Information Paper 4.2.1 Visual Assessments

Intent and Scope

The purpose of this package is to enhance the user's knowledge and ability to make decisions regarding visual assessments of watershed condition, including both narrative and photographic documentation. This Information Paper (IP) provides the principles, a brief description of methods, their applications, quality assurance practices for reducing error or subjectivity, a brief description of the Standard Operating Procedures (SOPs), and a glossary of terms used in visual assessments and other forms of citizen monitoring. The reader is referred to these SOPs for step-by-step instructions for each specific procedure. Sampling techniques for performing turbidity and transparency measurements, and flow measurements, which relate peripherally to narrative visual assessments, are also available in this Compendium.

Principles and Applications

A Visual Assessment is a technique to document waterway and watershed conditions and uses. It requires minimal technical equipment and training and relies primarily on the monitor's sensory abilities and common sense. There are really two general approaches to visual assessments. The narrative approach involves the use of standardized forms to interpret visual (and other sensory) observations into words or numeric descriptions. There is also a photographic approach. Photographic monitoring, also referred to as "photo documentation," provides a permanent visual documentation of specific waterway and/or watershed conditions. Photographic monitoring may be used as a stand-alone assessment or may accompany a narrative assessment.

Visual assessments are attempts to document conditions from the viewpoint of the individual observer, and are therefore usually qualitative or, at best, semi-quantitative. To conduct the assessment, the monitors walk a segment of shoreline or stream, recording information and/or taking photographs. This assessment can be used as a baseline for gross problem identification, or for tracking gross changes over time.

Visual assessments are usually performed on sections of stream or shore that are no more than a mile in length, and volunteers performing these assessments often work in teams of two or three. A common term used to describe a section of a stream is a "reach." Sometimes a group performing bioassessment on a stream in a mountainous environment may define a reach as having five riffles. Other groups working on low gradient rural streams, or urban storm drains, may use a different method for defining a reach. For example, certain structural features like bridges, roads, or tributaries may bracket a reach, or the reach may be given an arbitrary length (for example, ¼ mile). For purposes of the rest of this document, a reach is defined as a section of stream possessing homogenous physical and habitat features and is bounded by landmarks such as tributaries, bridges, etc. If such landmarks do not exist the reach can be defined in uniform increments such as ¼ mile or ½ mile.

Time frequency is also quite variable between groups performing visual assessments. Some groups monitor on a monthly basis, some more frequently, but others less frequently. Groups

who have specific volunteers or schools assigned to a stream or shore usually monitor more frequently. Groups who are primarily involved in macroinvertebrate sampling may only visit the site and record general habitat observations using the California Stream Bioassessment Physical Habitat Form once a year. Monitors attempting to document the implementation of a stream restoration project may take photographs before and after the project, and thereafter at decreasing frequencies over a period of several years.

Method menu

Narrative Stream and Shore Walk Visual Assessment

To conduct visual waterbody assessments volunteers may travel along a specifically identified length of stream or segment of coastline of a lake, bay, or the ocean and record information for that section of the waterbody. Travel may be on foot or by various means of transportation, but the method is still often referred to as a stream or shore "walk." These "walks" are often accompanied by the collection of chemical, physical or biological samples or analyses. Photos also may accompany the narrative assessment.

Narrative stream and shore walk forms are one of the most commonly employed methods used by citizen monitors. Observations are recorded on data sheets and given to the coordinator of the monitoring program for archiving or uploading electronically. When water quality problems are identified through the narrative assessment, then volunteers or the monitoring coordinator report these problems to the Regional Board staff or local authorities.

There are about as many forms as there are monitoring groups employing them. For example some groups use a standard "Watershed Survey Visual Assessment" and/or "Stream Habitat Walk" forms found in the United States Environmental Protection Agency, *Volunteer Stream Monitoring: A Methods Manual* (EPA 841-B-97-003, 1997), while others use forms that have been specialized for specific environmental conditions. The SOP Section of this folder contains the suggested ***California Stream and Shore Walk Visual Assessment***. This procedure was developed by the Visual Assessment Working Group of the Citizen Monitoring Technical Advisory Committee (TAC), based on a review of many of the existing procedures used by volunteer monitors. Environment-specific information is important for individual groups, and therefore there were some major differences in terms and approaches. A potential drawback to this approach is that it leads to inconsistencies when comparing results between areas around the state. Another potential disadvantage noted in this review was that some of the forms were several pages long, which can complicate work in the field.

Based on this review, the TAC Working Group developed the ***California Stream and Shore Walk Visual Assessment*** as a recommended SOP, with the following characteristics in mind:

- To the extent feasible, terms should be consistent with the EPA format.
- The form should fit on one page, double sided.
- There should be room on the form for a site-specific map.
- The narrative assessment should be compatible with photographic assessments.

- Specific instructions, consistent terminology, and definitions should be included.

In many cases specific environmental conditions dictate the need for specific forms. Groups may decide to modify the form provided in the SOP to serve their individual needs. However, when modifying the form, such groups should continue to use the instructions, terms and definitions in the SOP to insure consistency throughout the State.

Semi-Quantitative Physical Habitat Assessments on Streams

There was a major divergence in approaches between the stream walk, which describes specific features and certain water quality conditions and problems, and the physical habitat assessment, which is designed to give an overall rating to the condition of the stream habitat. Both approaches are valid and important, but on different time scales and for different purposes.

The stream walk is qualitative, while the physical habitat assessment, which is semi-quantitative, is designed to produce a numeric product that is used to rate the stream. This rating system does not rely heavily on empirical measurements but instead relies on the observers' interpretation of the visual appearance of the environment and converting that observation into a numeric rating. This procedure therefore does allow a certain amount of subjectivity; hence, such physical habitat assessments are only semi-quantitative at best. Still they are useful in providing consistent comparisons between streams.

The California Department of Fish and Game (DFG) ***Physical/Habitat Quality Form*** (DFG Water Pollution Control Laboratory, *California Stream Bioassessment Procedure*, May 1999) is now used widely around the State on high gradient streams as an integral component of citizen bioassessment monitoring. The DFG form is based on the U.S. EPA protocol for high gradient rocky bottom streams in mountainous regions (United States Environmental Protection Agency, *Volunteer Stream Monitoring: A Methods Manual*, EPA 841-B-97-003, 1997). The ***Physical/Habitat Quality Form*** is performed at the same time as the macroinvertebrate sample collection procedure. Therefore the use of this form is infrequent, ranging from once or twice a year to every several years. In addition to the required use of this form for the bioassessment procedure, we recommend the use of this form annually by other citizen monitoring groups as a supplement to the ***California Stream and Shore Walk Visual Assessment.*** Another version of this protocol, also in EPA's *Volunteer Stream Monitoring: A Methods Manual*, has been developed for use on low gradient, muddy bottom streams. This form may be more appropriate for groups working in lowland areas. The habitat scoring criteria used in both of these forms (high and low gradient versions) represents a standardized method used around the United States. These forms comprise the recommended SOP for semi-quantitative habitat assessments.

Photographic Monitoring

The old saying that "a picture is worth a thousand words" applies to citizen monitoring. Photographs provide a qualitative, and potentially semi-quantitative, record of conditions in a watershed or on a water body. Photographs can be used to document general conditions on a reach of a stream during a stream walk, pollution events or other impacts, assess resource conditions over time, or can be used to document temporal progress for restoration efforts or

other projects designed to benefit water quality. Photographic technology is available to anyone and it does not require a large degree of training or expensive equipment. Photos can be used in reports, presentations, or uploaded onto a computer website or GIS program. This approach is useful in providing a visual portrait of water resources to those who may never have the opportunity to actually visit a monitoring site.

The SOP Section of this folder contains the recommended ***State Water Resources Control Board Photo Documentation Procedures for Citizen Monitors.*** This SOP was developed and field tested by State Water Board staff in association with the Visual Assessment Working Group of the Citizen Monitoring Technical Advisory Committee (TAC), and was based on a review of many of the existing photographic procedures used by volunteer monitors and landowners.

Training and Standardization

Although visual assessments do not have the same procedural elements as chemical analytical procedures, there is still a need to assure the quality of the observations made and the assessments provided by field staff. Because the procedural elements are not measurement based, there are not objective standards that can be applied. However, since the goal of any visual assessment is to document changes in existing conditions, it is only necessary to assure that all assessors are capable of recording and describing observed conditions in a consistent manner. With the lack of a measurement system, initial and refresher training become important. It is also important that observers receive proper training to ensure that beginning and end points of the survey reach are effectively recorded for repeatability.

Establishment of Objectives and Observation Recording System

Before beginning any visual assessment program, it is important to review the objectives and reasons for the program and establish an observation recording system tailored to the task at hand. A panel of professional-level staff should go over all available information, including maps, previous assessments, and current local information in order to establish the critical parameters and effective assessment locations. Once set, these critical parameters help in designing viable visual assessor training programs.

Initial Training Program

All visual assessors, regardless of prior experience, should attend an initial training session for each study. In this training session, the professional-level staff describes the location, condition and critical parameters for the study. Visual aids showing unique or interesting points, and assigned viewing or photographic points should be used. The professional-level staff should go over the observation-recording sheet, explaining the parameters, scoring system, and critical points. A mock observation should be conducted using a well-characterized site and the observation-record sheets for each assessor compared. The initial training program is considered complete when all assessors agree within one scoring unit for each of the scored elements in the observation record.

Refresher Training Program

All visual assessors, regardless of number of years of experience with a study, must complete a refresher training course each year, or more often if an outside audit shows deviations from prescribed practices. The refresher training should be equal in scope as the initial training, but may be "condensed" covering only critical elements or topical issues. The same professional-level staff that provided the initial training program should conduct the refresher training program. Consideration should be given to the use of mock observations or written tests to confirm the effectiveness of training.

Professional-Level Audits and Supervision

At some interval, professional-level staff should conduct an on-site audit of each team. The audit should cover the team's procedures and record keeping when conducting observations or photographic techniques. The professional-level assessment should report the results of the assessment and any corrective actions, including retraining, necessary to re-establish proper procedure.

Glossary

The following definitions were taken from the following references: 1. California Deptartment of Fish and Game, California Salmonid Stream Habitat Restoration Manual, 1998; 2. Oregon Watershed Enhancement Board, Oregon Watershed Assessment Manual, Salem, Oregon 1999; 3. United States Environmental Protection Agency, Volunteer Stream Monitoring: A Methods Manual, EPA 841-B-97-003, 1997.

Bankfull stage: Corresponds to the discharge at which channel maintenance is most effective, that is, the discharge at which moving sediment, forming or removing of bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels. The bankfull stage is the most effective or is the dominant channel-forming flow, and has a recurrence interval of 1.5 years.[1]

Benthic: Pertaining to the bottom (bed) of a water body.[3]

Canopy cover: The terrestrial vegetation that projects over the stream. [1]

Channel: A natural or artificial waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks which serve to confine the water. [1]

Channelization: The straightening of a stream; this often is a result of human activity. [3]

Cobble: Medium-sized rocks (2-10 inches) that are found in a streambed. [3]

Cover: Anything that provides protection from predators or ameliorates adverse conditions of stream flow and/or seasonal changes in metabolic costs. May be instream cover, turbulence, and/or overhead cover, and may be for the purpose of escape, feeding, hiding, or resting. [1]

Culvert: Man-made construction that diverts the natural flow of water. [3]

Deposition: The settlement or accumulation of material out of the water column and onto the streambed. Occurs when the energy of flowing water is unable to support the load of suspended sediment. [1]

Effluent: Wastewater discharge. [3]

Embeddedness: The degree that larger particles (boulders, rubble, or gravel) are surrounded or covered by fine sediment. [1]

Fish habitat: The aquatic environment and the immediately surrounding terrestrial environment that, combined, afford the necessary biological and physical support systems required by fish species during various life history stages. [1]

Flow: a) The movement of a stream of water and/or other mobile substances from place to place; b) The movement of water, and the moving water itself; c) The volume of water passing a given point per unit of time. Synonym: Discharge. [1]

Glide/run: Section of a stream with a relatively high velocity and with little or no turbulence on the surface of the water. [3]

Headwaters: The origins of a stream. [3]

Instream cover: Areas of shelter in a stream channel that provide aquatic organisms protection from predators or competitors and/or a place in which to rest and conserve energy due to a reduction in the force of the current. [1]

Lake: An inland body of standing water of considerable size.

Macroinvertebrate: Organisms that lack a backbone and can be seen with the naked eye. [3]

Outfall: The pipe through which industrial facilities and wastewater treatment plants discharge their effluent (wastewater) into a waterbody.[3]

Pool: Deeper portion of a stream where water flows slower than in neighboring, shallower portions. [3]

Pool-riffle ratio: The ratio of the surface area or length of pools to the surface area or length of riffles in a given stream reach, frequently expressed as the relative percentage of each category. [1]

Reach: A section of stream possessing similar physical features such as gradient and confinement; usually the length of stream between two tributaries.[2]

> Representative reach: A length of stream that represents a large section of the stream with respect to area, depth, discharge, and slope.
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> Specific reach: A length of channel uniform with respect to selected habitat characteristics or elements (discharge, depth, area, slope, population of hydraulic units), fish species composition, water quality, and type and condition of bank cover.

Reservoir: An artificial lake where water is collected as a water supply.

Riffle: Shallow area in a stream where water flows swiftly over gravel and rock. [3]

Riparian: Pertaining to anything connected with or immediately adjacent to the banks of a stream or other body of water. [1]

Riparian vegetation: Vegetation growing on or near the banks of a stream or other body of water on soils that exhibit some wetness characteristics during some portion of the growing season. [1]

Riparian area: The area between a stream or other body of water and the adjacent upland identified by soil characteristics and distinctive vegetation. It includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation. [1]

Rip-rap: Rocks used on an embankment to protect against bank erosion. [3]

Sediment: Fragmental material that originates from weathering of rocks and decomposition of organic material that is transported by, suspended in, and eventually deposited by water or air, or is accumulated in beds by other natural phenomena. [1]

Seep: An area of minor ground water outflow onto the land surface or into a stream channel. Flows are too small to be a spring. [1]

Sheen: The glimmering effect that oil has on water as light is reflected more sharply off of the surface. [3]

Stream (includes creeks and rivers): A stream is a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation. [1]

> Types of streams:
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> Ephemeral: One that flows briefly only in a direct response to precipitation in the immediate locality and whose channel is at all times above the water table.

Intermittent or seasonal: One in contact with the ground water table that flows only at certain times of the year as when the ground water table is high and/or when it receives water from springs or from some surface source such as melting snow in mountainous areas. It ceases to flow above the streambed when losses from evaporation or seepage exceed the available flow.

Perennial: One that flows continuously throughout the year. Synonym: Permanent stream.

Stream bank: The portion of the channel cross section that restricts lateral movement of water at normal water levels. The bank often has a gradient steeper than 45 degrees and exhibits a distinct break in slope from the stream bottom. An obvious change in substrate may be a reliable delineation of the bank. [1]

Substrate: The mineral and/or organic material that forms the bed of the stream. [1]

Thalweg: The line connecting the lowest or deepest points along a streambed. The deepest part of the channel. [1]

Tributary: A stream feeding, joining, or flowing into a larger stream. [1]

Undercut bank: A bank that has had its base cut away by the water action along the man-made and natural overhangs in the stream. [1]

Velocity: The time rate of motion; the distance traveled divided by the time required to travel that distance. [1]

Watershed: A catchment area or basin. The total land area draining to any point in a stream, as measured on a map, aerial photo or other horizontal plane. [1]

Wetland: An area subjected to periodic inundation, usually with soil and vegetative characteristics that separate it from adjoining non-inundated areas. [1]

References:

California Coastal Commission, Site Visit Photo Documentation Form.

California Department of Fish and Game Water Pollution Control Laboratory, California Stream Bioassessment Procedure, May 1999.

Delmas, Rick, Kevin Farwell, and Glenn Nader, Monitoring With a Camera, InterMountain, a University of California Working Group.

Flosi, Gary, Scott Downey, James Hopelain, Michael Bird, Robert Coey, and Barry Collins, California Salmonid Stream Habitat Restoration Manual, California Department of Fish and Game, January 1998.

Guenther, Keith, Residual Dry Matter Monitoring Photo-Guide, Wildland Solutions Field Guide Series, 1998.

Harrelson, Cheryl C., C.L. Rawlins, and John P. Potyondy, Stream Channel Reference Sites: An Illustrated Guide to Field Techniques, United States Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-245.

Hannaford, Morgan J., Michael T. Barbour, and Vincent H. Resh, "Training reduces observer variability in visual-based assessments of stream habitat," Journal of The North American Benthological Society, Vol. 16, No. 4, 1997, pp.853-860.

Marcus, Laurel and Dennis Jackson, Creating a Watershed Atlas and Monitoring Program: Watershed Stewardship Workbook, Sotoyome Resource Conservation District, 1999.

Mill Valley Watershed Project, Stream Survey Data Collection, July 1996.

Oregon Watershed Enhancement Board, Oregon Watershed Assessment Manual, Salem, Oregon 1999.

Save Our Streams Program, Izaak Walton League of America, Save Our Streams Stream Quality Survey, April 1994.

606 Studio of California Polytechnic University, Pomona, Malibu Creek Watershed Stream Team Field Guide.

Starrett, Gwen, and the Los Angeles Volunteer Monitoring Steering Committee, Southern California Volunteer Monitoring Quality Assurance Project Plan, 1998.

United States Department of Agriculture, Forest Service, Northern Region, Stream Reach Inventory and Channel Stabilization Evaluation, a Watershed Management Procedure.

United States Department of Agriculture, Natural Resources Conservation Service, Stream Visual Assessment Protocol, National Water and Climate Center Technical Note 99-1, Dec. 1998.

United States Environmental Protection Agency, Volunteer Estuary Monitoring: A Methods Manual, EPA 842-B-93-004, 1993

United States Environmental Protection Agency, Volunteer Lake Monitoring: A Methods Manual, EPA 440/4-91-002, 1991.

United States Environmental Protection Agency, Volunteer Stream Monitoring: A Methods Manual, EPA 841-B-97-003, 1997.

University of California Center for Range and Forested Ecosystems, "Rangeland Monitoring #5," in Monitoring California's Annual Rangeland Vegetation, UC/DANR Leaflet 21486, Dec. 1990.