1.0 SCOPE

Freshwater benthic invertebrates for non-point source studies are sampled using a D-shaped kick net. Techniques for sampling and in-field processing are described in detail. This SOP follows the California Department of Fish and Game (CDFG) California Stream Bioassessment Procedure.

2.0 EQUIPMENT

- D-shaped kick net (0.5-mm mesh)
- Standard size No. 35 sieve (0.5 mm)
- Sample jars
- Measuring tape (100 m)
- 95% ethanol
- GPS
- Water quality meter for temperature, specific conductance, pH, and dissolved oxygen.
- Stadia rod and hand level
- Flowmeter
- California Bioassessment Worksheet
- Physical/Habitat Quality Worksheet
- Chain of Custody forms
- Log book
- Permanent ink pens, pencils
- Labels
- Random number table

3.0 PROCEDURE

3.1 Sampling Benthic Invertebrates for Non-Point Source Studies

1➢ The stream location to be sampled is assessed by walking the stream and selecting a reach containing at least five riffles (if possible) that are within the same stream order and relative gradient.

2➢ Three of the five riffles are selected randomly, and a photograph of each is taken prior to sampling.

3➢ A measuring tape is placed along the bank of the entire riffle, starting with the downstream riffle. The stream habitat is not disturbed. The riffle is divided into

1-meter units, and 1-meter mark from the top third of the riffle is randomly selected to be the sampling transect when possible.

4➢ The transect is inspected, and the substrate complexity is assessed. If the substrate appears uniform across the transect, a sample is taken from each side of the stream and the center. If the substrate appears variable along the transect, sample sites are selected to represent the different substrate types.

5➢ A sample on the transect is collected by placing the kick-net on the substrate and disturbing three 1x2 foot portions of substrate upstream of the kick-net to approximately 4 to 6 inches deep. Large rocks are picked up and scrubbed by hand under water in front of the net. These three 1x2 foot portions make up one sample. A consistent sampling effort is maintained (1-3 minutes, depending on substrate complexity) at all three portions.

6➢ The contents of the net are placed into the sieve, and large twigs, leaves, and rocks are removed without discarding any invertebrates. The sample material is placed in a sample jar and labeled, and 95% ethanol is added. Labels denote station identification, transect number, stream name, date, time, sampling device, and samplers initials. The jar is not filled more than half full of organic material or two-thirds full of rock and sand.

7➢ The California Bioassessment Worksheet (Figure 1) is used to record all required information.

8➢ The Physical Habitat Quality Scoresheet (Figure 2) is used to rate all the habitat parameters on a 0-20 scale. Also refer to the CDFG California Stream Bioassessment Procedure for more detailed descriptions of the parameters.

9➢ Steps 3-8 are repeated for the next two riffles upstream within the stream reach, so that three samples (one per riffle) are collected per stream.

10➢ Samples are returned to the laboratory, and custody is relinquished to the Sample Custodian with a chain-of-custody form.

4.0 HEALTH AND SAFETY CONSIDERATIONS

1➢ Dangerous Animals. Employees will be aware of the types of toxic and dangerous animals likely to be encountered. Terrestrial habitats may harbor rattlesnakes as well as venomous insects and toxic plants. Employees must take precautions to avoid injury in remote areas, and shall always bring a cell phone.

2➢ Adverse Weather. When performing fieldwork, employees will be prepared for extreme weather conditions. Adequate clothing for cold, windy, or rainy weather will be used. Field operations may be suspended during severe wind or lightning storms. Temperatures in inland valleys can be much hotter than at Weston offices, and employees should dress in layers and bring a hat, sunblock, and plenty of water.

Prepared By:	Approved By:	Date:	QA Concurrence:	Date:
[signature]	[signature]	11/21/05	[signature]	11/22/05

STREAM BIOASSESSMENT FIELD DATA SHEET

WATERSHED/STREAM _____ DATE/TIME _____

PROJECT _____ SAMPLE ID _____

SITE DESCRIPTION _____

SAMPLING CREW

SITE INFORMATION
Latitude
Longitude
Elevation
COMMENTS:

WATER QUALITY MEASUREMENTS	
WATER TEMP.	
CONDUCTANCE	
pH	
DISS. OXYGEN	
CHLOROPHYLL	
TURBIDITY	

Additional observations (water odor, color, siltation, algae growth, etc.):

PHYSICAL HABITAT CHARACTERISTICS

REACH LENGTH _____

	Riffle 1	Riffle 2	Riffle 3
Riffle Length			
Riffle Depth			
Avg. Riffle Width			
Riffle Velocity			
% Canopy Cover			
Substrate Complex			
Embeddedness			
Substrate Composition			
Silt (<0.1")			
Sand (0.1 -0.2")			
Gravel (0.2 -2")			
Cobble (2-10")			
Boulder (>10")			
Bedrock/Solid			
Substrate consolidation			
Percent Gradient			

Figure 1: California Bioassessment Worksheet.

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AQUATIC BIOASSESSMENT LABORATORY

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PHYSICAL HABITAT QUALITY
(California Stream Bioassessment Procedure)

WATERSHED/ STREAM: _____ DATE/ TIME: _____

COMPANY/ AGENCY: _____ SAMPLE ID NUMBER: _____

SITE DESCRIPTION: _____

Circle the appropriate score for all 20 habitat parameters. Record the total score on the front page of the CBW.

Parameters to be evaluated within the sampling reach

HABITAT PARAMETER	CONDITION CATEGORY			
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR
1. Epifaunal Substrate/ Available Cover	Greater than 70% (50% for low gradient streams) of substrate favorable for epifaunal colonization and fish cover; most favorable is a 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% (30-50% for low gradient streams) 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% (10-30% for low gradient streams) mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% (10% for low gradient streams) stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	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.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/ Depth Regimes *(deep<0.5 m, slow<0.3 m/s)*	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	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).
	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% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) 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% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	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.
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Figure 2: Physical Habitat Quality Scoresheet.

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Parameters to be evaluated in an area longer than the 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.
	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.
	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 of 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.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zones 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.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	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 haveimpacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Figure 2: Continued.

3➢ Uneven/Unstable Terrain. Employees shall use caution when negotiating steep muddy banks, particularly while transporting heavy equipment across such terrain.

4➢ Lifting Heavy Equipment. Employees shall use proper lifting techniques when transporting heavy equipment from the office to the field. Employees should not overexert themselves and should know their limitations. Employees need to get help when moving very heavy items.

5➢ Self Protection. When performing work near transient camps or gatherings of dubious characters, employees shall work in pairs and should carry items such as pepper spray and cell phones. If a situation is deemed too dangerous, employees should leave the area, as personal safety takes priority over work assignments.

6➢ Contaminated Water. When working on or in known or suspected contaminated water, employees shall wear proper personal protective gear. This may include gloves, face masks, tyvek suits, and rubber boots. Employees shall avoid touching the eyes or mouth after contacting contaminated water. If exposure occurs, employees shall seek medical attention at the first sign of symptomology (gastrointestinal problems, infections of the ear/nose/throat, skin lesions).

5.0 PERSONNEL

Sampling teams will consist of two employees, and will have at least one biologist who has received training in CDFG California Stream Bioassessment Procedure.

6.0 QUALITY ASSURANCE

The lead biologist shall be the primary person responsible for conducting field sampling and ensuring that procedures are followed according to the sampling protocol and Weston safety requirements.

7.0 REFERENCE DOCUMENTS

California Department of Fish and Game, Aquatic Bioassessment Laboratory. California Stream Bioassessment Procedure (Protocol Brief for Biological and Physical/Habitat Assessment in Wadeable Streams). May 1999.