura				
Polypedilum				
Prosimilium				
Similium				
Odonata				
Argia				
Libellula				
Other:				
Hirudinea				
Oligochaeta				
Gammarus				
Decapoda				
Gastropoda				
Corbicula				
Planaria				

Final Count: _____
 Name of Sorter(s): _____
 Name of Taxonomist(s): _____

C-2B. SOP: BMI Laboratory Bench Sheet

1.0 Introduction

The BMI Laboratory Bench Sheet is used to tally and record the final number of each BMI taxa in a sample.

2.0 Purpose

The Standard Operating Procedure (SOP) describes the method in which to complete the BMI Laboratory Bench Sheet.

3.0 Procedure

3.1 Sample ID Number – Enter the sample identification number.

3.2 Date Collected – Enter the date of the sampling event.

3.3 Sample ID Sort Time: Start - Enter the date/ time sorting started.

3.4 Sample ID Sort Time: End - Enter the date/ time sorting ended.

3.5 Sample Number (across the top) – Write any additional information about each sample (e.g. Sample #1: lower, #2: middle, and #3 is the top reach).

3.6 Columns

3.6.1 Column 1 – Column 1 contains the most common taxa found within the PLIR. Write any additional taxa that is identified.

3.6.2 Column 2 – Record the final number of BMI's identified for each taxa in sample #1.

3.6.3 Column 3 – Record the final number of BMI's identified for each taxa in sample #2.

3.6.4 Column 4 – Record the final number of BMI's identified for each taxa in sample #3.

3.6.5 Final Count (across the bottom) – Add the final counts of each sample, and enter on the line below each column.

3.7 Names of Sorter(s) – Enter the name or names of personnel who sorted each sample.

3.8 Names of ID'er(s) – Enter the name or names of personnel who taxonomically identified the taxa from each sample.

BMI Metric Worksheet		
Watershed/ HUC No.: _____		Date/ Time: _____
Site Description: _____		Sample ID Number: _____
Calculate the appropriate score for all Biological Metrics. Record the score on the PSBW.		
Biological Metrics	Description	Score
Richness Measures		
Taxa Richness	Total number of individual taxa	
Ephemeroptera Taxa	Total number of mayfly genera	
Plecoptera Taxa	Total number of stonefly genera	
Trichoptera Taxa	Total number of caddisfly genera	
EPT Taxa	Total number of genera in the mayfly, stonefly, and caddisfly insect genera	
Composition Measures		
EPT Index	Percent composition of mayfly, stonefly, and caddisfly larvae	
Sensitive EPT Index	Percent composition of mayfly, stonefly, and caddisfly larvae with Tolerance values of 0 through 3	
Percent Hydropsychidae	Percent of organisms in the caddisfly family hydropsychidae	
Percent Baetidae	Percent of organisms in the mayfly family Baetidae	
Percent Chironomidae	Percent of organisms in the Midge family of Chironomidae	
Tolerance/ Intolerance Measures		
Biotic Index	Tolerance values between 0 and 10 weighted for abundance of individuals designated as pollution tolerant (higher values) and intolerant (lower values)	
PLPT Index of Biological Integrity	A percentage score of 4 core metrics (taxa richness, percent dominate, percent tolerant, EPT index) aggregated into an index dev. by Tetra Tech	
Percent Intolerant Organisms	Percent of organisms in sample that are highly intolerant to impairment as indicated by a tolerance value of 0, 1, or 2	
Percent Tolerant Organisms	Percent of organisms in sample that are highly tolerant to impairment as indicated by a tolerance value of 8, 9, or 10	
Percent Dominant Taxa	Percent Composition of the single most abundant taxon	
Functional Feeding Groups		
Percent Collector/ Gatherers	Percent of macrobenthos that collect or feed upon Fine Particulate Organic Matter	
Percent Grazers/ Scrapers	Percent of macrobenthos that graze upon periphyton - attached algae	
Percent Collector/ Filterers	Percent of macrobenthos that filter-feed upon other organisms or FPOM	
Percent Shredders	Percent of macrobenthos that shred Coarse Particulate Organic Matter	
Habit		
Percent Clingers	Percent of macrobenthos that cling to substrate	
Abundance		
Density of BMI's	Total number of organisms in the sample per square foot	
Personnel Performing Calculations: _____		
Personnel Checking Calculations: _____		
COMMENTS:		

C-2D: SOP: Metric Worksheet



1.0 INTRODUCTION

The “Biological Metrics Worksheet” is used to record the calculations for each metric or biological measure for this metric sheet. The calculations are based on data generated from BMI’s collected and identified from each reach.

2.0 PURPOSE

The Standard Operating Procedure (SOP) describes the Method calculate the values for a range of biological metrics, most of which were identified as important by Tetra Tech, EPA contractor.

3.0 PROCEDURE

3.1 Top Portion

- 3.1.1 **Watershed/ HUC number** – Enter the name of the Watershed and the “Hydrologic Unit Code” for that watershed basin.
- 3.1.2 **Date/ Time** – Enter the Date and Time of the sampling event.
- 3.1.3 **Stream Name** - Enter the name of the stream.
- 3.1.4 **Sample ID Number** - Enter the sample site identification number.

3.2 Richness Measures

- 3.2.1 **Taxa Richness** – Count the total number of individual taxa (distinct groups), and enter that value on the Biological Metric Worksheet.
- 3.2.2 **Ephemeroptera Taxa** – Count the total number of mayfly genera (distinct genera groups), and enter value.
- 3.1.3 **Plecoptera Taxa** – Count the total number of stonefly genera, enter value.
- 3.2.3 **Trichoptera Taxa**– Count the total number of caddisfly genera, enter value.
- 3.2.4 **EPT Taxa** - Count the total number of Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) taxa and enter value.

3.2 Composition Measures

- 3.2.1 **EPT Index** - Count the total number of individual EPT organisms, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get EPT Index, and enter value.
- 3.2.2 **Sensitive EPT Index** - Count the total number of individual EPT organisms with tolerance values of 0 through 3, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get Sensitive EPT Index, and enter value.

- 3.2.3 Percent Hydropsychidae** - Count the total number of individuals within the Hydropsychidae taxa, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent Hydropsychidae, and enter value.
- 3.2.4 Percent Baetidae** - Count the total number of individuals within the Baetidae taxa, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent Baetidae, and enter value.
- 3.2.5 Percent Chironomidae** - Count the total number of individuals within the Chironomidae taxa, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent Chironomidae, and enter value.

3.3 Tolerance/ Intolerance Measures

- 3.3.1 Biotic Index** - #1. Using the Biotic Index Worksheet (C-2E), total the number of individual organisms. #2. Multiply the total number of each taxa by its designated tolerance value, then "total" those numbers. #3. Divide that number (#2) by the total number of BMI individuals (#1) to get the Biotic Index.
- 3.3.2 PLPT Index of Biological Integrity** - Use EDAS to compute this value.
- 3.3.3 Percent Intolerant Organisms** - Count the total number of individual organisms with tolerance values of 0 through 3, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent Intolerant organisms, and enter value.
- 3.3.4 Percent Tolerant Organisms** - Count the total number of individual organisms with tolerance values of 7 through 10, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent tolerant organisms, and enter value.
- 3.3.5 Percent Dominant Taxa** - Count the total number of individuals within the most abundant taxon, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent dominant taxa, and enter value.

3.4 Functional Feeding Groups

- 3.4.1 Percent Collectors/ gatherers** - Count the total number of individuals within the collector/ gatherer (CG) functional feeding group, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent collector/ gatherers, and enter value.
- 3.4.2 Percent Grazers/ scrapers** - Count the total number of individuals within the grazer/ scraper (SC) functional feeding group, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent grazer/ scrapers, and enter value.
- 3.4.3 Percent Filterers** - Count the total number of individuals within the filterer functional (CF) feeding group, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent filterers, and enter value.

- 3.4.4 Percent Shredders** - Count the total number of individuals within the shredder (SH) functional feeding group, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent shredders, and enter value.
- 3.5 Habit Group**
- 3.5.1 Percent Clingers** - Count the total number of individuals within the clinger habit group, then divide that number by the total number of individual organisms in the sample. Multiply this by 100% to get percent clingers, and enter value.
- 3.6 Abundance**
- 3.6.1 Density** - Count the total number of individual organisms in the sample. Divide by the number of square feet sampled to get density of benthic macro-invertebrates per square foot, and enter value.
- 3.7 Personnel Performing Calculations** - Enter the name(s) of the person performing these calculations, and their signature(s).
- 3.8 Personnel Checking Calculations** - Enter the name(s) of the person checking the accuracy of these calculations, and their signature(s).
- 3.9 Comments** - Enter any comments regarding this worksheet.

PSBP Biotic Index Worksheet

Benthic Macroinvertebrate Assemblage

(Order/Family/Genus)

E = Ephemeroptera (Mayflies)

F-design ↓ T-Value x Counted = Total ↓

Baetidae				
Baetis bicaudatus	SC	3	___	___
Baetis tricaudatus	SC	6	___	___
Callibaetis	CG	9	___	___
Centroptilum	CG	4	___	___
Leptophlebiidae				
Choroterpes	CG	3	___	___
Leptophlebia	CG	2	___	___
Leptohyphidae				
Tricorythodes	CG	5	___	___
Heptageniidae				
Heptagenia	SC	4	___	___
Ironodes	SC	3	___	___
Stenoema	SC	3	___	___
Rithrogena	CG	0	___	___
P = Plecoptera (Stoneflies)				
Perlidae				
Isoperla	P	2	___	___
Skawia	P	2	___	___
T = Trichoptera (Caddisflies)				
Brachycentridae				
Amiocentrus	CG	3	___	___
Hydropsychidae				
Hydropsyche	CF	5	___	___
Cheumatopsyche	CF	5	___	___
Hydroptilidae				
Hydroptila	P	6	___	___
Oxyethira	P	3	___	___
Stactobiella	P	4	___	___
Leptoceridae				
Nectopsyche	SH	3	___	___
Oecetis	SH	8	___	___
Limnephilidae				
Limnephilus	SH	3	___	___
Glossomatidae				
Anagapetus	SC	0	___	___
Rhyacophilidae				
Rhyacophili	P	0	___	___

Diptera (True Flies)

F-design (T-Value x Counted) = Total ↓

Ceratopogonidae				
Bezzia	P	6	___	___
Empididae				
Dolichocephala	P	6	___	___
Hemodromia	P	7	___	___
Simuliidae				
Simulium	FC	8	___	___
Prosimulium	FC	3	___	___
Tabanidae				
Tabanus	P	7	___	___
Chironomidae				
Chaetocladius	CG	6	___	___
Chironomus	CG	10	___	___
Conchapelopia	P	6	___	___
Cricotopus	SH	7	___	___
Cryptochironomus	P	8	___	___
Dicrotendipes	CG	8	___	___
Eukiefferella	CG	8	___	___
Hydrobaenus	CG	6	___	___
Larsia	P	6	___	___
Orthocladus	CG	6	___	___
Paracladopelma	CG	7	___	___
Pentaneura	P	6	___	___
Phaenopsectra	CG	7	___	___
Polypedium	SH	7	___	___
Rhectanytarsus	FC	7	___	___
Tanytarsus	FC	6	___	___
Zavelimyia	P	8	___	___
"Blood Red"		10	___	___
Coleoptera (Water Beetles)				
Elmidae				
Heterimnius	CG	4	___	___
Optioservus	CG	5	___	___
Stenelmis	CG	4	___	___
Zaitzevia	CG	4	___	___
Lepidoptera (Aquatic Moths)				
Pyralidae				
Petrophila	SH	4	___	___
Odonata (Damselfly/dragonflies)				
Coenagrionidae				
Argia	P	7	___	___
Ishnura	P	9	___	___
Gomphidae				
Opiogomphus	P	7	___	___

Odonata

F-design (T-Value x Counted) = Total ↓

Libellulidae				
Libellula	P	9	___	___
Annelida				
Hirudinea	P	9	___	___
Oligochaeta	P	8	___	___
Crustacea				
Gammarus	CG	6	___	___
Decapoda	CG	8	___	___
Acarina				
P	P	7	___	___
Mollusca				
Gastropoda	SC	8	___	___
Pelecypoda				
Cobricula	FC	7	___	___
Tubellaria				
Planaria	P	9	___	___
Other Invertebrates:				

Totals (1st Column / 2nd Column) = B.I.

Biotic Index Score: _____ / _____ = _____

Personnel Performing Calculation: _____

Name: _____

Signature: _____

Personnel Checking Calculation: _____

Name: _____

Signature: _____

Biotic Index Values

- 0.0 - 3.5 Excellent WQ (pure)
- 3.5 - 4.5 Very Good WQ
- 4.5 - 5.5 Good (a little polluted)
- 5.5 - 7.0 Fair (moderately polluted)
- 7.0 - 8.5 Poor (seriously polluted)
- 8.5 - 10.0 Very Poor (extremely polluted)

C-2F: SOP: Biotic Index Worksheet

1.0 INTRODUCTION

The “Biotic Index Worksheet” is used to record the calculations for each taxa to determine the Biotic Index for a BMI sample site. Given the tolerance values of each taxa to water pollution, the calculations are based on data generated from BMI’s collected/ identified from a site.

2.0 PURPOSE

The Standard Operating Procedure (SOP) describes the Method to determine the Biotic Index for a BMI sample site. The Biotic Index is based on a taxa’s response to stressors in its environment, such as point or nonpoint sources of pollution.

3.0 PROCEDURE

3.1 “Counted” Column - Enter the total number of BMI “counted” for each taxa.

3.2 “Total” Column - Multiply the total number of BMI counted for each taxa, by the T-Value (or tolerance value) for each taxa, and enter in the “total” column.

3.3 Other Invertebrates - Enter any other taxa and their Functional design (group) that is not listed on this sheet.

3.4 Biotic Index Score

3.4.1 First Column - Add up the three columns under the first or “total” column and enter that total.

3.4.2 Second Column - Add up the three columns under the second or “total” column and enter that total.

3.4.3 B.I. – Divide the total of the first column by the total of the second column. This is the Biotic Index for this sample. Enter this value for “Biotic Index Score.”

3.5 Personnel Performing Calculations - Enter the name(s) of the person performing these calculations, and their signature(s).

3.6 Personnel Checking Calculations - Enter the name(s) of the person checking the accuracy of these calculations, and their signature(s).

3.7 Comments - Enter any comments regarding this worksheet.

4.0 Biotic Index Values -These are the range of values which determine if the BMI sample represents excellent, very good, good, Fair (moderately polluted), or Poor (seriously polluted) waters.

Biotic Index Values

0.0 - 3.5	Excellent WQ (pure)
3.5 - 4.5	Very Good WQ
4.5 - 5.5	Good (a little polluted)
5.5 - 7.0	Fair (moderately polluted)
7.0 - 8.5	Poor (seriously polluted)
8.5 -10.0	Very Poor (extremely polluted)

C-3: SOP: EDAS DATABASE

1.0 Introduction

Environmental Data Analysis System (EDAS) is a Microsoft Access tool for data management and analysis designed specifically for USEPA by Tetra Tech. EDAS allows the user to store, query data, and also generates reports for each sample site.

2.0 Purpose

The Standard Operating Procedure (SOP) describes the “basic” method in which to enter BMI taxa into EDAS. Refer to Tetra Tech’s 2006 “User’s Guide, Version MT 3.2.2k” for more in-depth and comprehensive instructions for using EDAS.

EDAS is a data management and analysis tool to facilitate biological monitoring of water quality. It incorporates a range of functions from relational storage of data to calculation of metrics to the creation of export files (including the creation of formatted batch files to take advantage of STORET's upload capabilities). Modifications to any of the objects within this database (this does not include data population) may render it inoperable. For more information refer to the EDAS user's guide.

Calculate Benthic Metrics	Add New Data	Review Taxa Information
Data QA/QC	Administrator Functions	Review Personnel Information
Access Database Structure		EXIT EDAS

EDAS is a custom database application for use with Microsoft Access®. Microsoft, Windows, and Access are trademarks of the Microsoft Corporation. This application is regularly being updated and is subject to change. For the latest update, contact:
Tetra Tech, Inc. 10045 Red Run Blvd, Suite 110 Owings Mills, MD 21117 410-356-8993
<http://www.twater.com/edas.htm>

3.0 Procedure for Adding New Data

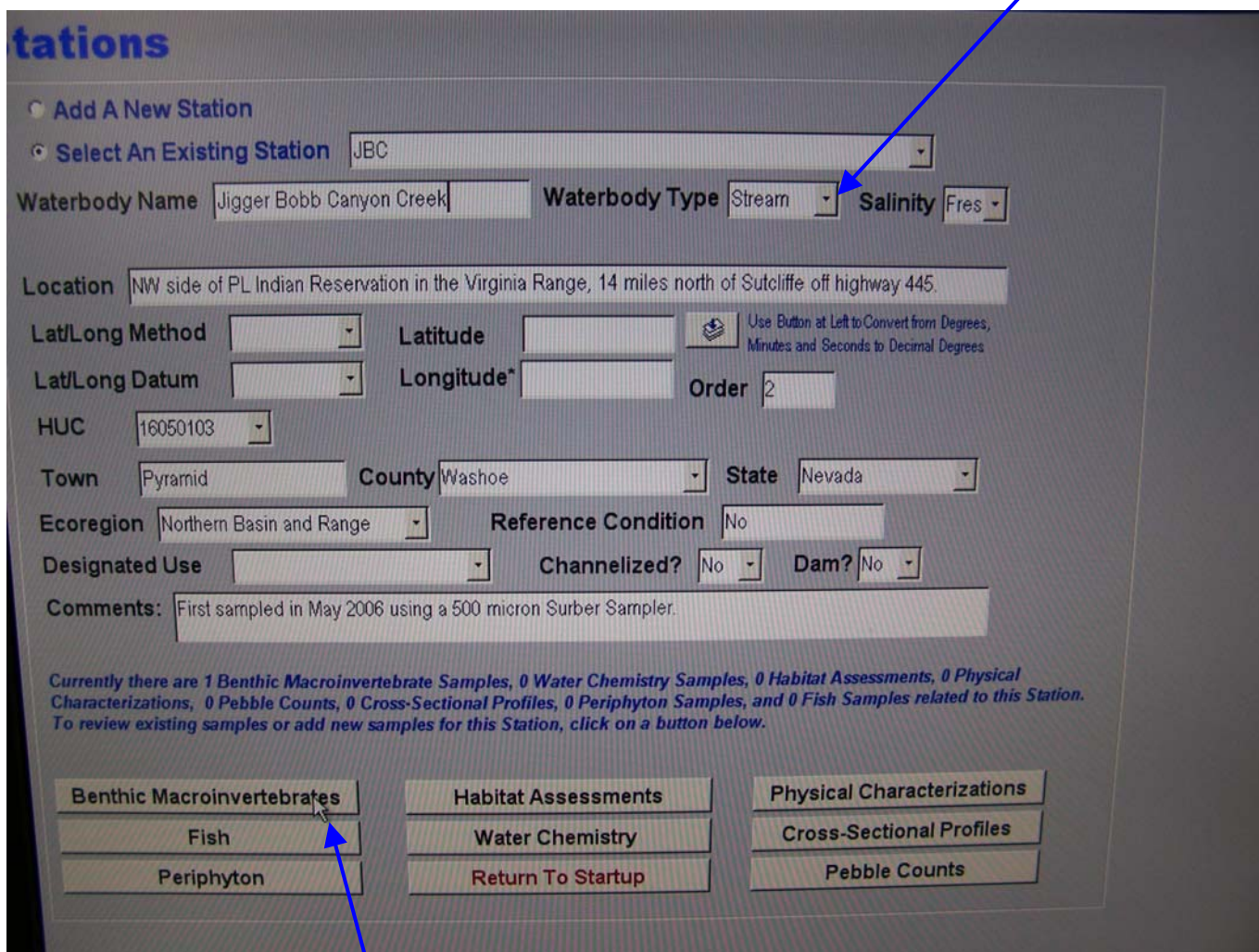
3.1 Open the EDAS program.

3.2 Place the cursor on the “Add New Data” button and enter the site.

3.3 Select "Add New Station" and enter the unique station name and select "OK".

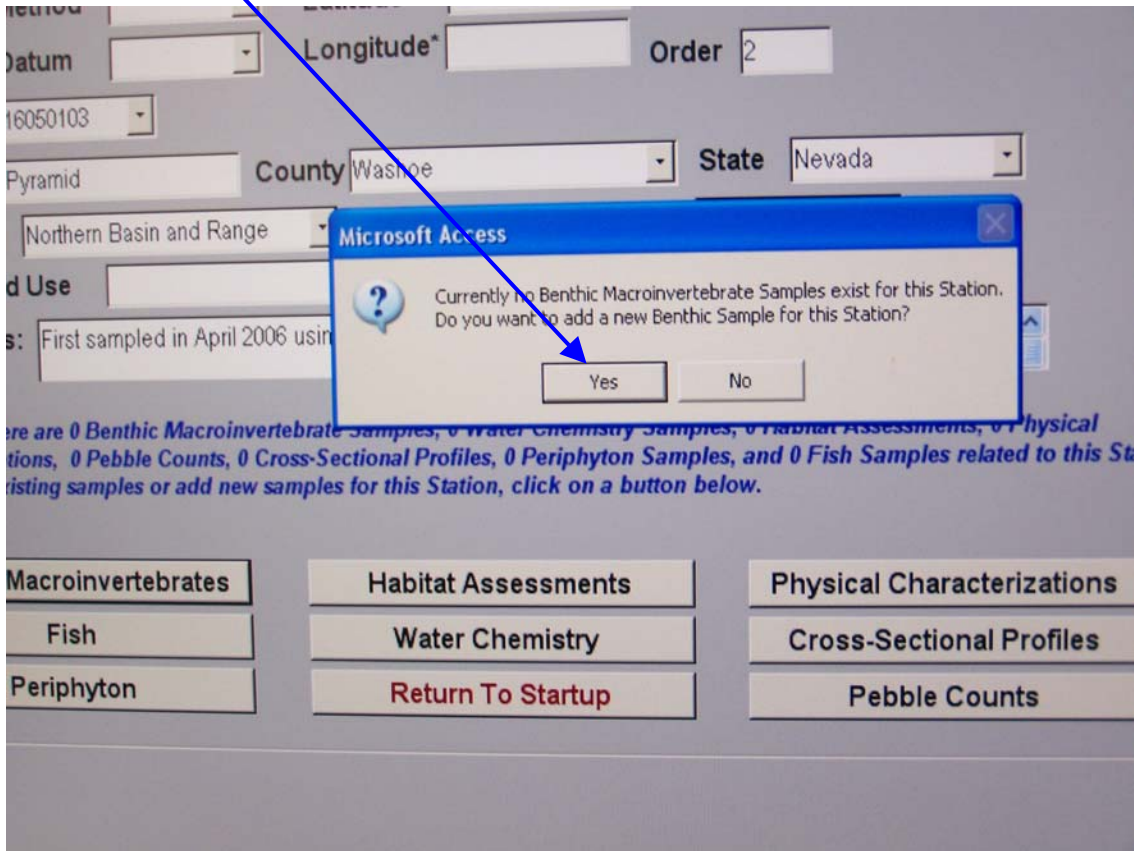


3.3 Fill out all the necessary fields to describe the sample site. Use the drop boxes to help make the appropriate choices.

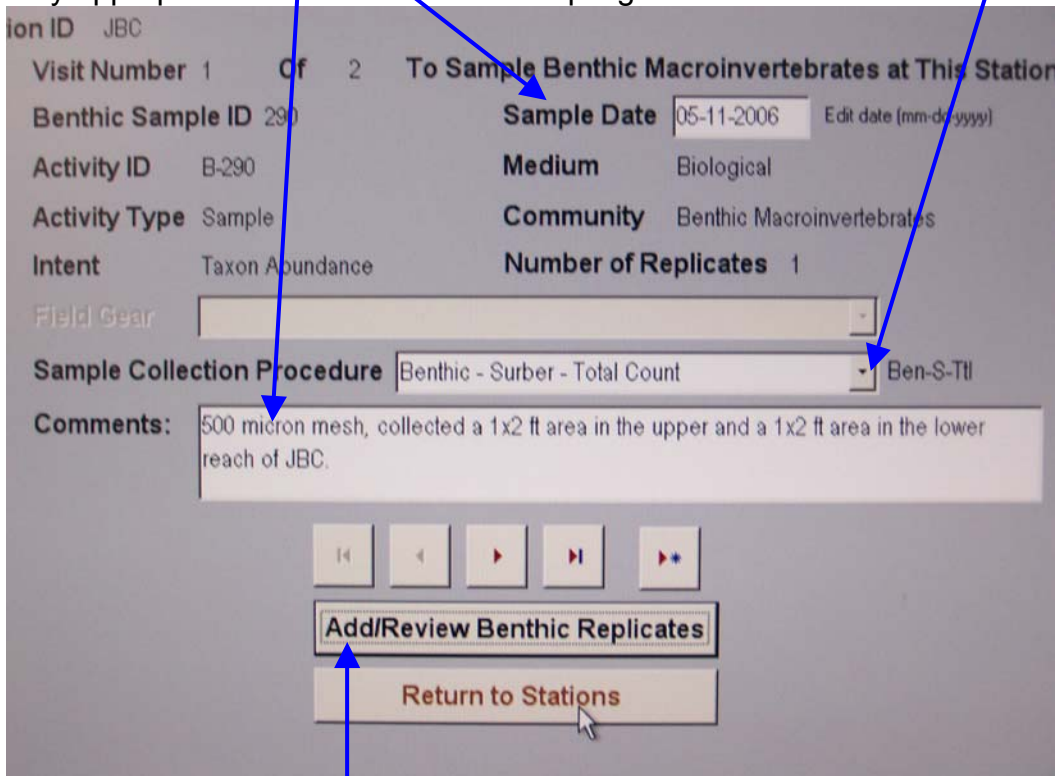


3.4 Select "Benthic Macroinvertebrates" to continue.

3.5 Select “yes” to “add new a new Benthic Sample for this Station”

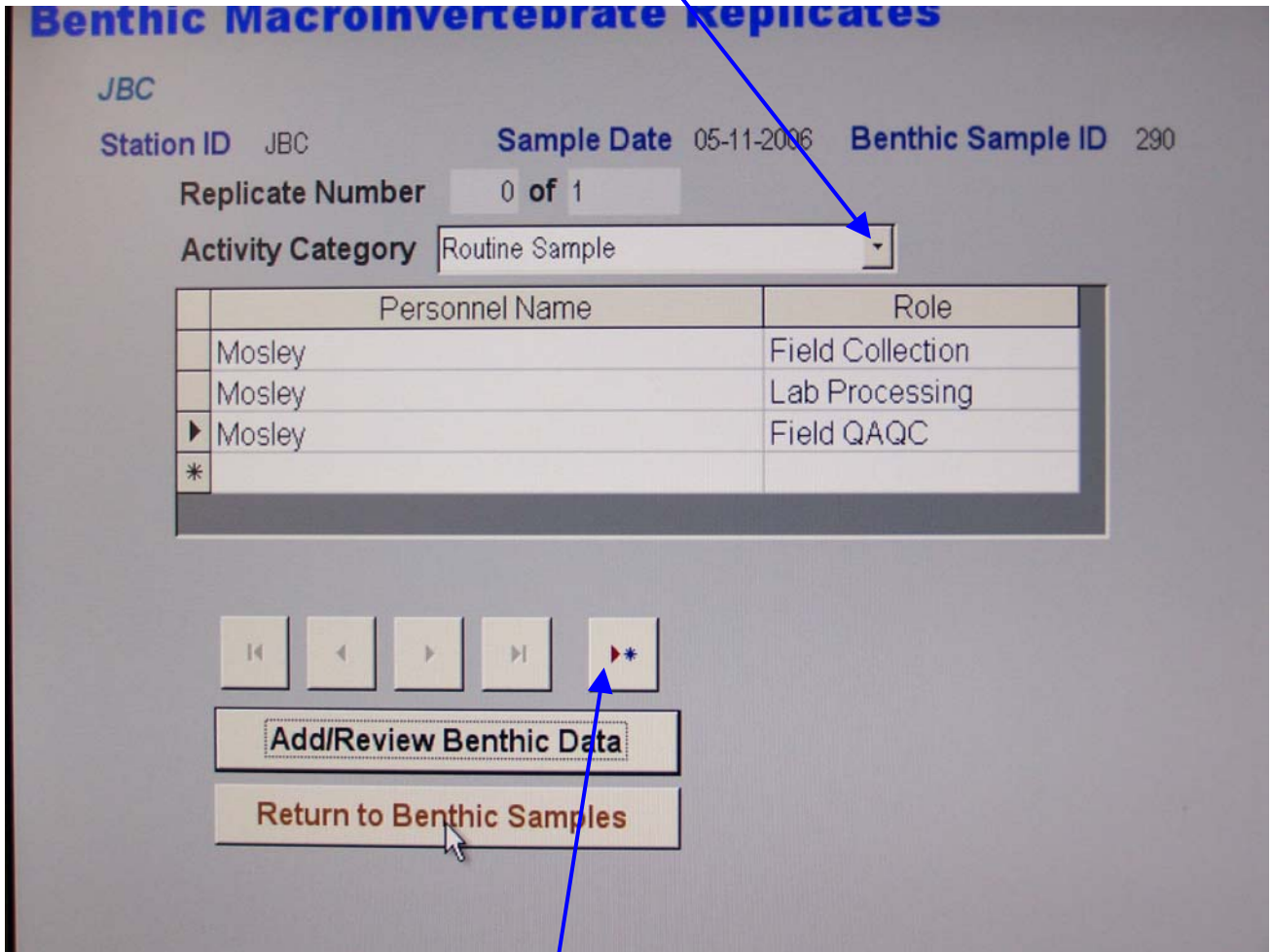


3.6 Enter the “Sample Date, Sample Collection Procedure (using the drop box), and any appropriate comments for this sampling event.



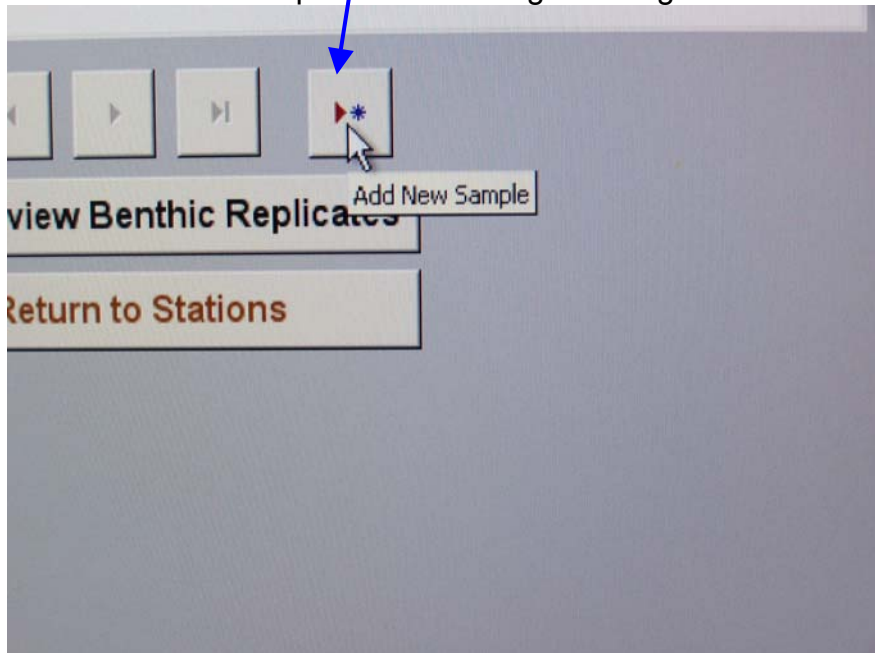
Then Select “Add/Review Benthic Replicates” for the next window.

3.7 Names of Sorter(s) – Use the drop box to select “Routine sample”



Then fill in the appropriate fields for “Personnel Name” and what role the person performed.

3.8 Select the “Add New Sample” button to begin adding BMI data.



3.9 Add the name and number of BMI taxa that were identified for this sample.

Use the “drop boxes” to access the “Master Taxa” list for easier data entry.

Benthic Macroinvertebrate Data
Jigger Bobb Canyon Creek NW side of PL Indian Reservation in the Virginia Range

Station ID JBC Sample Date 05-11-2006 Benthic Sample ID 290
 Replicate Number 0 of 1

FinalID	Individuals	Stage	Excluded Taxa	Comments
▶ Chironomus	7	X	<input type="checkbox"/>	
Cricotopus	14	X	<input type="checkbox"/>	
Hydropsyche	22	X	<input type="checkbox"/>	
Isoperla	9	X	<input type="checkbox"/>	
Baetis tricaudatus	24	X	<input type="checkbox"/>	
Dixa	32	X	<input type="checkbox"/>	
*		X	<input type="checkbox"/>	

[Return to Benthic Replicates](#)

- 3.10** Have someone check the data entry for every name and number of BMI taxa, and all other information entered for this sample before exiting out of EDAS. All data entry is automatically saved.
- 3.11** To review BMI data, go to the start menu and select “Review Taxa information”.
- 3.12** To exit EDAS, select “Return to Benthic Replicates”, then Select “Return to Benthic Samples”, then select “Return to Stations”, then select “Return to Startup”.

4.0 Reference:

Barbour, Michael and Erik Leppo, 2006. Ecological Application System (EDAS) User’s Guide Version MT 3.2.2k, “A User’s Guide”; Prepared for U.S.EPA by Tetra Tech, Inc.; Owings Mills, MD.

2- 4B: Chain of Custody Record Form - SOP

1.0 Introduction

The "Chain of Custody Record" (COC) form is used to document collection and transport of samples to each laboratory for laboratory processing and analysis. The COC form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are transferred to the laboratory, the custody of the samples will be the responsibility of the field personnel, who will sign the COC form in the "relinquished by" box and note the date, time, and 'other' applicable information.

2.0 Purpose

The Standard Operating Procedure (SOP) describes the method in which to complete this worksheet after each sampling event.

3.0 Procedure

- 3.1 **Project Name** – Enter the name of the sampling site (ID#).
- 3.2 **Sample Date** – Enter the date of the sampling event.
- 3.3 **Watershed Name** – Enter the watershed of sampling location.
- 3.4 **Laboratory Name** – Enter the name of the laboratory receiving the sample(s).
- 3.5 **Sample ID** – Enter the sample ID for each sample submitted to the laboratory.
- 3.6 **Time Received** – Enter the time the sample was received and submitted to the laboratory.
- 3.7 **Sample Description** – Enter the description of each sample.
- 3.8 **Other Comments** – Enter any other important comments for each sample submitted to the laboratory. (E.g. bottle leaked during transport,..., and corrections made)

4.0 Signatories

- 4.1 **Sample By** – Enter the name of the person(s) who collected the sample.
- 4.2 **Relinquished By** – Enter the name of the person(s) who relinquished the sample to the laboratory.
- 4.3 **Received By** – Enter the name of the person(s) who received the sample at the laboratory.
- 4.4 **Name/ Address of the sampler** – Enter the name of the sampler who collected and transported the samples to the laboratory.
- 4.5 **Name/ Address of the Project Manager** – Enter the name of the Project Manager (Dan Mosley).

C-5: Standard Taxonomic Effort SOP

**The PLPT will follow the California Bioassessment Workgroup's (CABW)
"Standard Taxonomic Effort" for Processing BMI's
Used by
California Aquatic Bioassessment Laboratory Network (CAMLnet)**

<http://www.dfg.ca.gov/cabw/camlnetste.pdf>

(see attached)