Aquatic Inventories Program
Methods for Stream Habitat and Snorkel Surveys

Inland Fish Science Program
Oregon Department of Fish and Wildlife

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Methods for Stream Habitat and Snorkel Surveys
Aquatic Inventories Program

Conservation and Recovery Program:
Oregon Department of Fish and Wildlife

Introduction

The Aquatic Inventories Program's stream habitat survey protocol is designed to provide quantitative information on habitat conditions for wadeable streams throughout Oregon. This information is used to provide basic information for biologists and land managers, establish monitoring programs, and direct or focus habitat restoration efforts.

Development of an Aquatic Inventories Program began within the Oregon Department of Fish and Wildlife (ODFW) in 1989 with sponsorship by the Restoration and Enhancement Program. The drafting of stream survey methods and implementation of fieldwork began in 1990. The conceptual background for this work came from the experience of project staff and interactions with Oregon State University, the forest industry, and USFS PNW research scientists (Bisson et al. 1982, Grant 1986, Everest et al. 1987, Hankin and Reeves 1988, Moore and Gregory 1989, and Gregory et al. 1991). Significant contributions and reviews of these methods were provided by ODFW research staff and from consultation with ODFW and United States Forest Service (USFS) biologists working on similar programs. Members of the Umpqua Basin Fisheries Restoration Initiative and the Oregon Forest Industry Council have provided additional review and consultation. Although a basin-type census survey was the primary driving force in developing these methods, additional objectives can be addressed using this stream habitat protocol. In 1998, monitoring programs under the Oregon Plan for Salmon and Watersheds were designed to assess the status and trend in fish populations and aquatic habitat in Oregon's coastal basins and later for Lower Columbia River tributaries. Additionally, the effectiveness of stream restoration efforts can be evaluated with these methods.

This methodology was designed to be compatible with other non–ODFW stream habitat inventories and classification systems (i.e., Rosgen 1985, Frissell et al. 1986, Cupp 1989, Ralph 1989, USFS Region 6 Level II Inventory 1992, and Hawkins et al. 1993). This compatibility is achieved by systematically identifying and quantifying valley and stream geomorphic features. The resulting matrix of measurements and spatial relationships can then be generalized into frequently occurring valley and channel types or translated into the nomenclature of a particular system. For example, information summarized at the reach level (valley width, channel type, slope, terrace height and width, sinuosity, width, depth, substrate, etc.) can be used to characterize the stream into one of the types described by Rosgen (1985) or to match the parameters collected in other quantitative (USFS) or historic (U.S. Bureau of Fisheries) surveys.

Conducting a stream habitat survey involves collecting general information from maps and other sources and the direct observation of stream characteristics in the field. Habitat assessment objectives may vary depending on the questions to be answered. Whether using a Generalized Random Tessellation Stratification (GRTS) survey design (Stevens and Olsen, 2004) or a basin (census) type survey design to conduct stream habitat surveys, this manual describes how to identify and collect pertinent stream habitat data using a standardized

protocol. This information is collected and analyzed based on a hierarchical system of regions, basins, streams, reaches, and habitat units. Region and basin data will primarily come from ODFW-EPA region and subregion classifications and map analysis. Supervisors will collect general information on regions and basins and direct the survey crews' activities. Survey teams will collect field data based on stream, reach, and channel unit characteristics.

The following instructions and definitions provide the outline for these activities and a description of the tasks involved in conducting ODFW's stream habitat inventory.

Each field crew comprises two people, with each member responsible for specific tasks, including identifying channel unit characteristics, the length and the average width of habitat units, the counts and relative distribution of several unit attributes, and more. The crew will share the responsibility for describing reach characteristics and riparian features, identifying habitat unit types, and quantifying the amount of large woody debris. Crew members may switch responsibilities when they start a new stream. They cannot, however, switch responsibilities on the same stream.

WATERSHED INFORMATION

Watershed information is gathered prior to and during the survey. Some of this information (primarily map work and regional classification) must be collected in the office. Most of this information is not the responsibility of the field crews. However, relevant comments by the survey crews should be included in their Field Books and on the Data Sheets. These summaries are used to group and classify streams and provide general information for the final analysis and reports.

1. Basin name. Use the name of the large river commonly used to describe a region. For example, use McKenzie River for Lookout Creek, not Willamette or Columbia.

2. Stream name. Use a standardized system of the name followed by descriptors of forks etc. Examples: Alsea R, Drift CR, Lobster CR, E FK. Spell out descriptive or non-standard types such as Branch, Slough, or Swale. Spell out compass direction only for larger streams and when the usage is common, such as the North Umpqua. If the site's identification is pre-determined with a name and/or number due to survey design, make sure to include this data when filling in the header information on datasheets. Use the same name format on all datasheets.

3. Stream order, drainage area, and drainage density of the study stream. Determined from blue line tributaries (perennial and intermittent) shown on U.S.G.S. 7.5-minute topographic maps.

4. Elevation (m) at the beginning and end of the survey and at reach changes (if applicable). These can be obtained from the GPS unit if adequate satellite coverage is available. Otherwise, they will have to be interpreted from the USGS topographic map.

5. ODFW-EPA Eco-Regions and Sub-regions, geology, and soils of the basin.

6. Stream Flow. Identify the location of USGS or other gauging stations. The location and stage height at any gauging station, marked bridge, or staff gauge will also be recorded during the survey.

7. Description of fish species present, management concerns, and linkage to other databases or research projects.

8. Flow Regulation: Description of existing or proposed dams, fish ladders, and diversions influencing the basin or site segment.

9. General description of land use and ownership in the basin (e.g., managed timber, rural residential, agricultural, livestock grazing).

10. Contacts. Provide the names, addresses, and phone numbers of key people to contact regarding the survey. This list should include ODFW district biologists, interested private individuals, landowners contacted for access, etc. **Do not trespass**.

EQUIPMENT

To conduct a thorough survey of a stream and its basin, it is important to have the right equipment and clothing. This includes USGS topographic maps, waterproof field books, survey forms, and paper. You will also need chest waders, rainwear, and appropriate clothing for the weather. Other essential tools include a measuring tape, compass, clipboard, and digital camera. It is also important to have safety gear, such as a first aid kit, headlamp, and CB radio. For a complete equipment list, please see page 40.

1. Maps – 7.5-minute quad (1:24,000 scale) USGS topographic maps of the stream and basin. Road map coverage by county or fire district. Oregon Atlas and Gazetteer (Delorme Mapping).

2. Recording Materials - Waterproof field book, survey forms for each component of the survey, waterproof paper, tablet, and pencils.

3. Clothes—Chest or hip waders, wading boots (non-slip soles are advised), rainwear, and clothing appropriate for the weather conditions.

4. Survey equipment – Two-meter-long depth staff (marked in meters and tenths). Compass, 50-meter fiberglass measuring tape, backpack, polarized glasses, thermometers, clinometer, clipboard, survey vest, flagging, permanent markers, phone/tablet, camera, paper data sheets, GPS device, and range finder.

5. Safety gear – First aid kit, poison oak pretreatment, headlamp, CB radio, cell phone, whistle, safety, or polarized glasses.

MAP WORK

Do not go into the field without a topographic map! Data that cannot be linked to the maps are essentially useless. Use the maps to orient to the stream and to identify the location of reach changes, named tributaries, roads, and bridge crossings. Clearly mark where you start and end the survey, and areas where you are denied access. Mark all reach changes (if they exist) and important features on the map. Write the channel unit number on the map at the place that corresponds to the location of named tributary junctions, bridges, and other landmarks.

Good correspondence between landmarks on the map and the data collected is essential for our survey effort. Survey information will be utilized and integrated with Geographic Information System (GIS) analysis. Well-documented and accurate maps are required for this process. In addition to a well-marked map, it is essential that the habitat survey follow the USGS-named stream on the topo map, regardless of the amount of flow.

See Appendix 2 for an example of field entries on a topographic map when conducting a Basin (census) type survey.

Record the Easting and Northing UTM coordinates at the beginning of the survey, at all reach changes (if applicable), at channel metrics and riparian transects, and at the end of the survey.

FIELD BOOK

Maintain a succinct log of your activities in the field book. Each day, record the date, the name of the stream or site you surveyed, and the unit numbers surveyed. Record relevant details about access to the stream, name(s) of corporate contacts of cooperating industry or agency groups, and private landowners you contact to gain permission to survey. Pay particular attention to descriptions of the riparian zone, additional details concerning land use, or factors that influence the fish populations. This is the appropriate place to express your opinions. Other comments, sketches of complex features, suggestions, complaints, etc., are helpful.

PHOTOGRAPHS

A good photograph and photographic record of the stream survey provide additional information and documentation. Take pictures that typify the reach at a site, any reach changes, riparian zones, interesting or unusual plants, animals, culverts, potential barriers, and other stream characteristics as described in this manual. For each picture, label the photo on your device (Appendix 4) with a complete description of the photographed subject. Remember, more photos are better than too few. Take time and effort with your photos. Make sure the photo is taken from the best angle possible and is in focus, and the content represents a clear and concise image of what you want to portray.

DATA COLLECTION

Reach Entry/ Data

A reach is a length of stream defined by some functional characteristic or identified in advance via survey design. It may be simply the distance surveyed but is more frequently defined as a stream segment with consistent valley and channel formation (geomorphology). However, depending on survey design (random or census surveys), identifying a stream reach within a watershed can lead to significant changes in vegetation type, land use or ownership, and stream segments between named tributaries. See Appendix 1 or 2 for survey-specific details.

1. **Crew Members**. Name of each member of the survey crew.
2. **Reach Number**. The numbered sequence of reaches as they are encountered. Each reach is comprised of a variable number of channel units.
3. **Unit Number**. Sequence number(s) of the first unit recorded.
4. **Resurvey**. Indicate whether the survey is a resurvey.
5. **Survey Conducted.** Select the survey type from the drop-down list.
6. **Fish Survey Type.** Select the type of fish survey that was conducted.
7. **Mussel Presence.** Select the corresponding totals and sizes from the drop-down menu if mussels were present, shells were collected, and Asian clams were observed.
8. **Beaver Activity.** From the drop-down menu, select all the relevant observations related to the Beaver's presence or absence.
9. **Amphibians Observed.** Select all the applicable amphibian presence or absence observations from the drop-down menu.
10. **Crayfish Observed.** Select all the applicable Crayfish presence or absence observations from the drop-down menu.
11. **Channel Form.** Determined by the morphology of the active channel, hill slopes, terraces, and flood plains. Identify the channel form and enter the appropriate two-letter code in this column.

    Refer to Valley and Channel Classification definitions, allowable combinations, and examples on pages 34-36.

    First, look at the ratio of the active channel width to the valley floor width to determine the **Valley Width Index** (VWI) (see page 7, #13).

    The **active channel** (also referred to as the bankfull stage) is the stage associated with the flow that just fills the channel to the top of its banks and at a point where the water begins to overflow onto a floodplain (Leopold et al. 1964). This flow is associated with a momentary maximum flow with an average recurrence interval of 1.5 years, as determined using a flood frequency analysis. This stage corresponds to the discharge at which channel maintenance is the most effective. Sediment shifts and modifies bars, bends, and meanders, resulting in the average morphological characteristics of channels.

The valley floor width is simply the width of the valley from the toe of the hillslope on one side to the toe of the hillslope on the other. This ratio determines if you are in a **broad** (VWI > 2.5) or **narrow** (VWI ≤ 2.5) valley floor type.
Next, look at the types of landforms adjacent to the stream channel to characterize and complete your classification.

The channel is constrained when adjacent landforms restrict its lateral movement. In constrained channels, stream flows associated with all but the most significant flood events are confined to the existing channel configuration.

- Narrow Valley Floor Types (VWI ≤ 2.5) Always constrained, defined by the characteristics of the constraining feature.

  CB **C**onstrained by **B**edrock (bedrock-dominated gorge)
  CH **C**onstrained by **H**ill slope

- Broad Valley Floor Types (VWI > 2.5) The valley is several times wider than the Active Channel. The channel, however, may be either unconstrained or constrained depending on the height and configuration of the adjacent landforms.

  Unconstrained Channel (terrace height < flood-prone height*and the flood-prone width* > 2.5X active channel width). Low terraces, overflow channels, and floodplains are adjacent to the active channel (see definition* on page 11; see drawing on page 36).

  US **U**nconstrained-predominantly **S**ingle channel.
  UA **U**nconstrained-**A**nastomosing (several complex, interconnecting channels usually separated by higher terraces with established vegetation, more stable than braided channels).
  UB **U**nconstrained-**B**raided channel (numerous, small channels often flowing over alluvial deposits).

  Constrained Channel (terrace height is greater than the flood-prone height*). Adjacent landforms (terraces, hillslopes) are not part of the active floodplain.

  CT **C**onstraining **T**erraces. (Terrace height > flood-prone height and flood-prone width < 2.5 X active channel width).
  CA **C**onstrained by **A**lternating terraces and hill slopes. Same rule for terrace height, but the channel may meander across the valley floor.
  CL **C**onstrained by **L**and use (road, dike, landfill)

12. **Valley Form.** General description of the valley cross-section with emphasis on the configuration of the valley floor. Divided into types with a narrow valley floor (valley floor width (VWI) ≤ 2.5 X stream active channel width (ACW) and types with a broad valley floor (VWI > 2.5 X ACW).

    Narrow Valley Floor (VWI ≤ 2.5) – see page 34 for examples:

    SV **S**teep **V**-shaped valley or bedrock gorge (side slopes ≥60°).
    MV **M**oderate **V**-shaped valley (side slopes >30°, <60°).
    OV **O**pen **V**-shaped valley (side slopes ≤30°).

    On rare occasions when you might encounter a different classification on each side of the stream, record only one on the Reach sheet and note the other in the Note column.

Broad Valley Floor (VWI > 2.5) – see page 34 for examples:

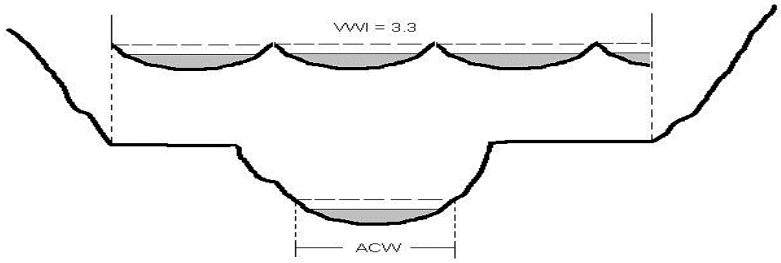
CT **C**onstraining **T**erraces. Terraces are typically high and close to the active channel. The terrace surface is unlikely to receive flood flows and lacks water-dependent (hydrophilic) vegetation.

MT **M**ultiple **T**erraces. Terraces with varying heights and distances from the channel that are within the constraining terrace(s). Lower terraces are annually inundated with high flows.

WF **W**ide-Active **F**loodplain. A significant portion of the valley floor is influenced by annual floods and has water--dependent vegetation (mesic meadow). Any terraces present do not impinge on the lateral movement and expansion of the channel.

Valley Form and Channel Form are related and can only occur in certain combinations (Table 1, page 33).

13. **Valley Width Index.** The ratio of the width of the active stream channel to the width of the valley floor. The Valley Width Index (VWI) is estimated for the Reach by dividing the average *Active Channel Width* by the average V*alley Floor Width*. The VWI is also entered when the channel metric measurements are conducted (see pages 11-12).



Do not start a new reach for minor changes in VWI. However, always start a new reach when the channel changes from VWI < 2.5 to VWI > 2.5; or VWI > 5.

When the valley width repeatedly changes within a short distance, select an average value for the VWI. For example, when the valley floor gradually widens from a hillslope-constrained reach to a broad valley reach, make one reach change, <u>not</u> new reach designations every few channel units.

It is possible to have an unconstrained channel but a VWI of 1. This may occur in some meadow reaches and other situations where the multiple channels and the floodplain spread across the entire valley floor.

Getting out of the stream channel will help you accurately estimate VWI, identify floodplain and terrace surfaces and classify reach types.

14. **Vegetation (Veg Class).** We consider streamside vegetation to be within 10 meters or one active channel width, whichever is greater, of either side of the stream channel. Separate entries are made for the dominant and subdominant plant communities, as estimated by crown density. (Note: In some instances, grass can be the dominant plant taxa). The first letter of the two-letter code identifies the plant community; the second part of the code refers to the size of trees within identified dbh classes.

Ex: C30 (dominant) & G (subdominant) describes a cedar/grass community.
<u>Do not</u> enter a size or age class for shrubs, brush, or grasses.

Vegetation Type:

N	**N**o Vegetation (bare soil, rock)
B	Sage**B**rush (sagebrush, greasewood, rabbitbrush, etc.)
G	Annual **G**rasses, herbs, and forbs.
P	**P**erennial grasses, sedges, rushes, and ferns
S	**S**hrubs (willow, salmonberry, some alder)
D	**D**eciduous Dominated (canopy more than 70% alder, cottonwood, big-leaf maple, or other deciduous spp.)
M	**M**ixed conifer/deciduous (~ 50:50 distribution)
C	**C**oniferous Dominated (canopy more than 70% conifer)

Size Class. Use groupings for the estimated diameter at breast height (dbh) expressed in centimeters of the dominant trees. Estimate the diameter of young conifers below the first whorl of branches. Enter the first number (in bold below) of your choice, ex. C30.

1- 3	Seedlings and new plantings.
3-15	Young established trees or saplings.
15-30	Typical sizes for second-growth stands. West side communities may have a fully closed canopy at this stage.
30-50	Large trees in established stands.
50-90	Mature timber. Developing understory of trees and shrubs.
90+	Old-growth. Very large trees, nearly always conifers. The plant community is likely to include big trees, snags, down woody debris, and a multi-layered canopy.

These size classes correspond to dbh estimated in inches of <1, 1-5,6-11, 12-20, 21-35, and 36+, respectively.

15. **Land Use.** Determined from observations of terraces and hillslopes beyond the riparian zone. Code subdominant land use where appropriate. Separate entries for the dominant and subdominant land uses (i.e. PT (dominant) and HG (subdominant) = **P**artial cut **T**imber and **H**eavy **G**razing). If a code listed below does not adequately describe a land use, use the most appropriate one and make a note. DO NOT create new codes.

AG	**AG**ricultural crop or dairyland.
TH	**T**imber **H**arvest. Active timber management, including tree felling, logging, etc. Not yet replanted.
YT	**Y**oung Forest **T**rees. Can range from recently planted harvest units to stands with trees up to 15cm dbh.
ST	**S**econd growth **T**imber. Trees 15-30cm dbh in dense, rapidly growing, uniform stands.
LT	**L**arge **T**imber (30-50cm dbh)
MT	**M**ature **T**imber (50-90cm dbh)
OG	**O**ld **G**rowth Forest. Many trees with 90+ cm dbh and plant communities with old-growth characteristics.
PT	**P**artial cut **T**imber. Selection cut or shelterwood cut with partial removal of large trees—a combination of stumps and standing timber. If there are only a few live trees or snags in the unit, describe them in the note column.
FF	**F**orest **F**ire. Evidence of recent charring and tree mortality.
BK	**B**ug **K**ill. Forest with > 60% mortality from pests and diseases. Enter bug kill as a comment on the unit sheet when it is observed in small patches.
LG	**L**ight **G**razing Pressure. Grasses, forbs, and shrubs are present, banks are not broken down, and animal presence obvious only at limited points, such as water crossings. Cow pies are evident.

Land Uses Continued:

HG	**H**eavy **G**razing Pressure. Primarily bare earth or early successional stages of grasses and forbs present: broken banks, well-established cow paths.
EX	**EX**closure. Fenced area that excludes cattle from a portion of rangeland
GN	**G**ree**N** way. Designated Green Way areas and parks (city, county, state).
UR	**UR**ban
RR	**R**ural **R**esidential
IN	**IN**dustrial
DW	**D**omestic **W**ater supply watershed.
CR	**C**onservation area or wildlife **R**efuge.
GF	**G**ol**F** course.
MI	**MI**ning
WA	Designated **W**ilderness **A**rea or Wilderness Study Area
WL	**W**et**L**and.
NU	**N**o **U**se identified.
WS	**W**ild and **S**cenic Area

16. **Water Temperature.** Stream temperature is recorded at each reach change or a minimum of once per page of data. Record the time as well. Note if the temperature is measured in ^{o}C or ^{o}F.

    At tributaries, record the stream temperature of the tributary **and** in the mainstem stream upstream from the tributary confluence. Identify and record each temperature in the appropriate line of the Note column.

17. **Stream Flow.** Description of observed discharge condition. Best observed in riffles. If a gauging station is present, be sure to record the stage height.

DR	**DR**y
PD	**P**u**D**dled. Series of isolated pools connected by surface trickle or
LF	**L**ow **F**low. Surface water flowing across 50 to 75 percent of the active channel surface. Consider general indications of low flow conditions.
MF	**M**oderate **F**low. Surface water flowing across 75 to 90 percent of the active channel surface.
HF	**H**igh **F**low. Stream flowing entirely across active channel surface but not at bankfull.
BF	**B**ankfull **F**low. Stream flowing at the upper level of the active channel bank.
FF	**F**lood **F**low. Stream flowing over banks onto low terraces or flood plain.

18. **GPS UTM Coordinates.** Record the Start and End UTM easting and northing coordinates.

19. **Reach Note.** Additional space for comments, names of tributaries, land ownership, and reach start location. Abbreviate by ownership code or use names of the forest, timber companies, ranches, etc. when known.

P	**P**rivate
M	**M**unicipal
C	**C**ounty
T	**T**ribal
GN	**G**ree**N**way
FW	Oregon Department of **F**ish and **W**ildlife
BL	**B**ureau of **L**and Management
SF	**S**tate **F**orest
NF	**N**ational **F**orest
US	**US** Fish and Wildlife Service
WA	**W**ilderness **A**rea

20**.** **Photo Number and Time.** Take photographs that show the stream and riparian zone at each reach change. Record the exposure number and the time displayed on the camera on the Reach and Photo Record sheets.

The Paper Datasheets will have an area for a sketch. In one of the boxes provided on the Reach form, make a sketch of the channel and valley cross-section for each reach. In the box, identify the reach number and reach start GPS reading. Label and give approximate measurements and dimensions for important landform features.

Metric Entry / Data

Channel Metrics are measured near the start of new reaches and at prescribed intervals (see Appendix 1 or 2 for survey-specific detail). The following 1 through 7 are referred to collectively as the Channel Metrics. The Active Channel (see definition on page 5) is the foundation for building these measurements. Be as accurate as possible when identifying 1 & 2 below.

Refer to the Illustrated Channel Metric Measuring Guide on pages 37-39 for detailed instructions for measuring these values in the field.

1. **Active Channel Height.** The vertical distance from the average-level streambed to the top of the Active Channel is determined by averaging 3 equally spaced measurements across the Active Channel at either the pool tail crest (PTC) or fast water unit transition.

2. **Active Channel Width.** The distance across the channel at "bankfull" flow. The boundary of the Active Channel can be difficult to determine; use changes in vegetation, slope breaks, a change in particle size on the stream bank, top of deposited bedload (gravel bars), or high-water marks as clues. Sum the width of all Active Channels in multichannel situations.

3. **Floodprone Height.** The Floodprone Height is determined by simply doubling the Active Channel Height. It is the average depth in the channel during a flood event occurring approximately every 50 years.

4. **Floodprone Width.** The distance across the stream channel and/or unconstraining terraces at Floodprone Height until the flood inundation meets a constraining feature such as a high terrace, hillslope, or anthropomorphic feature. The Floodprone Width is the portion of the Valley Floor that is submerged during a flood event occurring approximately every 50 years.

   The ratio of Floodprone Width to Active Channel Width is necessary to determine the reach type and entrenchment ratio.

5. **Terrace Height.** The height from the average streambed to the top of the high terrace. A high terrace is the first terrace encountered above the Floodprone Height. If there isn't a terrace, no measurement should be recorded.

6. **Terrace Width.** This is the inter-terrace distance measured from the first high terrace lip, across the stream channel, to the corresponding feature (terrace or hillslope) on the opposite side of the stream. In multichannel situations, sum the inter-terrace width of all channels. Measure a terrace width and height if the following two conditions exist:

   1) The Terrace Height is greater than the Floodprone Height

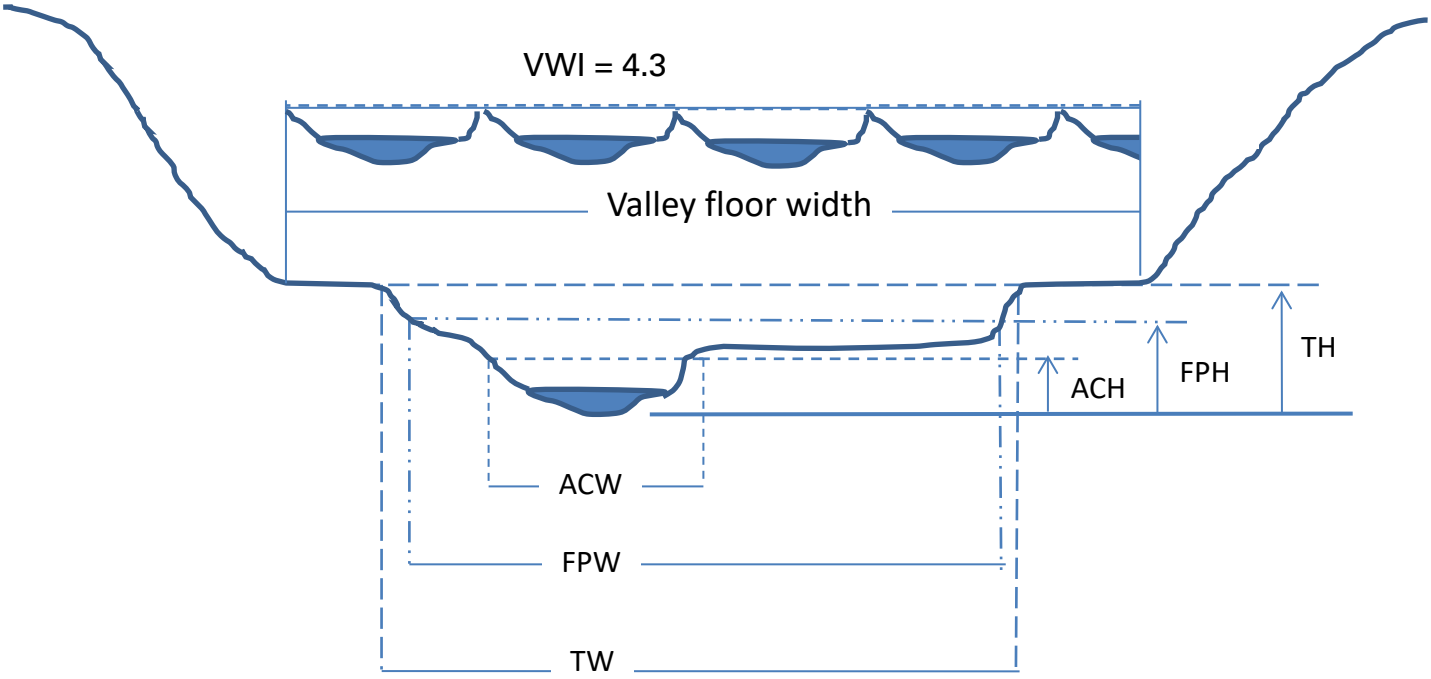
   AND

   2) The Terrace Width is less than 4 times the ACW.

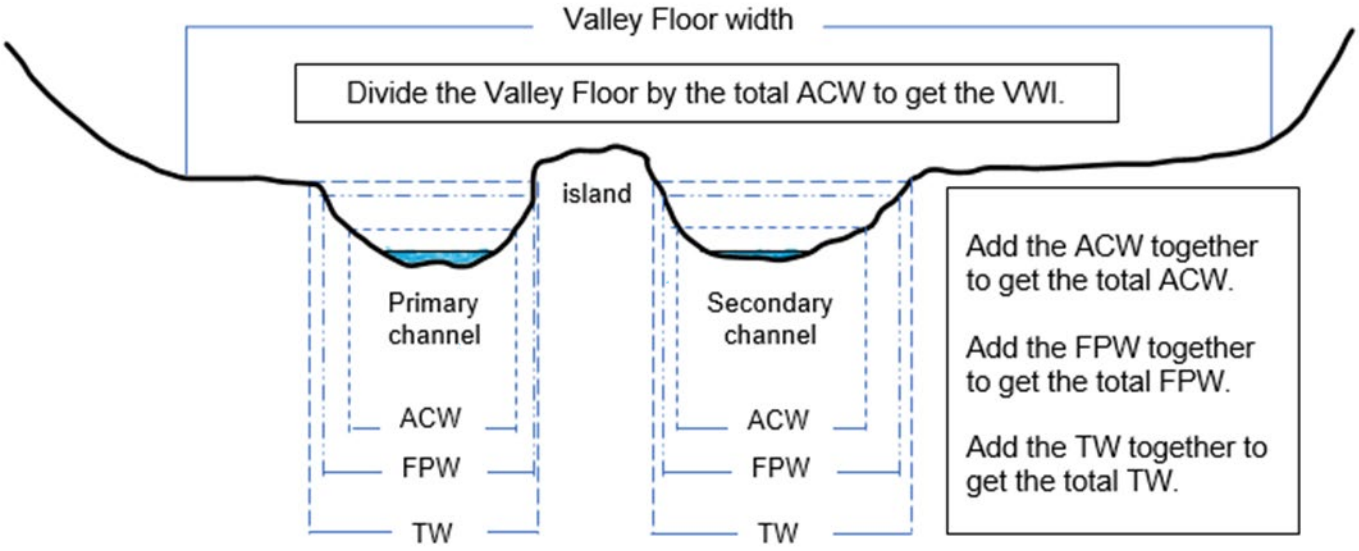
7. **VWI.** Valley Width Index. The same method is described in the Reach section of this Manual (page 7). The ratio of the active stream channel's width to the valley floor's width The Valley Width Index (VWI) is estimated for the reach by dividing the average A*ctive Channel Width* by the average *Valley Floor Width*. Additional estimates improve the accuracy of the average value.

Draw a cross-section of the transect on the appropriate data sheet (see example datasheets pages 43 and 45). Indicate the valley width and VWI estimate on the drawing.

For illustrations of active channel, flood-prone, terrace, and valley width measurements, refer to the diagrams below and in the appendix.



$$\text{VWI (Valley Width Index)} = \frac{\textit{Valley floor width}}{\text{ACW (}\textit{active channel width}\text{)}}$$



Unit Information

Crews work upstream, identifying and characterizing the sequence of habitat units. Proceed up the named stream on the USGS topographic map regardless of flow.

1. **Reach Key.** Matches the number of the Reach.

2. **Reach Number.** Matches the Reach Key; links unit data to reach data.

3. **Unit Number.** The sequential number describing the order of channel habitat units. A reach is comprised of many habitat units.

4. **Unit Class / Description / Type.** The concept of a channel habitat unit is the basic level of notation for our survey methodology. We subdivide the stream into *channel geomorphic unit* classes of unit types (pool, sub-unit pool, fast water, step) and *special case units*.

Channel geomorphic units are relatively homogeneous lengths of the stream that are classified by channel bed form, flow characteristics, and water surface slope. Individual units are formed by the interaction of discharge and sediment load with the channel resistance (roughness characteristics such as bedrock, boulders, and large woody debris). With some exceptions, channel geomorphic units are defined to be at least as long as the active channel is wide.

Channel units are defined (in priority order) based on characteristics of (1) bedform, (2) gradient, and (3) substrate.

Special case units describe situations where the usual channel geomorphic unit types do not occur because of streamflow level or a road crossing. Special case units include dry or partly dry channels and culverts.

GEOMORPHIC CHANNEL UNITS

Characteristic water surface slopes are given for each group of habitat unit types. However, channel bed form and flow characteristics are the primary determinants of unit classification. Use the unit slope to help make determinations when the other characteristics are ambiguous.

CLASS: POOL (The water surface slope is always zero)

PP **P**lunge **P**ool: Formed by scour below a complete or nearly complete channel obstruction (logs, boulders, or bedrock). Substrate is highly variable. Frequently shorter than the active channel width.

SP **S**traight scour **P**ool: Formed by mid-channel scour. Generally, with a broad scour hole and symmetrical cross-section.

LP **L**ateral scour **P**ool: Formed by flow impinging against one stream bank or partial obstruction (logs, root wad, or bedrock). Asymmetrical cross-section. Includes corner pools in meandering lowland or valley bottom streams.

TP **T**rench **P**ool: Slow flow with U or V-shaped cross-section typically flanked by bedrock walls. Often very long and narrow, with at least half of the substrate comprised of bedrock.

DP **D**ammed **P**ool: Water impounded upstream of channel blockage (debris jams, rock landslides). The length may be less than the active channel width.

BP **B**eaver dam **P**ool: Dammed pool formed by beaver activity and always preceded by an SD(step-over-beaver dam). The length may be less than the active channel width.

CLASS: SUBUNIT POOL (The water surface slope is always zero)

Alcoves, backwaters, and isolated pools are types of habitat subunits. Generally, they are shorter than the full channel width. However, they are generally easy to identify and are important habitat types. Subunit pools are formed by eddy scour flow near lateral obstructions.

AL **AL**cove: Most protected type of subunit pool. Alcoves are laterally displaced from the general bounds of the active channel. Substrate is typically sand and organic matter. Formed during extreme flow events or beaver activity; not scoured during typical high flows.

BW **B**ack**W**ater Pool: Found along channel margins; created by eddies around obstructions such as boulders, root wads, or woody debris. Part of the active channel at most flows; scoured at high flow. Substrates typically sand, gravel, and cobble.

IP **I**solated **P**ool: Pools formed outside the primary wetted channel but within the active channel. Isolated pools are usually associated with gravel bars and may dry up or be dependent on inter-gravel flow during late summer. Substrate is highly variable. Isolated pool subunits do not include ponded or perched water pools found in bedrock depressions. Additionally, this unit type is not to be used to characterize isolated pool units encountered within the main channel of puddled or dry channels.

CLASS: FAST WATER

GL **GL**ide: An area with generally uniform depth and flow without surface turbulence. Very low gradient; 0-1 % slope. Glides may have some small scour areas but are distinguished from pools by their overall homogeneity and lack of structure. Generally deeper than riffles with few major flow obstructions and low habitat complexity.

RI **RI**ffle: Fast, turbulent, shallow flow over submerged or partially submerged gravel and cobble substrates. Generally broad, uniform cross-section. Low gradient; usually 0.5-2.0% slope, rarely up to 6%. Low gradient bedrock is considered a rapid (see Rapids below).

RB **R**apid with protruding **B**oulders: Swift, turbulent flow including chutes and some hydraulic jumps swirling around boulders. Exposed substrate is composed of individual boulders, boulder clusters, and partial bars. Moderate gradient; usually 2.0-4.0% slope, occasionally as high as 7.0-8.0%.

RR **R**apid over Bed**R**ock: Swift, turbulent, "sheeting" flow over smooth bedrock. Sometimes called chutes. Little or no exposed substrate. Moderate to steep gradient; 2.0-30.0% slope. Like a riffle, low-gradient bedrock is considered “RR.”

CB **C**ascade over **B**oulders: Much of the exposed substrate is composed of boulders organized into clusters, partial bars, or step-pool sequences. Fast turbulent flow many hydraulic jumps, strong chutes, and eddies; 30-80% whitewater. Slope usually 3.5-10.0% or greater.

CR **C**ascade over Bed**R**ock: Same flow characteristics as Cascade over Boulders, but the structure is derived from the sequence of bedrock steps. Slope 3.5% or greater.

CLASS: STEP

Steps are abrupt, discrete breaks in channel gradient. Steps are usually much shorter than the channel width. However, they are important and therefore need to be recorded. In some cases, steps can separate sequential units of the same type. For example, small steps (<0.3m high) that separate pools may be important features in very low gradient reaches and should be recorded as individual habitat units. Low steps (<0.3m high) in moderate to high gradient reaches formed by gravel and small cobbles on the face of transverse bars can usually be included in the next fast water unit upstream.

Steps are classified by the type of structure forming the step.

SR **S**tep over Bed**R**ock (include hardpan and clay steps)
SB **S**tep over **B**oulders
SC **S**tep over face of **C**obble bar
SL **S**tep over **L**og(s) (natural pieces, including branches and root wads)
SS **S**tep created by **S**tructure (artificial structures, including culverts, weirs, artificial dams, and habitat structures). This unit must be broken out regardless of height.
SD **S**tep created by Beaver **D**am

- *Measure the height from the water surface of the preceding unit to the water surface flowing over the step. Record the step height in the Note column. Take a photograph of any step that is a potential barrier to fish passage.*

- *<u>Always</u> record a step height in the Note column for units **SS** and **SD**, even if it's not possible to determine a passage problem.*

- *Fish ladders should be surveyed as a **single unit** and recorded as **SS**. Use the NOTE field to describe the ladder, its dimensions, name of the facility, etc. Take a photograph.*

CLASS: SPECIAL CASE UNIT TYPES

DU **D**ry **U**nit: Dry section of stream separating wetted channel units. Typical examples are riffles with subsurface flow or portions of side channels separated by large, isolated scour pools. Record all unit data; use average active channel width for width; do not count boulders for the Boulder Count.

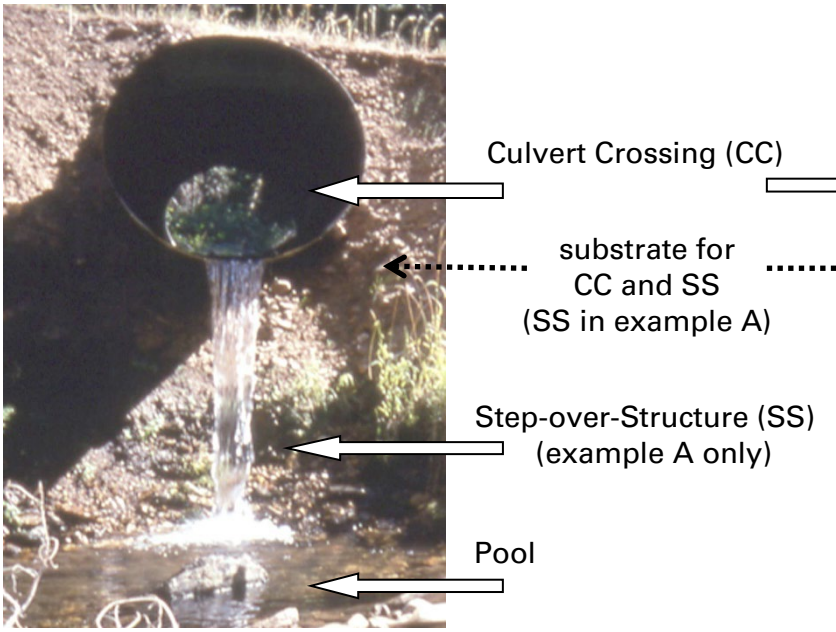
PD **P**u**D**dled: Nearly dry channel but with a sequence of small, isolated scour pools less than one channel width in length or width. Record all unit data, including the average wetted width and modal depth. Note the ACW and any deep pockets in the NOTE field.

DC **D**ry **C**hannel: Section of the main channel or side channel that is completely dry at the time of the survey. Record all unit data; use average active channel width for width; do not count boulders for the Boulder Count.

Note: In dry or puddled units, break out Step unit types (see STEP section above) that are potential barriers to upstream migration as individual units. Record the Step unit type and height as it would appear if wetted. Enter '0' for water depth.

CC **C**ulvert **C**rossing. Stream flowing through a culvert. The shade on a CC unit is recorded as 90° left and 90° right. Record all data as for any other habitat unit.

- *Open-bottom arch culverts are addressed differently; see below.*
- *When surveying a perched culvert, the fill material around the culvert is the substrate composition.*
- *The majority of CC units encountered will have an SS unit type immediately preceding it <u>unless</u> there is absolutely no drop to the water below. The height from the culvert lip to the stream surface (drop) is the SS. Write the SS height in the Notes.*
- *In the Notes, record the length, diameter, material, culvert shape, road name, and a UTM recording. Photograph any culvert that is a potential fish barrier. If possible, have a depth staff or person in the photo to reference the step height. Write "no drop" if there isn't.*



A. Perched culvert, as evident by the water drop. The sequence of habitat units as one proceeds upstream would be pool, SS, CC.

B. Non-perched culvert. Note that there is not a SS prior to CC.

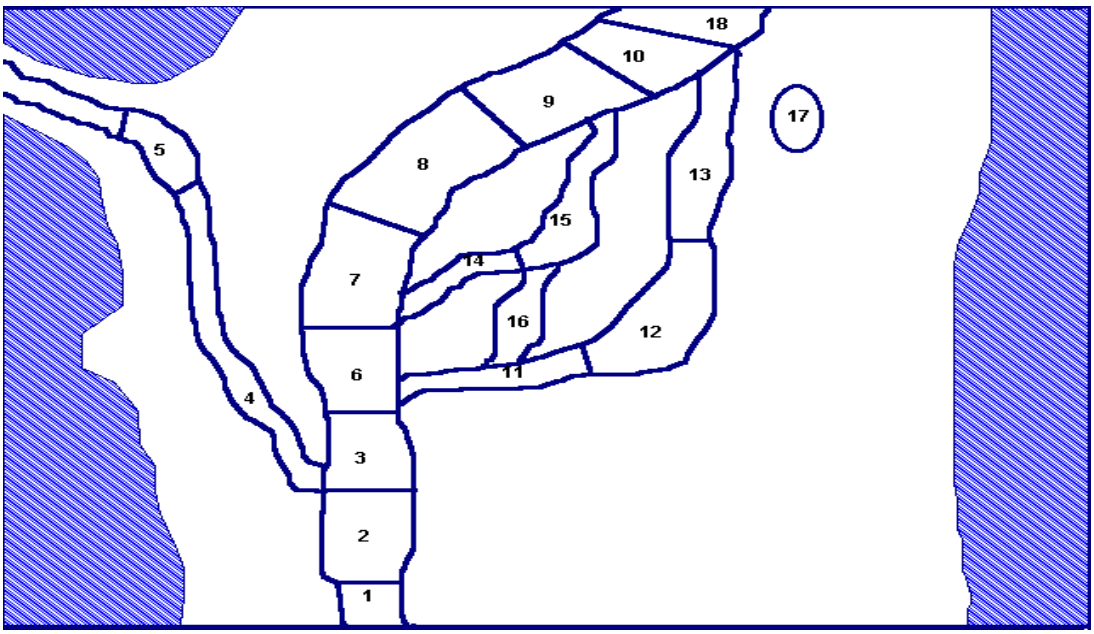
C. Open-bottom arch culvert. <u>Designate habitat unit(s) based on what flows through the culvert</u>. The natural streambed is the source of the recorded substrate. Units may begin or end outside the confines of the culvert, and there may be more than one habitat unit. Note which unit(s) flow through the arch culvert.

Unit 1 Entry / Data

1. **Unit Number.** The sequential number describes the order of channel habitat units. A reach is comprised of many habitat units.

2. **Channel Type.** Channel ordering code based on channel by size and location. Orders the sequence of single, multiple, and side channels.

   00 Single channel. No multiple channels (all flow in one channel)
   01 Primary channel (of multiple channel reach or in the unit where a tributary enters the channel)
   02 Side channel - secondary, tertiary, etc. channel* (of multiple channel reach)
   10 Isolated Pools, Alcoves, or Backwater Pools.
   11 Primary channel of valley floor tributary. If the tributary has a name, write it in the note column.
   12 Side channel of valley floor tributary



UNIT NUMBER	UNIT TYPE	CHANNEL TYPE	% FLOW
1	RI	00	100
2	LP	00	100
3	RB	01	90
4	RI	11	10
5	PP	11	10
6	RI	01	80
7	CB	01	80
8	RB	01	80
9	RI	01	80
10	LP	01	90
11	RI	02	15
12	LP	02	10
13	RB	02	10
14	RI	02	5
15	RP	02	10
16	RI	02	5
17	IP	10	0
18	CB	00	100

*In most cases, these channels are separated from the primary channel by an island-type feature (terrace, gravel bar) that is higher than the active channel.

The primary channel must be identified with the proper code. This information is used in a critical data analysis step to calculate primary and secondary channel length and sinuosity.

The intention is to survey and quantify all aquatic habitats within the valley floor. The inventory considers the stream as the system of all channels that transport water down the drainage. Classify all channels and unit types with a channel code and an estimate of the percent of total flow carried in each channel.

Surveying non-primary channel stream habitat:

- **At tributary junctions**

  Survey and record at least one habitat unit and additional habitat units (if applicable) that the primary channel would impact at bankfull flow. Tributary channels are identified and surveyed regardless of flow. Tributary channel units will be numbered and sequenced from the point where the tributary enters the main channel. Be sure to use the proper channel type code.

  Note a tributary junction with Comment Code TJ on the Unit Wood sheet; record the tributary's active channel width and temperature in the Note column. Refer to the topo map and indicate the tributary referencing the unit number into which the tributary flows. At each channel junction, estimate the percent of the total flow in each channel.

  When in doubt as to which is the primary channel and which is a tributary, proceed up the named stream on the USGS topographic map regardless of flow. If both channels are unnamed, proceed up that with the most significant flow.

  A tributary differs from a spring seep because it will have a defined channel. Spring seeps are not surveyed and are noted with a Comment Code SS.

- **In anastomosing or braided channels:**

  Continue upstream, always taking the channel with the most significant flow, until reaching the unit where the stream again forms a single channel. Backtrack and survey the sequence of units in the side channel, then the sequence of units in the side channel with the next most flow, etc.

3. **Percent Flow.** Visual estimate of the relative amount of flow in the channel, in each channel where multiple channels occur, or the contribution to total flow from a tributary. Record 0% for alcove, backwater, and isolated pool unit types. For dry unit types, do not try to estimate what the percentages would be if water were present – record 100% in the 00 or 01-channel unit(s) and 0% for the 02-channel unit(s).

This isn't easy to measure accurately. Don't be concerned about balancing your totals for flow to 100 percent. The information is used to identify the relative contribution or distribution of flow. Record the active channel width (ACW) and tributary temperature in the Note column.

4. **Depth at Pool Tail Crest.** The pool tail crest (PTC) location is where the water surface slope breaks into the downstream habitat unit. Measure the maximum depth to the nearest 0.01 meter along the hydraulic control feature that forms the pool. For beaver ponds unit type (BP) that does not have water flowing over the top of the dam, yet there is subsurface flow through the sticks and logs of the dam, record the PTC depth as 0.01 meter. For subunit pools (BW, AL, IP), a PTC is neither measured nor recorded.

5. **Unit Width.** The average width of the wetted channel. Measure the width at 3 locations and record the average width. On multiple wetted channel units, such as step-over-bedrock, where several wetted slots are carved into the rock, record the sum of the wetted widths. Pool measurements must yield the correct pool area; take additional measurements as needed.

6. **Depth.** Modal or typical depth in glides and fast water units; maximum depth in pools. Measure to the nearest 0.05 meter as accurately as possible in pools. Probe the bottom with the depth staff to find the deepest point. Small differences in pool depth can be significant.

7. **Unit Length.** Length of each unit in meters as measured along the thalweg of the unit. Measure every unit with a tape or range finder. Pools are always measured as a continuous, single unit. Restrictions to the measured length of non-pool units may vary according to the survey design. See Appendix 1 or 2 for survey-specific details.

8. **Substrate.** Percent distribution by streambed area of substrate material in six size classes: silt and fine organic matter, sand, gravel (pea to baseball. 2-64mm), cobble (baseball to bowling ball; 64-256mm), boulders, and bedrock. Estimate distribution relative to the total area of the habitat unit (Wetted area only). Round off each class to the nearest 5 percent.

   Do not worry about totaling your estimates exactly to 100%; the values will be weighted accordingly during analysis.

   *At units, **SS**, **SL**, and **CC,** estimate the distribution of the surrounding and/or supporting substrate to the best of your ability. For open-bottom culverts, estimate the substrate as for a geomorphic habitat unit.*

   Your estimate should include fine sediment that covers and embeds gravel and cobble. A thin layer over bedrock or boulders should not. Be sensitive to the difference between surface flocculants and other fine sediments.

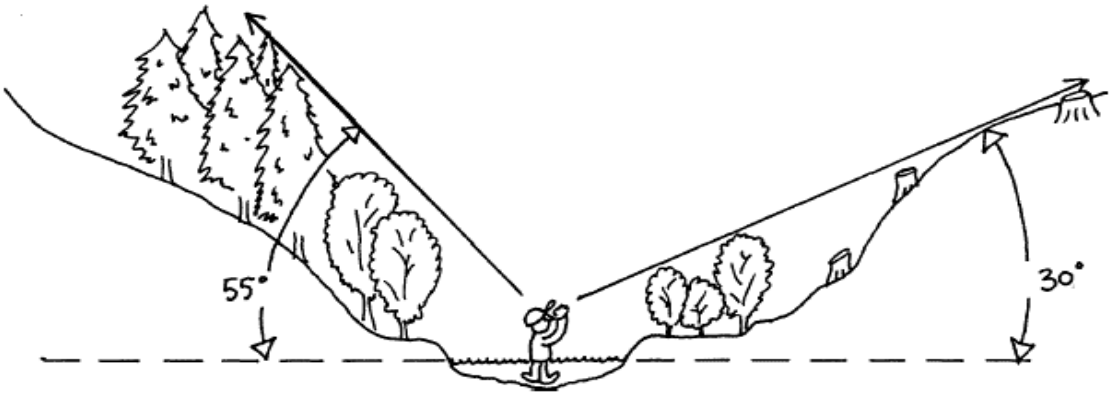
   Hardpan clay or conglomerate substrate has bedrock characteristics. Therefore it is classified as bedrock when estimating percent composition. Indicate this distinction in the Note field.

9. **Note.** Any pertinent additional information or items of interest. Please be descriptive. Use the yellow field book if needing additional space for detail or drawings. Observations to include in the Note column are fish or wildlife observations (be specific if possible), description of channel structure, names of roads or tributaries, step heights, non-native vegetation, stream, or tributary temperature, etc. If a debris jam, habitat structure, or mass movement spans more than one habitat unit, indicate the units impacted.

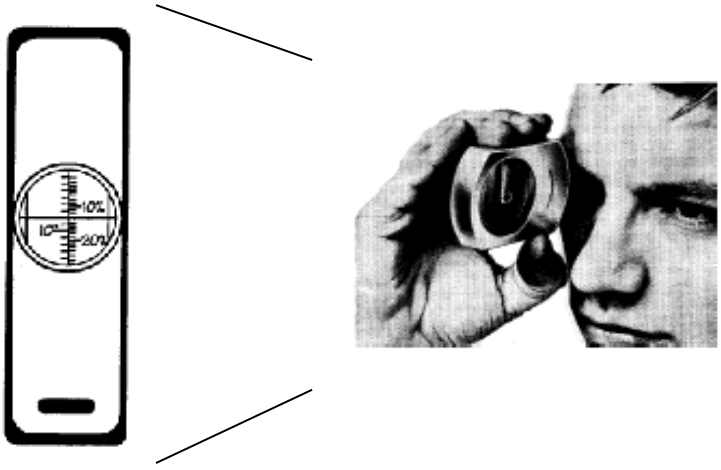
Unit 2 Entry / Data

1. **Unit Number.** Corresponds to the same number as UNIT 1.

2. **Channel Shade.** (Shade Left and Shade Right on datasheet). Measured with the clinometer as the **degrees** (<u>left</u> side in the viewfinder) above horizontal to the top of highest riparian vegetation (<u>≤</u>90º). Measured perpendicular to the channel unit on the left and right banks from the beginning of the habitat unit. If the value derived is from topographic shading, indicate this in the Note column.



3. **Slope.** The gradient of the water surface in the unit. It is expressed as the **percent** change in elevation over the length of the unit and estimated with a clinometer using the scale on the <u>right</u> side in the viewfinder.



4. **Step Height**. Measure the height from the water surface of the preceding unit to the water surface flowing over the step. Record the step height in the Note column. Take a picture of any step that is a potential barrier to fish passage.

> *<u>Always</u> record a step height in the Note column for the **SS** and **SD** unit type, regardless of whether a passage problem can be determined.*

5. **Boulder Count.** The count of boulders greater than 0.5 m in diameter. Within this size class, include only the boulders that have any portion exposed above the water surface and those within the active channel that are touching water. Boulders in dry units and dry channels are not counted.

6. **Undercut Bank.** Areas formed by overhanging bank material and root wads, which provide cover for fish. The undercut must be at least 1 meter long and have an average of 15 horizontal centimeters of the immediate overhanging ceiling. The ceiling of the undercut must be at or below ACH. If present, choose the appropriate box, 'Yes' or 'No.'

7. **Comment Codes.** Comments identifying important features. Enter as many codes as appropriate. For codes that apply to a specific bank, use a slash (/) to indicate the stream, and (when looking upstream) record those features originating on the left side of the slash, and likewise for those features on the right.

   AM **AM**phibian. Record species (if known) in the Note field.

   BC **B**ridge **C**rossing. Record the road name or number in Note field.

   BD **B**eaver **D**am. Include height of step/dam created by beavers.

   BK **B**ug **K**ill. Patches of insect or disease tree mortality.

   BV **BeaVer** Activity (beaver den, cut trees, chewings, pond, etc.) Indicate the age of the activity—very old, old, new, recent, or fresh.

   CC **C**ulvert **C**rossing. Stream passes through a culvert—record road name or number, as well as culvert material and dimensions. There must be a matching CC unit type.

   CE **C**ulvert **E**ntry. Applies to those tributaries a distance from the stream, usually for road drainage.

   CS **C**hannelized **S**treambanks. Rip-rap or other artificial bank stabilization and stream control.

   DJ **D**ebris **J**am. Accumulation of large woody debris that fills the majority of the stream channel and traps additional sediment and debris. These have potential to alter channel morphology.

   FC **F**ence **C**rossing.

   GS **G**auging **S**tation.

   HS Artificial **H**abitat **S**tructure. Describe type: gabion, log weir, cabled wood, interlocking log jams, etc. If the habitat structure spans several habitat units, record it in the unit most affected by the structure. Identify the habitat units it spans in the NOTE field.

   MI **MI**ning. Dredging, sluicing, tailings (old/new), equipment, etc.

   PA **P**otential **A**rtificial Barrier. Potential artificial or human-created barrier to upstream or downstream migration of fish.

   PN **P**otential **N**atural Barrier. Potential natural barrier to upstream or downstream fish migration.

   Natural and Artificial Barriers are relative to the stream size, fish species, and fish age class encountering them. Consider these variables when using this Comment Code. Document the height, take photographs, and record in Notes.

   RF **R**oad **F**ord. Road that crosses within the active channel of the stream (no bridge present).

   SD **S**creened **D**iversion. Pump or canal diverting water. Give some indication of size or capacity.

   SS **S**pring or **S**eep. Usually, small amounts of flow (<5% of total flow) directly entering from hillslope. For large springs, estimate the contribution to flow. Springs do not have defined channels.

Comment Codes continued:

TJ **T**ributary **J**unction (both named and unnamed). Use the TJ class only for tributaries with clearly developed channels. Survey even if the trib is dry. Place this code on the associated primary (01) channel unit and indicate the side of the stream where the trib is located. Record the unit number of primary channel unit on the topo map. Place the tributary name on the tributary (11) channel unit and record the tributary temperature and the ACW in the trib Note column.

UD **U**nscreened **D**iversion. Unscreened pump or canal diverting water. Give some indication of size or capacity

WL **W**ild**L**ife use of stream or riparian zone. Identify species if possible. This code refers to everything except fish, amphibians, and shellfish species. Use the AM code for amphibian observations and only record fish or shellfish observations in the Note column.

Do not invent a code if a code does not exist for an observation.
Add detail/description in the Note column.

Mass Movement. A two-part Comment Code to identify the type and condition of mass movements. The first letter of the code identifies the type of mass movement failure; the second letter evaluates the apparent activity of the failure. (Example: AI = inactive debris avalanche.) Do not confuse mass movements with bank erosion. Mass movements are not immediate stream bank-associated scouring or degradation. If a mass movement spans across several habitat units, record it once. Put the Comment Code in the unit most affected and record the other impacted units in the Notes column.

Type:

E **E**arthflow: general movement and encroachment of hillslope upon the channel. Groups of unusually leaning trees can identify these on a hillslope.

L **L**andslide: failure of a locally adjacent hill slope. It is usually steep, broad, and often shaped like a half oval, with exposed soils.

A **A**valanche: failure of small, high-gradient trib. It often appears "spoon-shaped," looking upslope. Water may flow in these intermittent or ephemeral channels, contributing alluvial soils and debris.

Condition:

A **A**ctive: contributing material now.

I **I**nactive: evidence of contribution of material during previous winter or high flows.

S **S**tabilized: vegetated scars, no evidence of recent activity.

Note. If a debris jam, habitat structure, or mass movement spans more than one habitat unit, indicate the units impacted. Additional information to describe or identify the habitat unit, Comment Code, riparian vegetation, fish species, measurements of steps, culverts, barriers, etc.

Wood Entry / Data

This effort aims to apply a standardized and consistent methodology to obtain quantitative estimates of wood pieces and volume and wood distribution within stream reaches. Information will evaluate the effects on fish habitat and channel structure and make quantitative comparisons between streams.

- Minimum size requirement: 15 cm (0.15m) diameter **AND** 3-meter length. Length exception: root wads less than 3m long and at least 15 cm (0.15m) diameter are included and counted on the Wood Form in a specific column (RW<3).

- Count all dead pieces within, partially within, or suspended over the active channel, regardless of the height above the channel. Do not count any live or partially alive woody material. Nurse logs are dead; the material growing on them is live.

- **Measure** the entire length and diameter of each qualifying piece; include the portion outside the active channel. If a log is partially buried, record the length for only that exposed portion.

- A LWD jam consists of 5 or more pieces that meet the minimum size requirements and are in contact with each other. Note: A jam on the Wood Form does not automatically qualify for a DJ Comment Code.

- Indicate if the LWD is part of a habitat project / artificially placed wood. Make sure an HS Comment Code is recorded in the Comment field on the unit sheet for each purposefully placed habitat structure.

- Only make entries for units with woody debris.

1. **Unit Number.** Matches the habitat data unit number.

2. **Diameter.** Measure the diameter of each piece 2 meters from the base of the stem or from the largest diameter—record pieces to the nearest 0.05 meter (e.g., 0.15, 0.20, 0.25, 0.30…, etc.). For pieces ≥ 0.60-meter diameter, be as accurate as possible when determining diameter and length.

3. **Length.** Measure, count, and tally the number of pieces within each length class. Wood >3m but <6m goes in the 3-6m field; wood >6m but <9m goes in the 6-9m field, etc. Root wad <3m long (frequently with a cut end) is a special case and has its own field (Root wad<3).

4. **Wood Note.** Note the tree species, if known, and any other information or assessments of the source (i.e. part of a habitat improvement structure), influence, or character of the woody debris.

***Record and tally all countable pieces**. A photograph CANNOT be used as a substitute for the wood count. However, take a photograph of massive jams so they can be included in the final report.*

Snorkel Entry / Data

See Appendix 3 for a detailed description of the Snorkel Survey protocol.

1. **Unit Number.** The sequential number describes the order of channel habitat units. Snorkel entry unit number corresponds to the (Unit 1 and Unit 2) unit entries.

2. **Visibility.** Rate the visibility of each pool on a scale of 0 to 3.
   0 = Unsnorkelable - Very poor (Zero water visibility)
   1 = Unsnorkelable - Poor (Copious hiding cover or poor water clarity)
   2 = Moderate - Moderate hiding cover or moderate water clarity.
   3 = Little hiding cover and good water clarity.

3. **Species**.
   - Tally the number of **90+mm cutthroat and steelhead and all coho and Chinook salmon** encountered within each pool unit.
   - Record "Yes" or "No" if **Shiners**, **Dace**, or **0+Trout** (steelhead and cutthroat trout <90mm fork length) are observed.
   - Select "Other Fish" from the drop-down menu for any other fish species observed in each pool unit.

4. **Notes.** Any pertinent additional information or items of interest. Please be descriptive. Use the yellow field book if needing extra space for detail or drawings.

Electrofishing Entry / Data

See Appendix 5 for a detailed description of the Electrofishing protocol.

1. **Sequence Number**. Order in which the channel units are sampled.

2. **Unit Number**. Corresponds to the Unit entry.

3. **Unit Class.** Type of habitat unit. Corresponds to the Unit entry.

4. **Average unit width**. Average width (meters) of the habitat unit.

5. **Depth.** Measured modal depth in fast water and maximum depth in pools.

6. **Unit length.** Length of the habitat unit.

7. **Fish. Species, size, number capture**. Refer to Appendix 5 for specifics.

8. **Notes.** Any pertinent information. Be descriptive. Use the yellow field book if additional space is needed for drawings. Take photos as needed.

Barrier Entry / Data

This effort aims to apply a standardized and consistent methodology to obtain quantitative estimates of barriers to fish movement within stream reaches. The information will be used to evaluate the effects on fish passage.

1. **Unit Number.** The sequential number describes the order of channel habitat units. The Barrier entry unit number corresponds to Unit entries.

2. **Barrier Type.** Select the type of barrier from the drop-down menu.
    - Dam
    - Culvert
    - Weir/Sill
    - Falls
    - Cascade

    Record the Passage status as “Absolute,” “Partial,” or “Unknown.”
    Record if a Jump Pool is present.

3. **Pool Depth.** Record the depth in the drop-down menu if a Jump Pool is present.

4. **Notes.** Record information regarding the barrier, including the material, estimated height, estimated width, age, and condition. (ex. 40-meter-tall bedrock waterfall – or - old concrete dam ~7 meters tall by 35 meters wide, appears sound, no visible cracks or leaks.)

5. **Barrier Photo.** Take a photograph of the barrier.

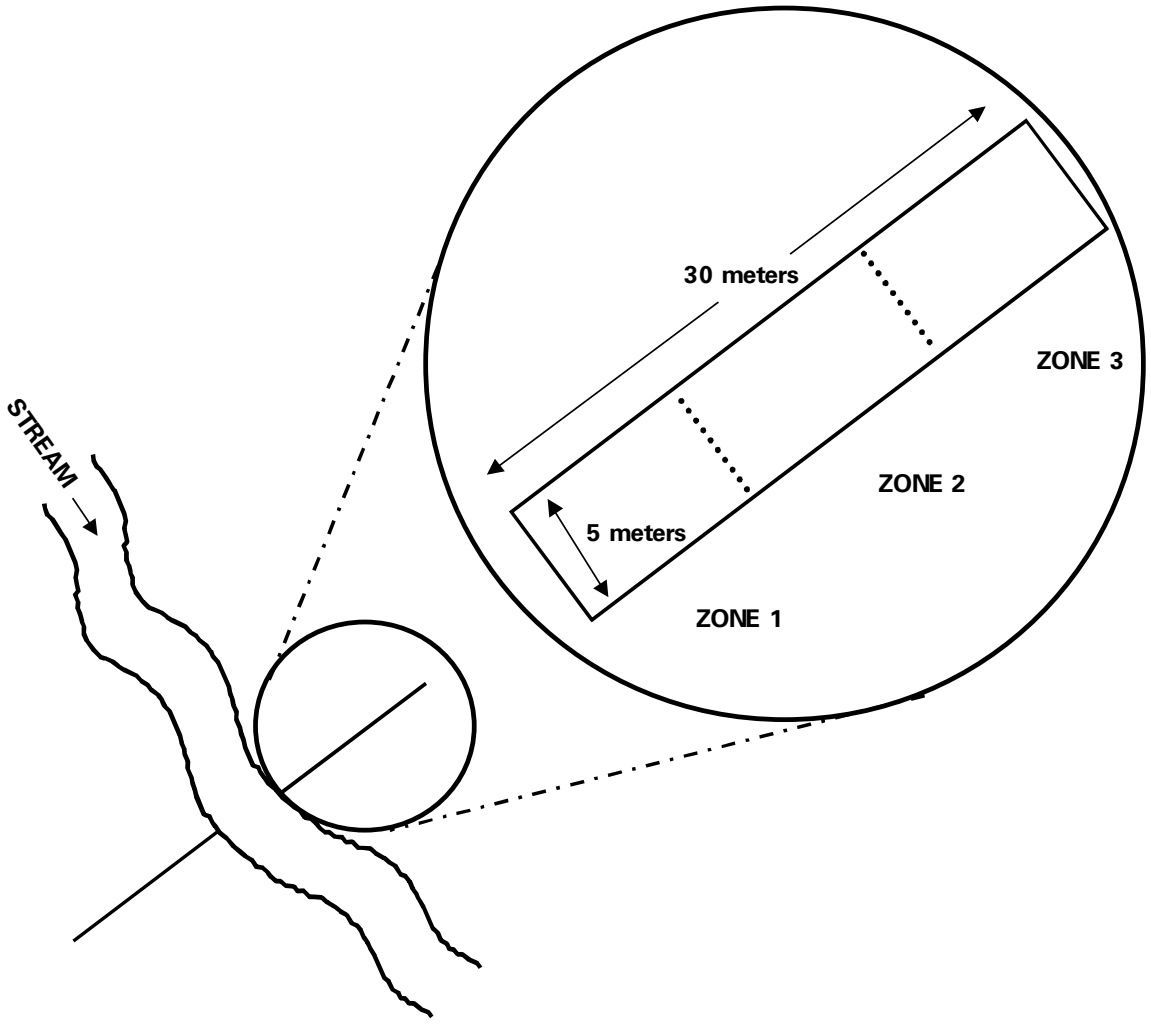
Riparian Entry / Data

Purpose: The Riparian Inventory provides additional quantitative information on the species composition, abundance, and size distribution of riparian zone vegetation.

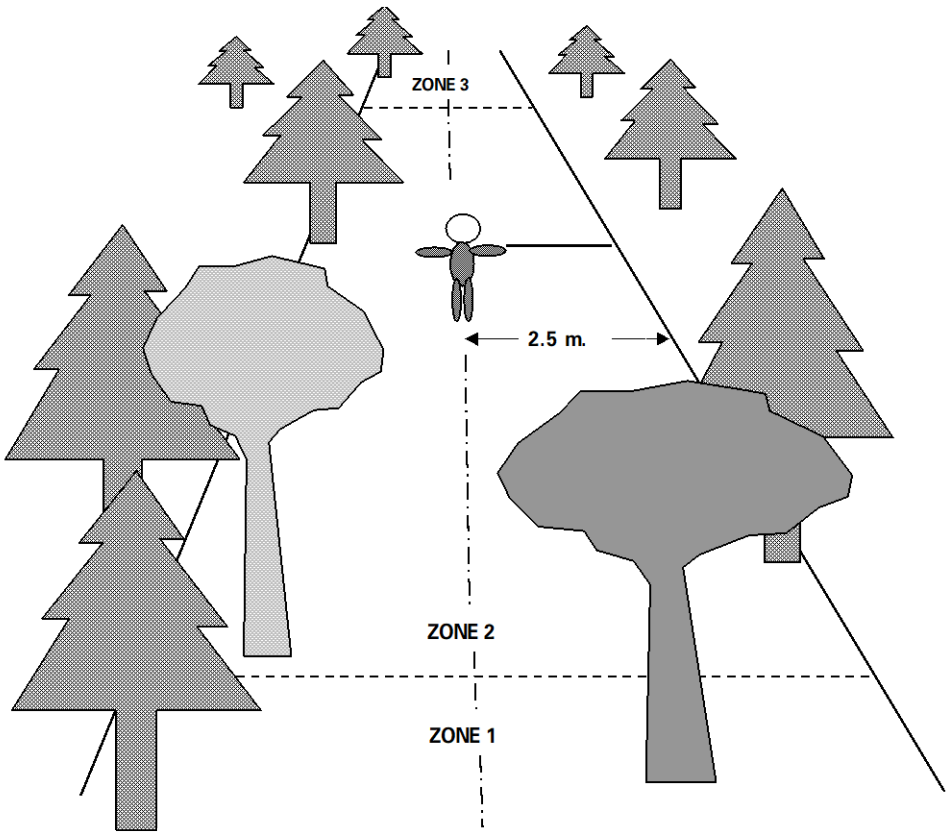
The Riparian Inventory will consist of a type of belt transect extending across the riparian zone perpendicular to the stream channel on each side.

Frequency: Transects will be conducted at prescribed intervals (refer to Appendix 1 or 2 for survey-specific details) and near the beginning of each reach. **Every** identified reach must have at least one riparian transect. The transect should be located at the bottom or top of the identified habitat unit. Do not select a starting point elsewhere in the unit because of ease of access or to get a "better" sample. Record a GPS reading. Mark the location of each transect with 3D coverage on the 7.5-minute topo map. Discuss transect spacing/frequency with your field supervisor.

Transects will begin at the margin of the active channel or where the initial band of riparian trees starts, whichever comes first. They will be perpendicular to the main axis of the stream and extend 30m as measured on the ground. The transects will be 5m wide and subdivided into up to three sections or zones, with Zone 1 being closest to the water.



One survey crew member will extend the tape measure out from the stream channel for 30 meters (if feasible - do not risk injury or death to perform this task). The other crew member will follow with the datasheets or tablet and record the measurements their survey partner calls out. Use the depth staff to determine if trees are within the area to be counted. Any tree **trunk** that can be touched with the depth staff extended 2.5 meters from the mid-line of the transect (practice the amount of reach you require to represent a 5m band) should be counted.



Visually estimate and count only under challenging situations. There is no need, for example, to try and walk through 30m of blackberry bramble to measure the diameter of one or two alder trees. Likewise, climbing steep slopes to measure tree diameters is unnecessary. Use the Note column to indicate the reason for estimation.

Complete the following entries on the Riparian form:

1. **Unit Number.** The unit at which the transect is established.

2. **Side.** Left or right side of the channel when looking upstream.

3. **Zone.** Subdivision of the transect.

    Zone **1** typically 0-10 meters
    Zone **2** typically 10-20 meters
    Zone **3** typically 20-30 meters

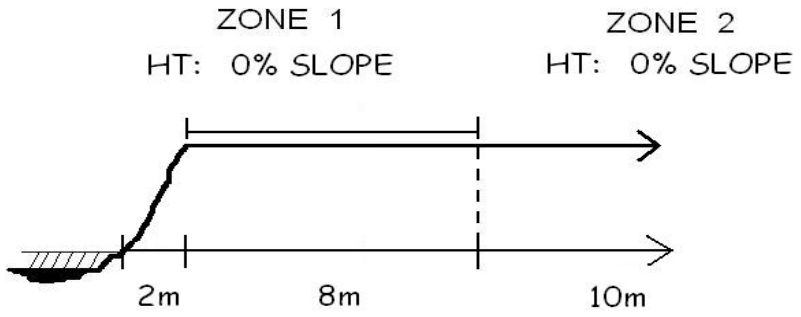
4. **Surface.** Geomorphic surface observed within the zone.

FP	**F**lood**P**lain
LT	**L**ow **T**errace (height is < Flood Prone Height)
HT	**H**igh **T**errace (height is > Flood Prone Height).
HS	**H**ill**S**lope
SC	**S**econdary **C**hannel
TC	**T**ributary **C**hannel
IP	**I**solated **P**ool or unconnected valley wall channel.
WL	**W**et**L**and bog or marsh with no obvious channel.
RB	**R**oad **B**ed (indicate surface type, i.e. pavement, gravel)
RG	**R**ailroad **G**rade
RR	**R**ip **R**ap

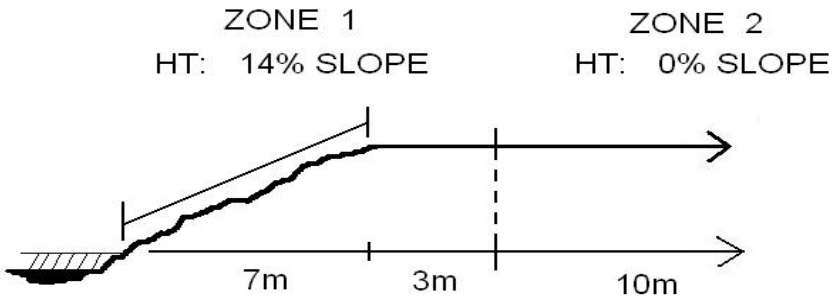
5. **Slope.** Measure the **<u>percent</u>** slope of the <u>dominant</u> surface in the zone.

NOTE: A typical terrace slope measurement for terraces will be similar to example #1 below. However, for transitioning terraces (examples #2 and #3), measure and record the slope of the transition <u>but</u> record the feature as a **H**igh **T**errace (do **<u>NOT</u>** record transitioning terraces as a **H**ill**S**lope – a hillslope feature cannot precede a high terrace). In the RIPARIAN NOTE field, make a comment that it is a transitioning feature and note approximate distances. A transitioning terrace is defined as having a measurable slope <u>over 5 meters in length that is measured from the active channel margin to the</u> top of a defined level terrace surface.

1



#2



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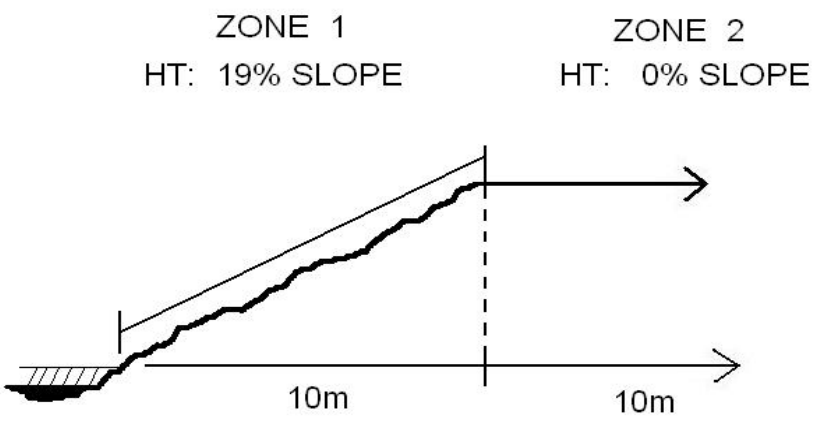


6. **Surface Length.** Measure the length of each zone. Typically, the zone will be 10m long. In some cases, you will measure the surface feature-length in its entirety.

7. **Canopy Closure.** The percent canopy closure is estimated by looking up while standing in the middle of the zone being recorded. Include the influence of both conifer and hardwood species. Tall shrub cover (above your head) should also be included—estimate within 10% increments.

8. **Shrub Cover.** The percentage of ground cover provided by shrubs. Include blackberry, salmonberry, devils club, willow, sage, etc. Small trees (seedlings and saplings less than 8 feet high) should be included in shrub cover—estimate within 5% increments.

9. **Grass Cover.** The percentage of ground cover provided by grasses, ferns, moss, herbs, sedges, rushes, etc. Estimate within 5% increments.
10. **Tree Count.** Conifer or hardwood. Tally the live trees by type and diameter class. Measured at the dbh in centimeters as 3-15, 15-30, 30-50, 50-90, or 90+.

11. **Riparian Note.** Optional comments that describe tree species or the plant community, large woody debris, invasive plants, or characteristics of snags or old stumps. Note the presence or absence of large down wood in the riparian zone. Record the riparian photo number and time in this column as well.

Literature Cited

Bisson. P. A., J. A. Nielsen, R. A. Palmason, and E. L. Grove. 1982. A system of naming habitat types in small streams, with examples of habitat utilization by salmonids during low stream flow. Pages 62-73 *in* N. B. Armantrout, ed. Acquisition and utilization of Aquatic Habitat Inventory Information. Western Division, American Fisheries Society, Portland, OR.

Cupp, C. E. 1989. Stream corridor classification for forested lands of Washington. Hosey and Assoc. Bellevue, WA 46 p.

Everest, F. H., R. L. Beschta, J. C. Scrivener, K. V. Koski, J. R. Sedell, and C J. Cederholm. 1987. Fine sediment and salmonid production: A paradox. Pages 98-142 *In* E. O. Salo and T. E. Cundy eds., Streamside Management: Forestry and Fishery Interactions. Contribution No. 57. Institute of Forest Resources, University of Washington, Seattle, Washington.

Frissell, C. A., W. J. Liss, C. E. Warren, and M. D. Hurley. 1986. A hierarchical framework for stream habitat classification: viewing streams in a watershed context. Environ. Manage. 10: 199-214.

Grant, G. E. 1988. Morphology of high gradient streams at different spatial scales, Western Cascades, Oregon. Pages 1-12 *in* Shizouka Symposium on Geomorphic Change and the Control of Sedimentary Load in Devastated Streams, Oct. 13-14, 1988. Shizouka University, Shizouka, Japan.

Gregory, S. V., F. J. Swanson, and W. A. McKee. 1991. An ecosystem perspective of riparian zones. BioScience 40: 540-551.

Hankin, D. G., and G. H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Can. J. Fish. Aquat. Sci. 45: 834-844.

Hawkins, C. P., J. L. Kershner, P. A. Bisson, M. D. Bryant, L. M. Decker, S. V. Gregory, D. A. McCullough, C. K. Overton, G. H. Reeves, R. J. Steedman, and M. K. Young. 1993. A hierarchical approach to classifying stream habitat features at the channel unit scale. Fisheries 18 (6): 3-12.

Moore, K. M., and S. V. Gregory. 1989. Geomorphic and riparian influences on the distribution and abundance of salmonids in a Cascade Mountain Stream. Pages 256-261 *in*: D. Abell, ed., Proceedings of the California Riparian Systems Conference; 1988 September 22-24, 1988; Davis, CA. Gen. Tech. Rep. PSW-110. Berkeley CA: Pacific Southwest Forest Range and Experiment Station, U.S.D.A.

Ralph, S. C. 1989. Timber/Fish/Wildlife stream ambient monitoring field manual. Center for Streamside Studies, University of Washington. Seattle, Washington.

Rosgen, D. L. 1985. A stream classification system. Pages 95-100 *in* Riparian Ecosystems and Their Management; Reconciling Conflicting Uses. First North American Riparian Conference, April 16-18, 1985, Tucson, Arizona. USDA Forest Service. Gen. Tech. Rep. RM-120. Fort Collins, Colorado.

Stevens, Jr., D.L. and A.R. Olsen, 2004, Spatially-balanced sampling of natural resources. Journal of the American Statistical Association 99:262-277

Additional Literature

Dambacher, J.M. and K.K. Jones. 1997. Stream habitat of juvenile bull trout populations in Oregon and benchmarks for habitat quality. Pages 353-360 in Mackay, W. C., M. K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Dolloff, C. A., H. E. Jennings, and M. D. Owen. 1997. A comparison of basinwide and representative reach habitat survey techniques in three southern Appalachian watersheds. North American Journal of Fisheries Management 17:339-347.

Hankin, D. G. 1984. Multistage sampling designs in fisheries: applications in small streams. Canadian Journal of Fisheries and Aquatic Sciences 41:1575-1591.

Hannaford, M. J., M. T. Barbour, and V. H. Resh. 1997. Training reduces observer variability in visual-based assessments of stream habitat. Journal of the North American Benthological Society 16 (4): 853-860.

Jones, K. K., and K. M. S. Moore. 2001. Habitat assessment in coastal basins in Oregon: implications for coho salmon production and habitat restoration. Pages 329-340 In E.E. Knudsen, C.R. Steward, D.D. McDonald, J.E. Williams, and D.W. Riser Editors. Sustainable Fisheries Management. CRC Press New York 724 p.

Jones, K.K., J.M. Dambacher, B.G. Lovatt, A.G. Talabere and W. Bowers. 1998. Status of Lahontan cutthroat trout in the Coyote Lake Basin, southeast Oregon. North American Journal of Fisheries Management 18:308-317.

Keller, E. A., and W. N. Melhorn. 1978. Rhythmic spacing and origin of pools and riffles. Geological Society of America Bulletin 89:723-730.

Leopold, L. B., Wolman, M. G., and Miller, J. B. 1964. “Fluvial Processes in Geomorphology,” W. H. Freeman, San Francisco.

McKinney, S. P., J. O’Conner, C. K. Overton, K. MacDonald, K. Tu, and S. Whitwell. 1996. A characterization of inventoried streams in the Columbia River basin. Aqua-Talk. R-6 Fish Habitat Relationship Technical Bulletin 11, Portland, Oregon.

McIntosh, B. A., J. R. Sedell, N. E. Smith, R. C. Wissmar, S. E Clarke, G. H. Reeves, and L. A. Brown. 1994. Historical Changes in fish habitat for select river basins of Eastern Oregon and Washington. Northwest Science 68 (Special Issue):36-53.

Moore, K.M.S, K.K. Jones, and J.M. Dambacher. 2008. Methods for Stream Habitat Surveys: Aquatic Inventories Project. Information Report 2007-01, Oregon Department of Fish & Wildlife, Corvallis. 67p.

Reeves, G. H., L. E. Benda, K. M. Burnett, P. A. Bisson, and J. R. Sedell. 1995. A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of evolutionary significant units of anadromous salmonids in the Pacific Northwest. American Fisheries Society Symposium 17:334-349.

Roper, B. B., and D. L. Scarnecchia. 1995. Observer variability in classifying habitat types in stream surveys. North American Journal of Fisheries Management 15:49-53.

Table 1: Possible Reach – Channel – Valley Combinations

CHANNEL FORM	VALLEY FORM					
	VWI < 2.5			VWI > 2.5		
	NARROW VALLEY FLOOR			BROAD VALLEY FLOOR		
CONSTRAINED CHANNEL	STEEP V (SV)	MODERATE V (MV)	OPEN V (OV)	HIGH TERRACE (CT)	MULTIPLE TERRACE (MT)	FLOODPLAIN (WF)
BEDROCK (CB)	CB - SV	CB - MV	CB - OV			
HILLSLOPE (CH)	CH - SV	CH - MV	CH - OV	≤ 2.5 x ACW within FPW		
ALTERNATING HILLSLOPE TERR. (CA)				CA - CT	CA - MT	
HIGH TERRACE (CT)				CT - CT	CT - MT	
LAND USE (CL)				CL - CT	CL - MT	CL - WF
UNCONSTRAINED CHANNEL				≥ 2.5 x ACW within FPW		
SINGLE CHANNEL (US)					US - MT	US - WF
ANASTOMOSING (UA)					UA - MT	UA - WF
BRAIDED CHANNEL (UB)					UB - MT	UB - WF

Check the Valley Form description against the Valley Width Index (VWI). If it does not match, is it because the reach was not described properly, or was the ACW determined incorrectly?

Does the Terrace Height work with the Channel and Valley Form calls?
Remember that a high terrace is any terrace above the Flood Prone Height (FPH).

Streamside terraces are frequently present within Narrow Valley floors. When the VWI <2.5, it is a Hillslope or Bedrock-constraining reach call, regardless of the terraces encountered.

In rare cases, notably flooded bogs, multiple channel wetlands, or flooded valley bottoms due to beaver activity, the VWI will equal 1 (ACW spans the width of the valley floor). But technically, the channel is unconstrained (drain the beaver pond, and the VWI will be greater than 2.5, usually). Make a note and explain.

Use the boxes on the Reach form to make diagrams of the Reach cross-section. Label your drawings so that ambiguous or exceptional reach types can be understood.

An Unconstrained Reach must meet at least these two criteria: 1) VWI must be greater than 2.5, and 2) the Flood Prone Width (FPW) must be greater than 2.5 times the Active Channel Width (ACW).

Narrow and Broad Valley Diagrams

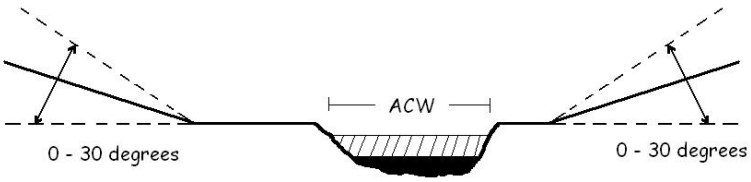
NARROW VALLEY FLOOR

VWI < 2.5

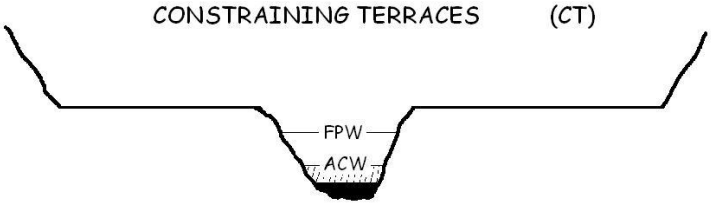
BROAD VALLEY FLOOR

VWI > 2.5

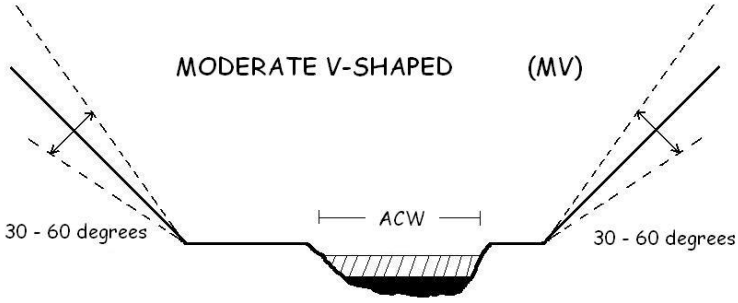
OPEN V-SHAPED (OV)



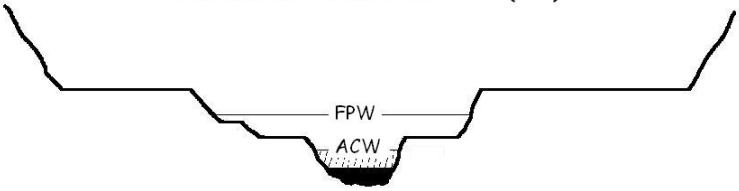
CONSTRAINING TERRACES (CT)



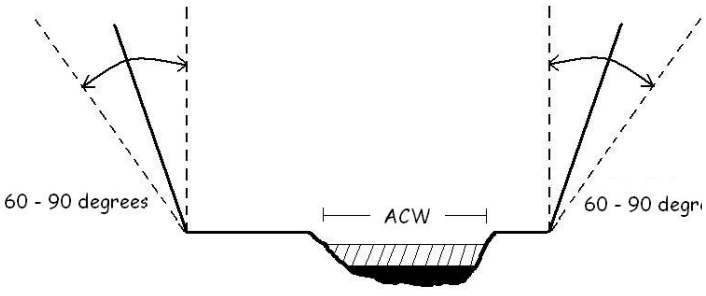
MODERATE V-SHAPED (MV)



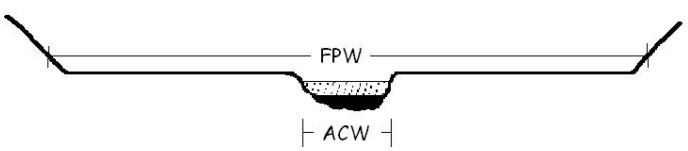
MULTIPLE TERRACES (MT)



STEEP V-SHAPED (SV)

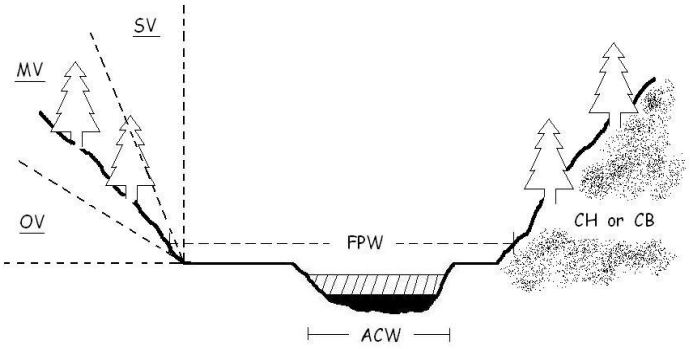


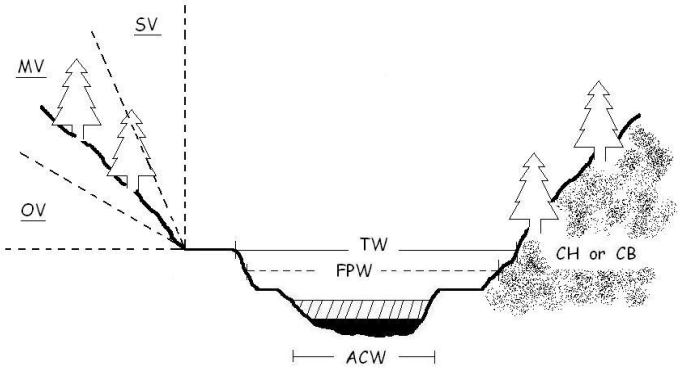
WIDE - ACTIVE FLOODPLAIN (WF)

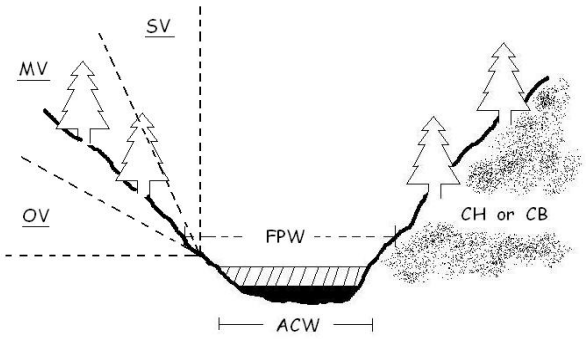


Examples of Constrained Channel Morphology:

VWI < 2.5



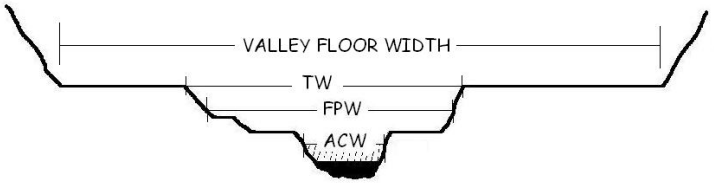




VWI > 2.5

CONSTRAINED WITHIN TERRACES WITH MULTIPLE TERRACE FEATURES:

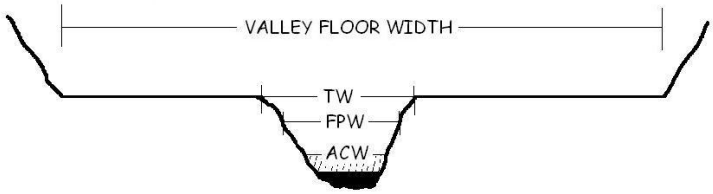
CT / MT



VALLEY FLOOR WIDTH ÷ ACW = VWI

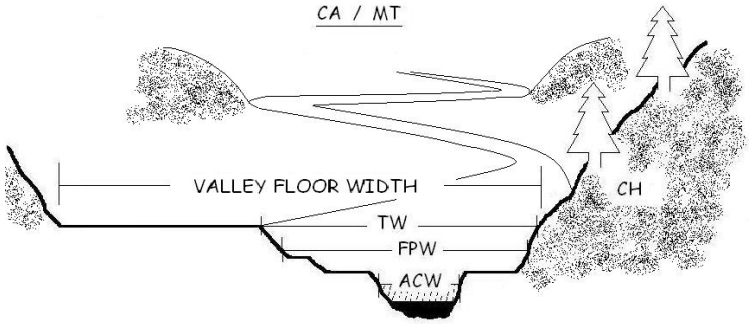
CONSTRAINED WITHIN TERRACES

CT / CT



ALTERNATINGLY CONSTRAINED BY HILLSLOPE AND TERRACES WITH MULTIPLE TERRACE FEATURES:

CA / MT



Examples of <u>Unconstrained</u> Morphology:

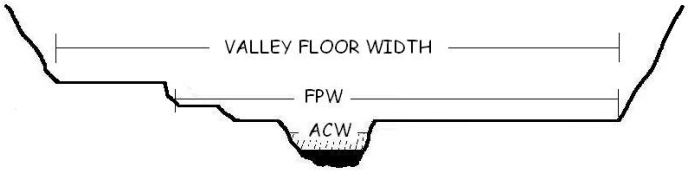
A channel is unconstrained when FPW > 2.5x ACW.

Note: It is not necessary to locate and measure a TW if the FPW > 4x ACW

<u>VWI > 2.5</u>

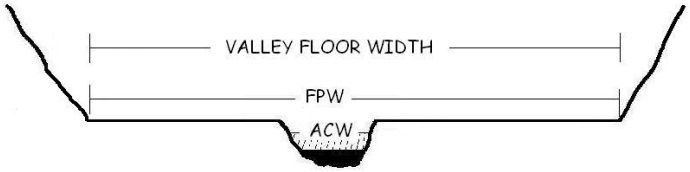
UNCONSTRAINED WITH MULTIPLE TERRACE FEATURES:

<u>US / MT</u>



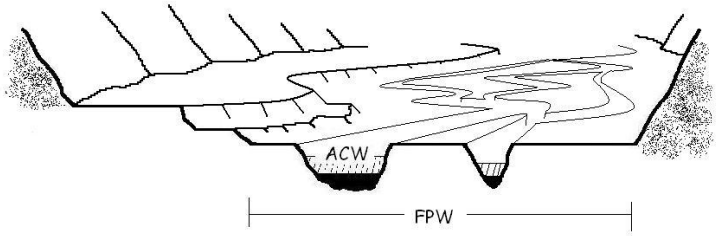
UNCONSTRAINED SINGLE CHANNEL WITHIN A WIDE-ACTIVE FLOODPLAIN

<u>US / WF</u>



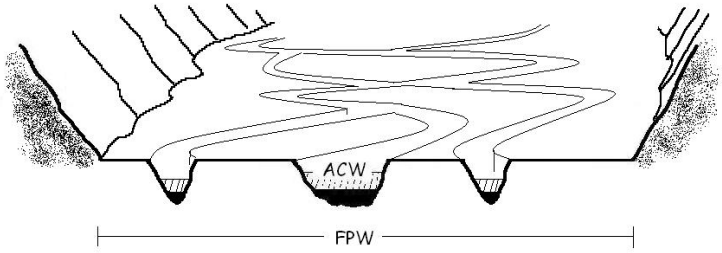
UNCONSTRAINED ANASTOMOSING CHANNEL WITH MULTIPLE TERRACE FEATURES:

<u>UA / MT</u>



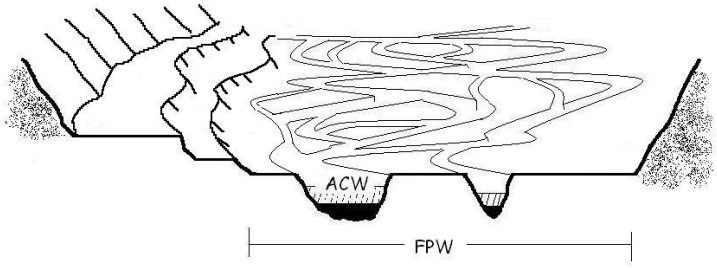
UNCONSTRAINED ANASTOMOSING CHANNEL WITHIN A WIDE-ACTIVE FLOODPLAIN:

<u>UA / WF</u>



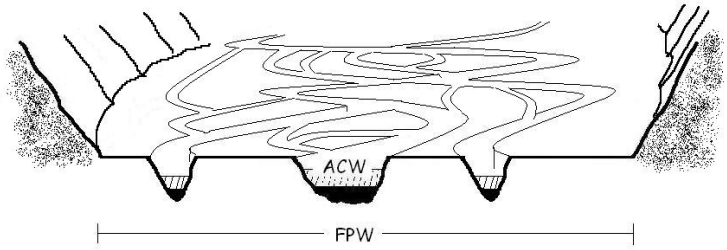
UNCONSTRAINED BRAIDED CHANNEL WITH MULTIPLE TERRACE FEATURES:

<u>UB / MT</u>

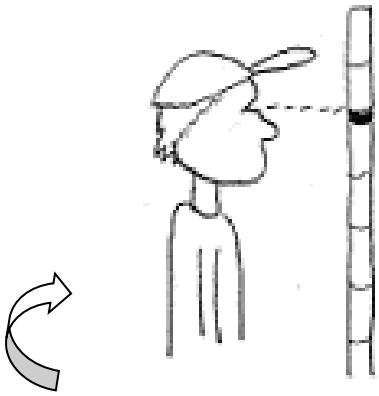


UNCONSTRAINED BRAIDED CHANNEL WITHIN A WIDE-ACTIVE FLOODPLAIN:

<u>UB / WF</u>

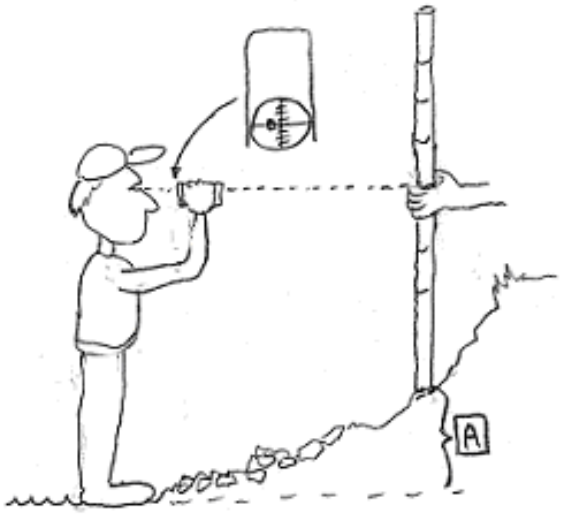


Guide to Measuring Channel Metrics



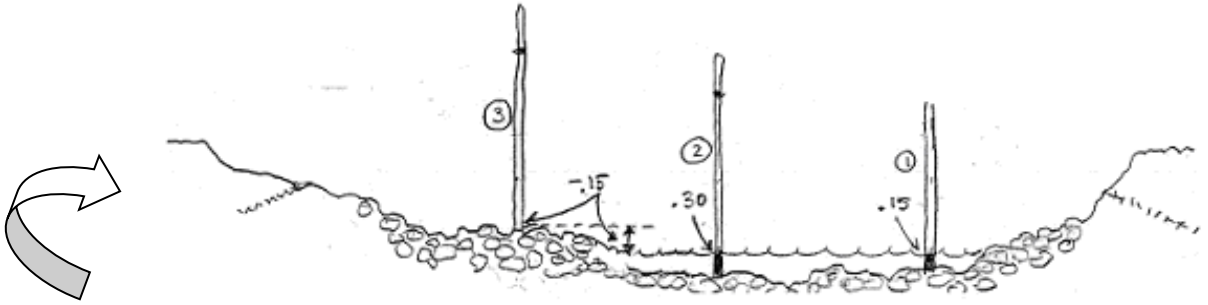
Step 1: Clinometer (CLINO) identifies his eye height on the depth staff.

Step 2: CLINO and survey partner (TAPE) discuss and agree on the active channel scour or margin on either side of the stream. **NOTE:** Channel metrics are to be conducted at the pool tail crest or at the top or bottom of a fast water unit type.



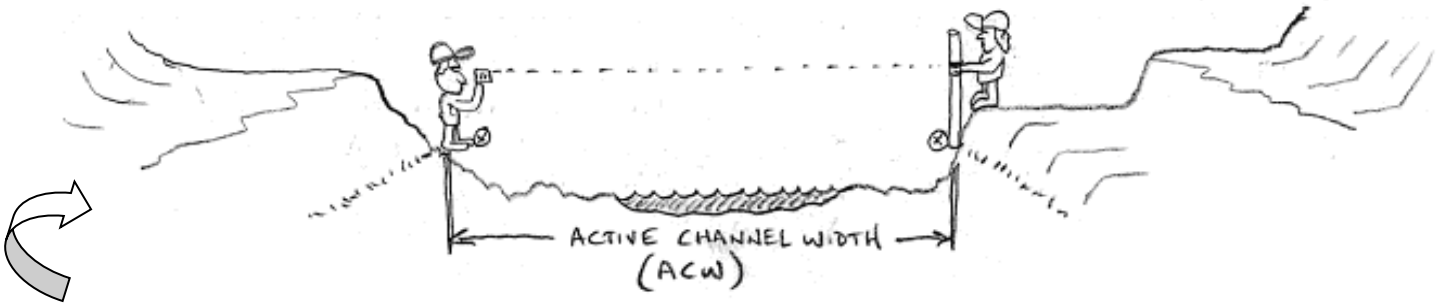
Step 3: TAPE places depth staff at top of the active channel. CLINO stands at the water surface. TAPE slides her hand down the depth staff until CLINO sees the hand come into view while keeping the clinometer on 0% slope.

Step 4: Subtract the height where CLINO saw the hand on the depth staff (Step 3) from the eye height established in Step 1. This is the height above the water surface ("A" in Step 3).

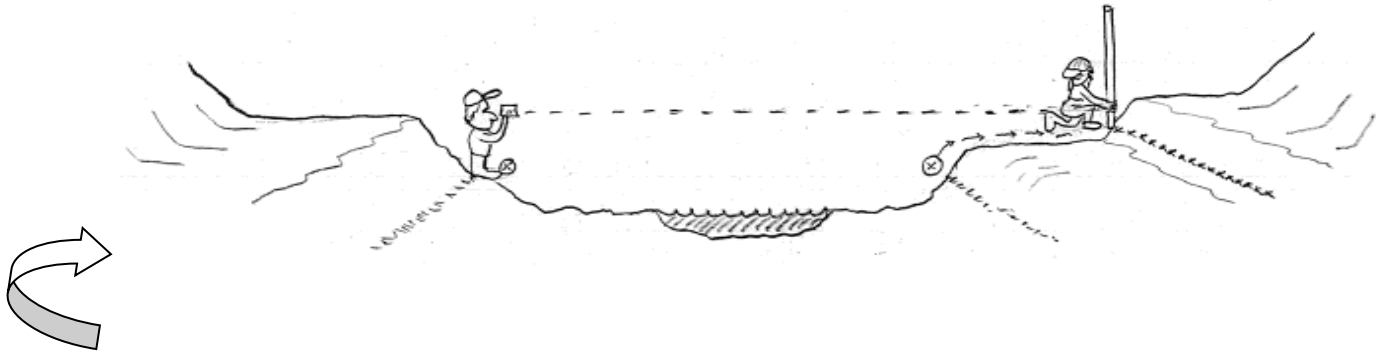


Step 5: CLINO takes the end of the tape measure and starts across the channel while TAPE stays at the active channel margin. CLINO takes 3 depth measurements at $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ distance of the active channel width while crossing the channel (the measurements are usually the water depth but occasionally can be an exposed gravel bar above the water surface – thus a negative value).

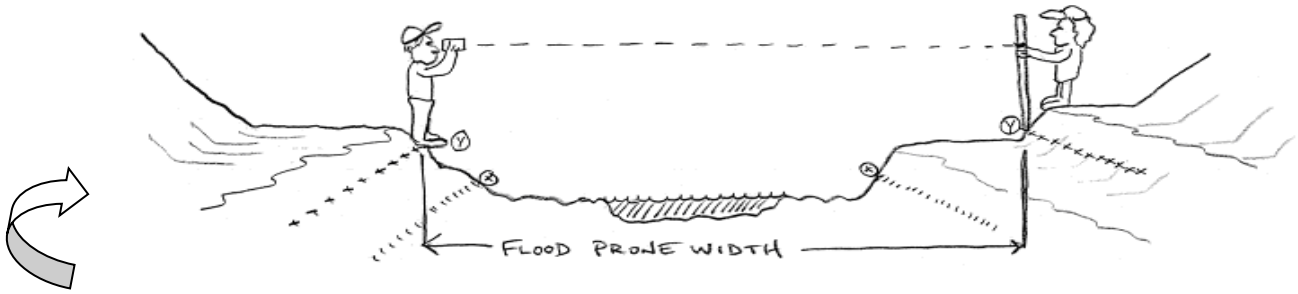
Step 6: Take the average of the three measurements. The example in Step 5 has the measurements 0.15, 0.30, and -0.15 (average = 0.10). Add this value to the measurement "A" obtained in Step 3. This sum is the **A**ctive **C**hannel **H**eight (ACH).



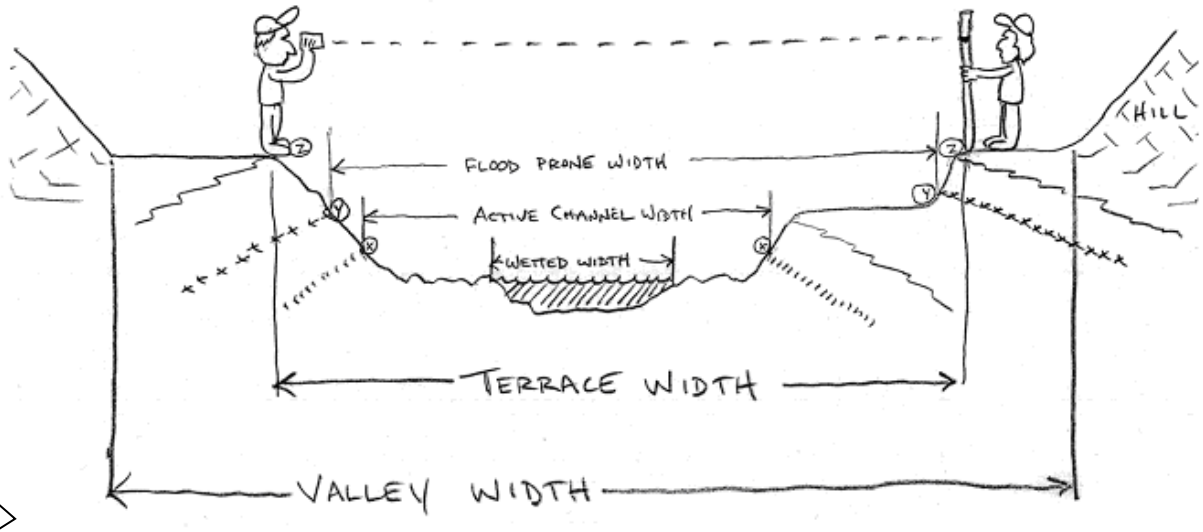
Step 7: TAPE repositions her hand at CLINO's eye height on the depth staff. On the other side of the stream, CLINO backs up the bank until his eye is level with TAPE's hand on the depth staff (using the clinometer at 0% slope). CLINO has now established the active channel margin on the other bank. The distance between CLINO and TAPE is the **A**ctive **C**hannel **W**idth (ACW) as **x** depicts above.



Step 8: TAPE subtracts the Active Channel Height value from CLINO's eye height on the depth staff. CLINO remains at the active channel margin with the clinometer at his eye on 0% slope. TAPE backs up the bank until her hand (at the new position) comes into CLINO's view. TAPE has now established the margin of the flood prone on her side of the stream.



Step 9: TAPE repositions her hand back to CLINO's eye height on the depth staff and does not move. CLINO backs up until his eye (clinometer on 0%) is looking at TAPE's hand. CLINO has now established the flood prone margin on his side of the stream. The measurement between CLINO and TAPE is the **F**lood **P**rone **W**idth (FPW) as depicted by **y** in the above illustration. **F**lood **P**rone **H**eight (FPH) is simply 2X the Active Channel Height.



Step 10: If a high terrace (terrace feature above FPH) exists within 4 active channel widths then measure a terrace height (TH) and terrace width (TW). TAPE backs up until she is on the edge of the high terrace lip while CLINO stays at the flood prone margin on his side of the stream. TAPE slides her hand down the depth staff until CLINO (with clinometer on 0%) sees TAPE's hand in view. Subtract this height from CLINO's eye height on the depth staff. Add this difference to the Flood Prone Height value. This sum is the **T**errace **H**eight (TH).
TAPE repositions her hand back to CLINO's eye height on the depth staff and stays at the terrace lip while CLINO moves back until his eye (on 0%) is looking at his corresponding eye height on TAPE's depth staff. The distance between them is the **T**errace **W**idth (TW) as **z** depicts above.

The **V**alley **W**idth **I**ndex (VWI) is an estimate of how many Active Channel Widths can fit between the toe of the hillslope on one side of the valley to the toe of the slope on the other side of the valley. In the illustration above, if the Valley Width is 30 meters and the Active Channel Width is 15 meters, then the VWI is 2.0.

Equipment Checklist

IN STORAGE BOX:

- ☐ ATLAS
- ☐ FIELD IDENTIFICATION GUIDES (Amphibian, Non-native plants, Fish)
- ☐ USGS TOPOGRAPHIC MAPS
- ☐ CLINOMETER
- ☐ CLIPBOARDS
- ☐ COMPASS
- ☐ CELL PHONE and CHARGER
- ☐ GPS / BLUETOOTH unit
- ☐ DATA FORMS / FILE BOX
- ☐ FIBERGLASS MEASURING TAPE
- ☐ FIELD BOOK
- ☐ FLAGGING TAPE (Blue and white stripe)
- ☐ SURVEY METHODS AND INSTRUCTIONS
- ☐ THERMOMETER (Pocket Celsius scale)
- ☐ VESTS
- ☐ STORAGE BOX
- ☐ CB RADIO
- ☐ LASER RANGE-FINDER (optional)
- ☐ PENCILS, SHARPIE WATERPROOF MARKER
- ☐ FIRST AID KITS
- ☐ AXE / PULASKI
- ☐ SHOVEL
- ☐ DEPTH STAFF
- ☐ ODFW HATS AND UNIFORM SHIRTS
- ☐ HIP BOOTS
- ☐ BOOTIES
- ☐ POLARIZED SUNGLASSES
- ☐ WADERS
- ☐ WADING SHOES
- ☐ RAINGEAR
- ☐ HEADLAMP, WHISTLE
- ☐ WATER JUG
- ☐ FORMULA 409®
- ☐ OREGON PLAN SIGNAGE (Yellow signs, orange whiskers, nails
- ☐ VEHICLE SAFETY EQUIPMENT (Flares, jumper cables, fire extinguisher)

All equipment must be checked in at the end of the field season. Your supervisor will replace hip boots, wading shoes, and other equipment that may become worn out during the summer. Keep your supervisor informed of your equipment needs.

GCG: 1-NC **SITE ID:** 771

ODFW RANDOM HABITAT SURVEY SITE FORM

GCG: 1-NC **SITE ID:** 771 **LENGTH:**
SURVEY TYPE: s,r,h **INTERVAL:** s48
STREAM: Summit Cr, S Fk **QUAD:** Dovre Pk
BASIN: Trask River
SUBBASIN: South Fork

START: Start at trib right

END: Survey 1000 meters

COMMENTS:

Date Completed: / / **Surveyors** _____

Township-Range-Section-1/4: T R S 1/4

	Reach 1	Reach 2 Unit ___
Channel Form		
Valley Form		
VWI		
Temp (C)		
Flow		

	Reach 1	Reach 2 Unit ___
Veg Class Dominant		
Veg Class Sub-Dom		
Land Use Dominant		
Land Use Sub-Dom		

Reach Drawings

GPS Coordinates	UTM EASTING (10T)	UTM NORTHING (UTM)
START		
POINT	451884	5021575
UPSTREAM		

AMPHIBIANS OBSERVED: At Riparian Transect? (Y or N) ___ Within Survey? (Y or N) ___

LANDOWNERS

GCG	Site#	Name	Contact	Address	City	State	ZIP	Phone	OK Date	DATA REQUEST	Tax Lot #	Comments
1-NC	771	STATE									100	T3SR8W
1-NC	771	Green Diamond Resources	Mitch Parker/Dan Clay	PO Box 190	Tillamook	OR	97141	503-842-3180			6400	503-704-9195

SITE ACCESS DESCRIPTION

This is how the spawners got to their site. FROM TRASK, PARK ON TRASK RIVER RD. CONTINUE 2.0 MILES TO A FORK. GO RIGHT AND PROCEED 4.6 MILES TO A ROAD BRIDGE ON RIGHT. TURN RIGHT AND PROCEED 0.6 MILES TO A SHOULDER ON THE LEFT BEFORE THE ROAD BENDS RIGHT. SUMMIT CR. IS VISIBLE ACROSS S. FK. TRASK R. HIKE DOWN THE BANK, CROSS S. FK. TRASK R. AND ACCESS SUMMIT CR. WALK UPSTREAM 100M TO S. FK. SUMMIT CR. ON RIGHT.

REACH

PAGE:_____ OF:_____

STREAM:_____ CREW:_____

BASIN:_____ USGS 7.5' MAP NAMES:_____

DATE	REACH #	UNIT NUMBER	CHANL FORM	VALLEY FORM	VWI	VEG CLASS DOM.	VEG CLASS SUB-DOM.	LAND USE DOM.	LAND USE SUB-DOM.	WATER TEMP	STRM FLOW	LOCATION TWN-RNG-SEC-1/4	PHOTO # /TIME	REACH NOTE
													/	

UTM: _____

UTM: _____

UTM: _____

UTM: _____

UTM: _____

UTM: _____

REACH

PAGE: 1 OF: 1

STREAM: EXAMPLE CREEK

CREW: JANE DOE, JOHN DOE

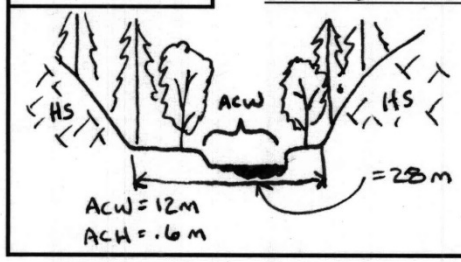
BASIN: NORTH SOMEWHERE RIVER

USGS 7.5' MAP NAMES: CEDAR BUTTE

DATE	REACH #	UNIT NUMBER	CHANL FORM	VALLEY FORM	VWI	VEG CLASS DOM.	VEG CLASS SUB-DOM.	LAND USE DOM.	LAND USE SUB-DOM.	WATER TEMP	STRM FLOW	LOCATION TWN-RNG-SEC-1/4	PHOTO # /TIME	REACH NOTE
7-2-03	1	1	CH	MV	2.3	M30	S	LT	YT	14°C	MF	T4S-R5W-20NW	10/09:12	BEGIN SURVEY @ CONF. W/MAPLE CK.
7-2-03	2	97	CT	CT	3.5	M30	—	LT	YT	14°C	MF	T4S-R5W-20SE	13/11:30	TRIB: ELK CK.
7-2-03	3	180	US	MT	5	D15	S	YT	—	15°C	MF	T4S-R5W-29NE	16/15:13	
7-3-03	4	257	CH	MV	1.5	D30	S	ST	YT	12°C	MF	T3S-R5W-1SE	18/08:14	
7-3-03	5	391	CH	MV	1.5	D30	S	ST	YT	14°C	MF	T3S-R5W-1SW	22/11:30	BLM BOUNDARY
7-3-03	6	440	CH	SV	1.0	C30	D3	ST	LT	14°C	MF	T3S-R5W-10NE	26/13:11	

1

UTM: 10T 435640
UTM 4803030



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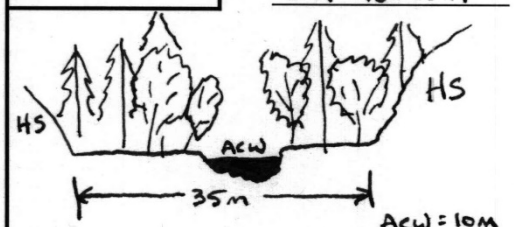

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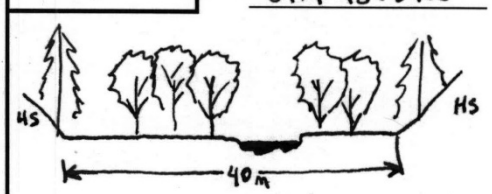
UTM 4805100



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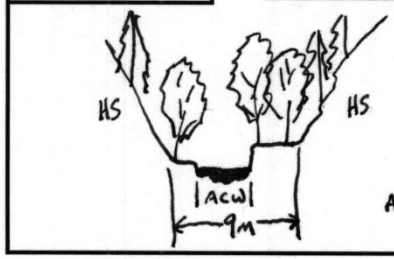
UTM 4806929



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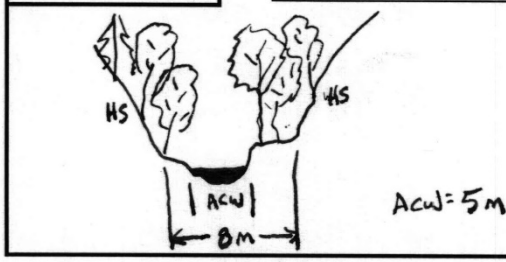
UTM: 10T 436440
UTM 4807500



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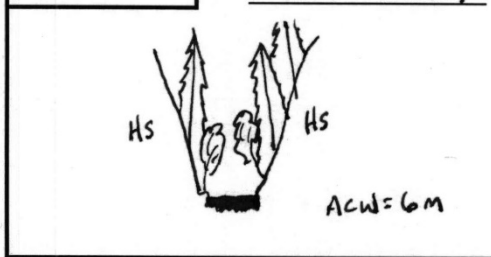
UTM: 10T 436503
UTM 4807999



UNIT-1

PAGE:_____OF:_____

STREAM:_____ DATE:_____ ESTIMATOR:_____

REACH #	UNIT #	UNIT TYPE	CHANL TYPE	% FLOW	UNIT LENGTH	UNIT WIDTH	SLOPE %	SHADE (0-90) LEFT	SHADE (0-90) RIGHT	ACTIVE CHANNEL HT.*	ACTIVE CHANNEL WIDTH	FLOOD PRONE HT.	FLOOD PRONE WIDTH	TERRACE HT.**	TERRACE WIDTH	VWI	NOTE

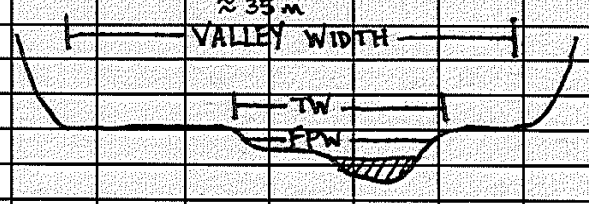
* MEASURE FROM THE STREAMBED TO THE TOP OF THE ACTIVE CHANNEL . TAKE THE MEASUREMENT AT POOL TAIL CREST ON POOL UNITS.

* * MEASURE FROM THE STREAMBED TO THE TOP OF THE TERRACE.

UNIT-1 BASIN ☐ OR. PLAN ☑ RESTORATION ☐ GCG: 1-NC SITE #: 333 PAGE: 1 OF: 2

STREAM: EXAMPLE CREEK DATE: 7-2-13 ESTIMATOR: JANE DOE

REACH #	UNIT #	UNIT TYPE	CHANL TYPE	% FLOW	UNIT LENGTH	UNIT WIDTH	SLOPE %	SHADE (0-90) LEFT	SHADE (0-90) RIGHT	ACTIVE HT.*	ACTIVE CHANNEL WIDTH	FLOOD PRONE HT.	FLOOD PRONE WIDTH	TERRACE HT.	TERRACE WIDTH	VWI	NOTE
1	1	RI	00	100	12	6	2	55	70								T = 14°C @ 10:32
	2	RB	00	100	18	7	4	60	65								
	3	LP	00	100	10	7	0	75	85								
	4	RB	00	100	14	6	5	70	70								
	5	LP	00	100	6	5	0	85	50								
	6	RB	00	100	22	6	4.5	65	55								
	7	LP	01	80	12	6	0	60	60								
	8	RI	11	20	9	2	3	90	85								T = 11°C @ 11:04,
	9	LP	11	20	5	1.5	0	90	90								ACW = 4.5 m
	10	LP	00	100	10	7	0	85	80								
	11	SP	00	100	12	8	0	70	70								
	12	RI	01	100	28	8	2.5	75	65								
	13	BW	10	0	5	1	0	85	80								COHO FRY
	14	LP	00	100	14	6	0	90	90								
	15	RI	00	100	30	7	2	90	85								
	16	LP	00	100	10	5	0	80	80								
	17	SC	00	100	1.5	7	8	80	85								
	18	LP	00	100	13	6	0	70	80								KINGFISHER
	19	RI	00	100	45	7	3	70	85								
	20	LP	00	100	10	7	0	70	70	.40	11.0	.80	18.0	1.5	22.0	3	
	21	RI	00	100	27	8	2	80	85								
	22	LP	01	75	11	6	0	85	85								
	23	RI	01	75	10	5	3.5	90	80								
	24	LP	01	75	8	5	0	85	85								
	25	SR	02	25	2	3	–	90	80								H = .90 m
	26	RI	02	25	25	2.5	1.5	80	80								
	27	PP	00	100	4	7	0	75	80								
	28	SS	00	100	.2	.5	–	80	80								H = 1.8 m
	29	CC	00	100	17	.5	2.5	90	90								USFS ROAD #2045
	30	RB	00	100	39	6	4.5	80	75								PACIFIC GIANT SAL



* MEASURE FROM THE STREAMBED TO THE TOP OF THE ACTIVE CHANNEL. TAKE THE MEASUREMENT AT POOL TAIL CREST ON POOL UNITS.

UNIT-2

BASIN ☐ OR. PLAN ☐ RESTORATION ☐ GCG:__________ SITE #:_____________ PAGE:________ OF:________

STREAM:____________________________________ DATE:________________________ NUMERATOR:____________________________

UNIT #	UNIT TYPE	DEPTH*	DEPTH** PTC	VERIFIED LENGTH	VERIFIED WIDTH	S/O	PERCENT SUBSTRATE SND	GRVL	CBLE	BLDR	BDRCK	BLDR COUNT	EROSION (Y / N)	UNDERCUT (Y / N)	COMMENT CODES	NOTE
V																
V																
V																

* MAX DEPTH POOLS - MODAL DEPTH IN FAST WATER UNITS

** ONLY MEASURED @ POOLS (EXCEPT OFF-CHANNEL POOLS)

UNIT-2 BASIN ☐ OR. PLAN ☑ RESTORATION ☐ GCG: 1-NC SITE #: 333 PAGE: 1 OF: 2

STREAM: EXAMPLE CREEK DATE: 7-2-13 NUMERATOR: JOHN DOE

UNIT #	UNIT TYPE	DEPTH*	DEPTH** PTC	VERIFIED LENGTH	VERIFIED WIDTH	PERCENT SUBSTRATE S/O	SND	GRVL	CBLE	BLDR	BDRCK	BLDR COUNT	EROSION (Y / N)	UNDERCUT (Y / N)	COMMENT CODES	NOTE
1	RI	.20	–			5	10	45	40	0	0	0	N	N		
2	RB	.25	–			0	5	30	65	10	0	4	Y	N		
3	LP	1.2	.15			10	10	40	20	0	0	0	Y	Y	BV	
4	RB	.20	–			0	0	35	65	10	0	6	N	N	BV	
5	LP	.90	.15			5	15	60	15	5	0	0	N	Y		
6	RB	.20	–			0	5	60	40	5	0	2	N	N		
7	LP	1.1	.20			10	15	50	25	0	0	0	Y	Y	/TJ	ELK CREEK
8	RI	.10	–			0	10	65	25	0	0	0	N	N		
9	LP	.60	.05			10	15	40	25	5	0	0	N	N	BV	
V 10	LP	.90	.20			5	10	50	30	0	0	0	N	Y		
11	SP	1.2	.10			10	10	65	10	0	0	0	N	N		
12	RI	.25	–			0	5	65	30	0	0	0	N	N		
13	BW	.30	–			40	20	30	0	5	0	0	N	Y		
14	LP	1.1	.25			10	10	50	35	0	0	0	N	N		
15	RI	.25	–			0	5	50	40	0	0	0	N	N	BC	HIGHWAY 588
16	LP	1.0	.20			5	10	40	20	0	0	1	Y	N		
17	SC	.10	–			0	0	60	40	0	0	0	N	N		
18	LP	.90	.20			10	10	40	30	0	0	0	N	Y	GS/	GAUGE = 1.25 FEET
19	RI	.25	–			5	5	45	40	0	5	0	N	N		
V 20	LP	1.1	.15			10	20	45	25	0	0	0	N	N		
21	RI	.30	–			0	10	50	40	0	0	0	N	N		
22	LP	.70	.25			15	10	35	20	0	0	0	Y	N		
23	RI	.25	–			0	5	50	35	5	0	0	N	N		
24	LP	.85	.20			5	10	55	25	0	0	0	N	N		COHO
25	SR	.05	–			0	0	0	5	5	90	0	N	N		
26	RI	.15	–			0	5	60	30	5	0	0	Y	N	SS/LS	
27	PP	.90	.20			5	15	50	20	5	0	0	N	N		
28	SS	.05	–			0	0	30	35	30	0	0	N	N		
29	CC	.05	–			0	0	30	35	30	0	0	N	N	CC	DIA = 5.8 m, METAL
V 30	RB	.25	–			0	0	30	60	10	0	2	Y	N		

* MAX DEPTH POOLS - MODAL DEPTH IN FAST WATER UNITS

** ONLY MEASURED @ POOLS (EXCEPT OFF-CHANNEL POOLS)

WOOD BASIN ☐ OR. PLAN ☐ RESTORATION ☒ GCG: 1-NC SITE #: 361 PAGE: 1 OF: 1

STREAM: EXAMPLE CREEK DATE: JULY 12, 2009 NAME: JOHN DOE

UNIT NUMBER	UNIT TYPE	DBH CLASS	HS	JAM	LENGTH CLASS (m) RW <3	3	6	9	12	15	18	21	24	28	32	36+	WOOD NOTE
1	LP	0.35					I										
		0.5	X							I							
		0.15															
5	RI	0.65						I									
12	RI	0.7					I										
		0.35		X		II											
		0.2		X			I										
		0.55	X	X				I		I							LWD CABLED TO BOULDERS
		0.3				III											
20	LP	1.2										I					
21	RB	0.4				I	I										
28	PP	0.45				II											
29	SS	0.65	X						I								LWD HAS MOVED FROM ORIG
		0.2				I											PLACEMENT SITE
42	LP	0.35					II	I									
		0.7							I								
46	RB	0.25										I					
		0.55	X						I								
		0.35				I											
58	LP	0.5		X			I										
		0.35		X		III											
		0.2		X		~~III~~	II			I							MANY SMALL PIECES
		0.7	X	X				I									ACCUMULATED IN JAM
		0.4		X			I										
		0.9	X	X							I						LWD W/ ROOTWAD
		1.2	X	X						I							LWD W/ ROOTWAD
		1	X	X								I					LWD PLACED BETWEEN ALDERS
		0.3				III		I									

WOOD

BASIN ☐ OR. PLAN ☐ RESTORATION ☐ GCG:_____ SITE #:_____ PAGE:_____ OF:_____

STREAM:_____ DATE:_____ NAME:_____

UNIT NUMBER	UNIT TYPE	DBH CLASS	HS	JAM	LENGTH CLASS (m) RW <3	3	6	9	12	15	18	21	24	28	32	36+	WOOD NOTE

RIPARIAN

PAGE:_____ OF:_____

STREAM:_____ DATE:_____ NAME:_____

UNIT NUMBER	SIDE	ZONE	SURFACE	SLOPE	CANOPY CLOSURE	SHRUB % COVER	GRASS/FORB % COVER	TREE	COUNT (DBH in CENTIMETERS) 3-15	15-30	30-50	50-90	90+	RIPARIAN NOTE
	LEFT	1						CONIFER						
								HARDWOOD						
		2						CONIFER						
								HARDWOOD						
		3						CONIFER						
								HARDWOOD						
	RIGHT	1						CONIFER						
								HARDWOOD						
		2						CONIFER						
								HARDWOOD						
		3						CONIFER						
								HARDWOOD						
	LEFT	1						CONIFER						
								HARDWOOD						
		2						CONIFER						
								HARDWOOD						
		3						CONIFER						
								HARDWOOD						
	RIGHT	1						CONIFER						
								HARDWOOD						
		2						CONIFER						
								HARDWOOD						
		3						CONIFER						
								HARDWOOD						

UNIT # _____

UNIT # _____

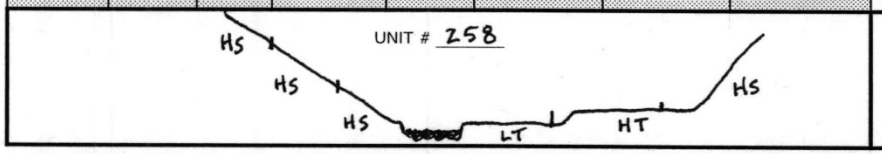
FOR EACH RIPARIAN TRANSECT, DRAW AND LABEL THE SURFACES (HT, LT, FP, HS, ETC) OF A CROSS SECTION IN THE BOX PROVIDED ABOVE. DRAWING AND LABELING VEGETATION IS NOT NECESSARY.

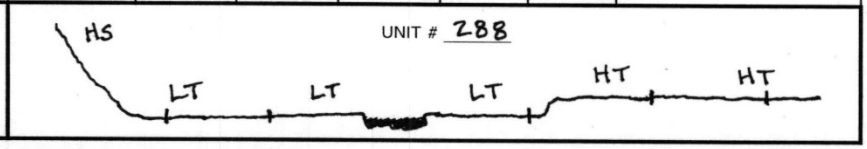
RIPARIAN

PAGE: 5 OF: 11

STREAM: EXAMPLE CREEK DATE: 7-3-96 NAME: JANE DOE / JOHN DOE

UNIT NUMBER	SIDE	ZONE	SURFACE	SLOPE	CANOPY CLOSURE	SHRUB % COVER	GRASS/FORB % COVER	TREE	COUNT (DBH in CENTIMETERS) 3-15	15-30	30-50	50-90	90+	RIPARIAN NOTE
258	LEFT	1	HS	50	85	65	30	CONIFER		1				
								HARDWOOD	II	1				
		2	HS	60	90	70	30	CONIFER		1	1			
								HARDWOOD		1				
		3	HS	60	90	75	20	CONIFER		1	1			5% ROCK COVER
								HARDWOOD	—	—	—	—	—	
	RIGHT	1	LT	0	100	60	35	CONIFER	—	—	—	—	—	
								HARDWOOD	IIII	1				
		2	HT	4	90	70	30	CONIFER			1			
								HARDWOOD	—	—	—	—	—	
		3	HS	45	90	80	20	CONIFER			1			
								HARDWOOD		1				
288	LEFT	1	LT	0	70	40	45	CONIFER	—	—	—	—	—	
								HARDWOOD	II	II	1			
		2	LT	3	65	60	40	CONIFER	—	—	—	—	—	
								HARDWOOD	1	1				
		3	HS	45	90	40	50	CONIFER			1			
								HARDWOOD		1				
	RIGHT	1	LT	0	25	80	20	CONIFER	—	—	—	—	—	
								HARDWOOD	IIII II		1			
		2	HT	0	70	70	30	CONIFER	—	—	—	—	—	
								HARDWOOD	II	1				
		3	HT	0	80	70	25	CONIFER		1				
								HARDWOOD	—	—	—	—	—	





FOR EACH RIPARIAN TRANSECT, DRAW AND LABEL THE SURFACES (HT, LT, FP, HS, ETC) OF A CROSS SECTION IN THE BOX PROVIDED ABOVE. DRAWING AND LABELING VEGETATION IS NOT NECESSARY.

METRIC WORKSHEET

STREAM: _____ BASIN: _____ CREW: _____ PAGE: _____

DATE	REACH NUMBER	UNIT NUMBER	CHANL FORM	VALLEY FORM	VWI	VEG CLASS DOM	VEG CLASS SUB-DOM	LAND USE DOM	LAND USE SUB-DOM	WATER TEMPERATURE °C	WATER TEMPERATURE TIME	STRM FLOW	NOTE

UTM _____ VALLEY WIDTH _____

ACH: _____ FPH: _____ TH: _____

ACW: _____ FPW: _____ TW: _____

UTM _____ VALLEY WIDTH _____

ACH: _____ FPH: _____ TH: _____

ACW: _____ FPW: _____ TW: _____

UTM _____ VALLEY WIDTH _____

ACH: _____ FPH: _____ TH: _____

ACW: _____ FPW: _____ TW: _____

UTM _____ VALLEY WIDTH _____

ACH: _____ FPH: _____ TH: _____

ACW: _____ FPW: _____ TW: _____

METRIC WORKSHEET STREAM: Munger Cr BASIN: Saltzman Cr CREW: A. Toth, R. Hays PAGE: 1

DATE	REACH NUMBER	UNIT NUMBER	CHANL FORM	VALLEY FORM	VWI	VEG CLASS DOM.	VEG CLASS SUB-DOM.	LAND USE DOM.	LAND USE SUB-DOM.	WATER TEMPERATURE °C	WATER TEMPERATURE TIME	STRM FLOW	NOTE
8/3/20	1	1	CH	MV	1	D50	S	GM	—	15	1125	LF	
8/3/20	1	4	CH	MV	1	D50	C50	GN	—	15	1225	LF	
8/3/20	1	6	CA	CT	6	D50	C50	GN	—	[illegible]	1330	DR	~~dry Temp~~
8/4/20	1	10	VS	WF	3	D50	D30	GN	—	15	1237	LF	Wide floodplain only in area above culvert
8/5/20	2	19	CL	MV	1	S	D30	GN	—	15	1220	LF	
8/5/20	2	22	CH	MV	1	C90	D30	GN	—	15	1330	LF	

1
UTM 519414 5045059
VALLEY WIDTH: 1

ACH: 0.25 FPH: 0.5 TH: —
ACW: 2.9 FPW: 5.4 TW: —

4
UTM 519218 5044920
VALLEY WIDTH: 1

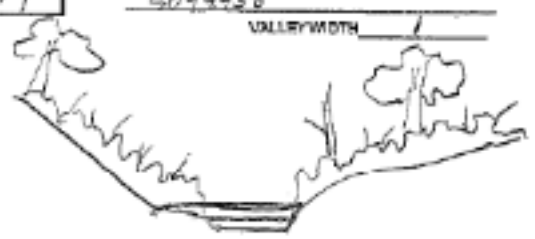
ACH: 0.25 FPH: 0.5 TH: —
ACW: 2.5 FPW: 4.5 TW: —

6
UTM 519047 5044729
VALLEY WIDTH: 6

ACH: 0.25 FPH: 0.5 TH: 0.5
ACW: 1.3 FPW: 2.6 TW: 2.5

10
UTM 518868 5044575
VALLEY WIDTH: 2

ACH: 0.2 FPH: 0.4 TH: —
ACW: 1.6 FPW: 4.6 TW: —

19
UTM 518707 5044438
VALLEY WIDTH: 1

ACH: 0.15 FPH: 0.3 TH: —
ACW: 1.1 FPW: 2 TW: —

22
UTM 518531 5044252
VALLEY WIDTH: 1

ACH: 0.15 FPH: 0.3 TH: —
ACW: 1.5 FPW: 1.9 TW: —

FISH SURVEY

CREW:_____ DATE:_____ SECTION #:_____

NOTES:_____

STREAM: _____

USGS MAP: _____ UTM START:_____

BASIN: _____ UTM END:_____

MAP CODE	AC WIDTH	AC HEIGHT	STREAM FLOW	WATER TEMP	GEAR / METHOD	PHOTO # / TIME	LOCATION TWN-RNG-SEC-1/4
					/	/	

SURVEY #	SEQ. #	UNIT OR CHANNEL TYPE	LENGTH	WIDTH	DEPTH	FISH CODE	TALLY BY FORK LENGTH GROUP, OR MEASURE AND SEPARATE WITH COMMAS 3-5.9	6-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-23.9	24-26.9	27-29.9	30-32.9	33-35.9	36-38.9	39-41.9	>42 cm	NOTE (E,M,PASS #)

0 cm 3 cm 6 cm 9 cm 12 cm 15 cm 18 cm

FISH SURVEY

CREW: JANE DOE / JON DOE

DATE: 7/2/2003

NOTES: STARTED UPSTREAM FROM TJ/

SECTION #:

STREAM: EXAMPLE CREEK (MC-258)

USGS MAP: CEDAR BUTTE

BASIN: NORTH SOMEWHERE RIVER

UTM START: 10T 0435640, 4803030

UTM END: 10T 0435789, 4803100

MAP CODE	AC WIDTH	AC HEIGHT	STREAM FLOW	WATER TEMP	GEAR / METHOD	PHOTO # / TIME	LOCATION TWN-RNG-SEC-1/4
MC-258	9.0	0.5	MF	14°C	E-FISHER	5/1145	T04S-R05W-S20NW

SURVEY #	SEQ. #	UNIT OR CHANNEL TYPE	LENGTH	WIDTH	DEPTH	FISH CODE	TALLY BY FORK LENGTH GROUP, OR MEASURE AND SEPARATE WITH COMMAS 3-5.9	6-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-23.9	24-26.9	27-29.9	30-32.9	33-35.9	36-38.9	39-41.9	>42 cm	NOTE (E.M.PASS #)
N/A	1	RI	10.3	9.0	0.20	X															LOTS OF SHRUBS ALONG MARGIN
	2	LP	32.0	9.2	0.8	CT		III													
						RB			I												
						COT	I														
						D	(5)														
	3	RI	15.7	8.7	0.2	X															
	4	BW	5.5	2.5	0.4	D	(8)														
	5	LP	22.2	10.0	.60	RSS	(4)														LWD PROVIDES GOOD COVER
						UNK		I													
						RSN		III													
						CT		I	I												LARGER CT ONLY HAS 1 EYE
	6	RB	17.5	8.2	.17	PGS			I												
N/A	7	PP	11.5	9.7	0.65	CT		II													
						CO	I														

0 cm 3 cm 6 cm 9 cm 12 cm 15 cm 18 cm

Appendix 1: Random Probability Habitat Surveys

Oregon Plan for Salmon and Watersheds Monitoring Survey

Introduction

An important objective of the Oregon Plan for Salmon and Watersheds is to determine current salmon habitat conditions and track trends in habitat over time. To accomplish this goal, a long-term monitoring program was developed to coordinate stream habitat surveys, juvenile snorkeling inventories, and spawning salmon surveys. All field surveys encompass a randomly selected point. Due to the standard survey length of the monitoring sites, some measurements are taken at an increased frequency while others are omitted. These survey modifications are specific to the random monitoring surveys and do not apply to the comprehensive basin survey design. See Appendix 2 for Basin details.

Reach Information

The goal of the random habitat survey is to describe stream conditions that are representative of the point selected in the original sampling design. Therefore, it is best to document only one reach in the field survey. There are instances where the beginning or end of a survey may be moved to accommodate a reach break. Always check with your field supervisor BEFORE moving a survey. Surveys should not cross a spawning survey start or end sign. Please update your Reach Sheet.

Example: On a 1km survey, if a reach break occurs 100 meters into a survey and the survey point has not been reached, move the start of the survey to the beginning of the new reach. If the same condition occurs, but the point is surveyed in the first 100 meters, then move the survey below your initial survey point and restart the survey so that it ends at the reach break.

While some modifications may allow the maintenance of only one reach, there are instances when a reach break may occur mid-survey. If a major reach change does occur during the survey, the reach will be recorded as a separate reach, and the survey will continue for the full length. Only major changes in channel and valley constraint or major tributary junctions are reasons to call additional reaches.

Metric Information

The Metrics (Active Channel Width and Height, Flood Prone Width and Height, and Terrace Height and Width (when applicable)) will be measured 5 times per survey. Conduct these measurements at the beginning of the unit closest to these desired distances.

- For 1 km sites, these will be taken at 0, 250, 500, 750, and 1000m
- For 0.5 km sites, these will be taken at 0, 125, 250, 375, and 500m

To ensure an adequate number of habitat units, maximum unit lengths are:

- There is no maximum length for slow water units (pools).
- The maximum length of fast-water units for 1 km sites is 50m(+5m).
- The maximum length of fast-water units for 0.5 km sites is 25m(+5m).

If a unit naturally ends within 5 meters of the maximum unit length, the unit may be extended to the natural end.

Example: In a 1 km survey, if a 55 m-long rapid is followed by a lateral scour pool, there is no need to divide the rapid into two units, one 50 meters in length and one 5 meters in length.

Photos

Photos will be taken throughout the survey to represent the stream attributes. The first photo for the site will be of the Reach Sheet - make sure you zoom into the Site ID number and stream name. All the photos following this will be assumed to be of that site. Photos should be taken of outstanding features of interest (such as significant barriers, debris flows, large log jams, or riparian blowdowns). If using the phone camera and saving to the SD card, label the photo appropriately (See Appendix 4). If using a camera, record the photo description on the Photo Sheet and the corresponding habitat unit on the tablet. Complete all fields on the Photo Sheet; be sure to include the Site number and name.

Site Set-Up

It is crucial that the field surveys are set up correctly. Some sites will be shared by the spawning survey program. **The following rules are necessary for successful site set-up and are listed in order of importance.**

- ✓ Surveys must encompass the point identified for the site.
- ✓ Surveys will be 1000 meters or 500 meters (habitat-only surveys) in length.

Additional important guidelines:

- ✓ Include only one homogeneous reach in the survey (see reach section below)
- ✓ When possible, start and end surveys at obvious recognizable points (e.g., sharp bends, tributaries, bridges, etc.).
- ✓ Clearly mark sites with flagging and yellow survey signs, take GPS readings at start and end points whenever possible, and reference these locations on the map.
- ✓ If you have questions about the set-up of a site, contact your field supervisor.

Site Marking

UTM coordinates will be taken at the start and end of the survey, and each will be recorded on the paper Reach sheet and documented in the electronic forms. If coordinates are acquired with a handheld GPS (Garmin, for example), please indicate the quality of the coverage and datum used.

Yellow site tags, orange whiskers, and flagging will be placed at a **noticeable** location at the start and endpoints of the survey. Location of the tags will be noted on the Reach sheet (e.g. large 30-50cm dbh conifer on right). Use a Sharpie pen on the yellow tag to indicate the stream name, site #, START or END, and year. If the Sharpie marking is faded or illegible, trace over the faded existing markings to refresh the labeling. Site tags and flagging should be replaced on repeat surveys only when missing.

The following instructions indicate what to do in certain scenarios:

a) You are surveying a previous year's site. You navigate to the start coordinates but cannot find a yellow start OPlan sign anywhere. After making a significant effort, you still cannot find it. You hang a new sign, mark it accordingly, hang flagging, and record UTM coordinates. After surveying several hundred meters upstream, you encounter the original start sign on a tree. WHAT DO I DO? At this point, go back downstream and remove the sign you hung earlier. Walk back upstream and restart the survey at the original sign (record UTM coordinates and datum you are using). NOTE: Make sure that the encountered yellow sign refers to the site number you are supposed to survey. There are other surveys being conducted throughout the area (snorkeling, restoration, etc.) and similar site numbers. Restart the survey at this location. Update the situation and the new start information on the Reach sheet and on the tablet.

b) You are surveying a previous year's site. You successfully navigated to the start sign and noticed that the UTM coordinates differ substantially from those in the previous survey. The sign is legible, and the location/placement agrees with the reach sheet. WHAT DO I DO? It is possible that the previous crew collected the UTM coordinates in a different datum (NAD27 versus NAD83, for instance). If this is the situation, you can have waypoint discrepancies up to several hundred meters. Record the UTM coordinates you obtained and the datum you are using. Begin the survey.

c) You are surveying a previous year's site. You find the original start sign and begin the survey. After surveying approximately 950 meters, you come across a yellow sign on a 30-50cm dbh alder on the left bank, indicating the end of the survey. You double-check the reach sheet for the End sign location, survey length, and UTM coordinates for where to expect the sign. Everything agrees except that the reach sheet shows the survey to be 1050 meters long. WHAT DO I DO? First, ensure the End sign refers to the site you're working on. If it is, then this is probably the correct end location, and record it as such (get UTM coordinates, conduct channel metrics, etc.). If time permits, leave your gear, take a scouting hike upstream for approximately 200 meters, and see if you find another end sign. If you find another end sign referring to the site you're surveying, go back to your gear and continue the survey to this sign (collect UTM, channel metrics, etc.). Make a note of the discrepancy and record this in your notes.

d) If the point is denied by a landowner, talk to your supervisor about dropping the site.

e) If the point is in a tidal zone or above a barrier, talk to your supervisor before dropping the site.

f) If part of the survey (but not the point) is in a tidal zone or above a barrier, talk to your supervisor before modifying or conducting the survey.

g) If a survey is shortened or shifted, indicate which landowners are no longer on the survey on the Reach sheet Landowner section and in the Not On Survey field in the tablet. Talk to your supervisor about any changes that may have been made.

GCG: 1-NC SITE ID: 85

ODFW RANDOM HABITAT SURVEY SITE FORM

Reminder: All reach information needs to be entered on paper and on the PDA.

GCG: 1-NC SITE ID: 85 LENGTH: 557
SURVEY TYPE: HABITAT INTERVAL Annual
STREAM: Mud Fork Battle Cr QUAD: Pittsburg
BASIN: Nehalem River

START: Start just below /clear cut. Sign on fir right. There is a sign on an alder posted in 2007 (20603)

END: Tag on alder/. Posted new sign on 50dbh alder left. Old sign was on an alder that had fallen over.

GPS Coordinates	UTM EASTING (10T)	UTM NORTHING (UTM)
START	484416	5093183
POINT	484444	5093265
UPSTREAM	484609	5093650

AMPHIBIANS OBSERVED WITHIN SURVEY (Y/N): ____

MUSSELS OBSERVED WITHIN SURVEY (circle): 0 1-50 51-200 Dense

SITE ACCESS DESCRIPTION

From Mist, drive east on hwy 47 to Taylor Ln. Go straight to first bridge crossing, then turn right. Stay right to next bridge crossing--this is Mud Fork Battle Creek. Hike upstream to start.

Date Completed: / / Surveyors _____

Township-Range-Section-1/4: T R S 1/4

	Previous Reach	Current Reach
Channel Form	US	
Valley Form	WF	
VWI	6.9	
Temp (C)		
Flow		

	Previous Reach	Current Reach
Veg Class Dominant	G	
Veg Class Sub-Dom	D15	
Land Use Dominant	YT	
Land Use Sub-Dom		

Comments:
Last Year Surveyed: 2010
No coho observed. Shrubby with lots of blowdown at start. Old beaver dams, blown out from high flows.

Survey Setup:

Reach Drawing

- Site name is a combination of GCG, Site ID, and Stream name (ex., NC-85 Mud Fork Battle Creek). Use the site name on photo sheets and when recording in the yellow book.
- Survey Type indicates whether the site is shared with other survey projects. Types include STW (Steelhead), Rearing, Spawning, and Habitat. Of the four types, only the habitat surveys are ~500m long; the others are ~1000m long.
- Survey Interval describes the frequency of the survey. There are Annual, Three-year, Nine-year, or Once surveys. The three- and nine-year sites are visited every three or nine years.
- Start and End refer to the survey's start and end locations. Use this as a guide; update as necessary.
- GPS Coordinates reflect those gathered by crews in previous years. Please write the GPS readings for the start and end points. Point is the GPS coordinate of the point needed to be captured; be sure the survey extent contains it.
- Complete the Amphibian and Mussel observations.
- Please complete the Date, Surveyors, and Township-Range-Section (from the topo map).
- Current Reach – A summary of the reach information. Complete at the end of the survey.
- Draw a Reach Drawing that reflects your reach call.
- Comments will be completed if previous crews had something to share.
- Survey Set-up will indicate possible start or end location information if the site is new this year (Once interval) or other information.
- Site Access Description lists the driving directions. The quality of the directions depends upon the care taken to write them. Please add details and update if necessary. Remember that the previous crew may have been traveling from a different ODFW office.

Take the Oregon Plan Reach Sheet in the field and complete the information as appropriate.

Appendix 2: Basin (Census) Habitat Surveys

Introduction

Conducting a stream habitat survey using a basin or census design captures habitat conditions at a watershed scale. This design produces the most accurate and reliable inventory of all habitats in a watershed. Data collected at this comprehensive scale are often needed to evaluate and prioritize habitat restoration projects, detect changes resulting from natural and anthropogenic influences, and help guide habitat management plans.

Reach Information

When conducting surveys using a census design, enter a new line on the Reach datasheet at any significant change in any one of the reach variables (valley type, channel form, adjacent landform, valley width index, vegetation, or land use) *and/or* at the confluence with tributaries named on 7.5-minute topographic maps. When a new reach is identified by a named tributary, write the name in the Reach Note column. Also, describe a new reach if an unnamed tributary contributes significant flow (approx. 15-20% of the total). Do not invent names for unnamed tributaries; instead, identify them as Trib. 1, Trib. 2, etc., and record them on the datasheet and the map.

Changes in reach characteristics verify survey location and identify reach and stream segments within our basin classification system. Circle the variable that resulted in the new reach entry.

Record a GPS reading on the Reach sheet to correspond with the downstream end of the new reach. Flagging can be helpful if a crew returns to this location. Mark the flagging with the unit number, unit type, date, and "ODFW AQI.". These flags will be used to locate specific reaches and units for fish sampling and to link units and locations for repeat habitat surveys. Ask your crew lead when flagging is needed.

Metric Information

The Metrics (Active Channel Width and Height, Flood Prone Width and Height, Terrace Height and Width (when applicable), and Valley Width Index) will be measured at intervals appropriate for the survey. See page 56 for general intervals. Measurements will be conducted at the beginning of the habitat unit. Draw a cross-sectional diagram of the transect above or below your measurements (see example on data sheets) when using paper forms or the Metric Worksheet (pg. 52-53). Contact your supervisor if you have questions regarding the frequency of these measurements and/or when to change the frequency as stream size changes, or if you are surveying a very large stream. To ensure an accurate measurement of habitat unit length and width, follow these guidelines:

- Measure every habitat length and width using a rangefinder or measuring tape.
- Limit the length of habitat units to ~150 meters (if the habitat unit is a pool, keep it as one unit regardless of the length).
- At the top of each habitat unit, record the UTM of that unit. Additional UTM recordings for other features (survey start, tributaries, culvert crossing, etc.) should also be recorded

Habitat Information

If not using a measuring device, estimate every habitat unit length and width and verify every 10th measurement. When using this protocol, try to have a variety of verified lengths so that the calibration factor applied during analysis will be adequately represented for all units surveyed. For example, if every 10th unit ends up being a step by chance, verify the unit above it so that longer unit estimations can be made and incorporated into the correction factor. The verified length and

width columns are to be filled in when a habitat unit's measurements are being verified against the estimated value. This will determine a calibration or correction factor to be applied to the estimated lengths and widths during analysis. This should be conducted every 10th unit. The recorded value is not to be disclosed to the estimator so that they can make adjustments to their estimation.

Riparian Inventory Information

A Riparian Transect survey will be conducted for AQI basin surveys. Conduct a survey at the start of each reach and then at an interval of every 250 or 500 meters, depending upon stream size. Make sure there is a minimum of 1 transect for each reach identified in the survey. Ask your crew lead for assistance making that determination.

Photographs

Reach and riparian photos will be taken throughout the survey. If using the phone/Tablet camera and saving to the SD card, label the photo appropriately (See Appendix 4). Record photo description on the Photo Sheet and the corresponding habitat unit NOTE field. Complete all fields on the Photo Sheet; be sure to include the stream name and unit number. Other photos may be taken of outstanding features of interest (such as significant barriers, debris flows, large log jams, or riparian blowdown).

Field Books

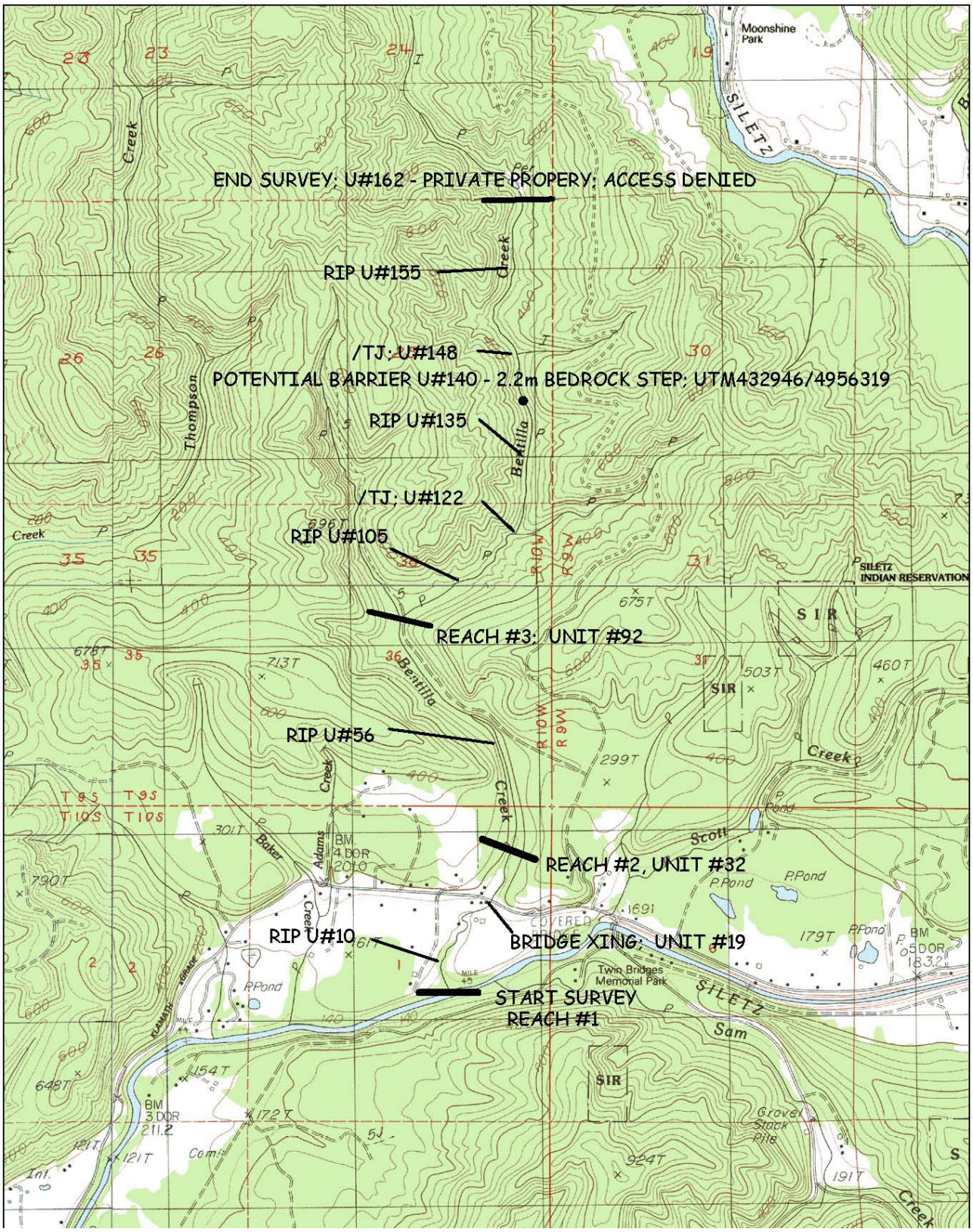
Maintain a succinct log of your activities in the field book. Each day, record the date, the name of the stream or site you surveyed, and the unit numbers surveyed. Write a paragraph or so of a general description for each reach. Record relevant details about access to the stream, name(s) of corporate contacts of cooperating industry or agency groups, and private landowners you contact to gain permission to survey. Pay particular attention to descriptions of the riparian zone, additional details concerning land use, or factors that influence the fish populations. This is the appropriate place to express your opinions. Other comments, sketches of complex features, suggestions, complaints, etc., are helpful.

Map Work

Do not go into the field without a topographic map! Data not linked to the maps are essentially useless. Use the maps to orient to the stream and to identify the location of reach changes, tributaries, roads, and bridges. Clearly mark where you start and end the survey, and areas where you are denied access. Mark all reach changes (if they exist) and important features on the map. Write the channel unit number on the map at the place that corresponds to the location of named tributary junctions, bridges, and other landmarks.

Good correspondence between landmarks on the map and the data collected is essential for our survey effort. Survey information will be utilized and integrated with Geographic Information System (GIS) analysis. Well-documented and accurate maps are required for this process. In addition to a well-marked map, it is essential that the habitat survey follow the USGS-named stream on the topo map, regardless of the amount of flow. Record the Easting and Northing UTM coordinates at the beginning of the survey, at all reach changes (if applicable), at channel metrics and riparian transects, and at the end of all surveys.

Example of Basin Map Detail



Appendix 3: Snorkel Surveys

Oregon Plan for Salmon and Watersheds Monitoring Survey

Introduction

Monitoring trends in juvenile salmonid distribution and abundance is a key part of the Oregon Plan for Salmon and Watersheds. Primarily, the data are used to inform population viability assessments of Coho salmon and steelhead in western Oregon for federally mandated Endangered Species Act reporting. Additionally, data are used to inform restoration efforts, detect changes in fish communities, and investigate relationships between freshwater habitat characteristics, adult spawner abundance, and juvenile recruitment. Snorkel surveys allow monitoring in three Coho Evolutionarily Significant Units (ESUs) and four steelhead Distinct Population Segments (DPSs) in western Oregon.

Snorkel Survey Protocol

The snorkel and habitat surveys will start and end at the same location and should be conducted simultaneously.

- To begin, start at the habitat survey start point.
- Proceed upstream and identify pools that meet the snorkeling criteria
    - Snorkeling criteria
        - A pool, as defined by the protocol in this manual
        - ≥20cm in maximum depth
        - ≥6m² in surface area.
- Snorkel all pools that meet the size criteria until reaching the habitat survey endpoint. *Include* subunit pools and pools on side channels and braids; *do not include* those in tributaries. *Do not* snorkel pools that don't meet the surface area and depth requirements. *Do not* snorkel habitat units that meet the surface area and depth requirements but are not AQI-defined pools.

The goal of snorkeling a pool is to count every fish once; no fish are missed, and none are counted more than once. Snorkeling is conducted by making a single pass through the pool and counting steelhead and cutthroat that are ≥90mm in fork length and all juvenile coho and Chinook salmon, regardless of size. Steelhead and cutthroat <90mm fork length are categorized as 0-aged trout. Indicate if 0-aged trout, dace, or shiner are present or absent. Enter the downstream end of the pool slowly and calmly and make the pass in the same manner, disturbing fish as minimally as possible. During the pass through the pool, be sure to cover all areas of the pool, paying special attention to areas that provide cover for fish, such as substrate interstices, woody debris, and undercut banks. Use a dive light to illuminate dark or shaded areas.

Rate the visibility of each pool on a scale of 0 to 3, where:

0 = not snorkelable due to an extreme amount of hiding cover or zero water visibility
1 = high amount of hiding cover or poor water clarity
2 = moderate amount of hiding cover with good or moderate water clarity, with little cover. Conditions should not impede accurate fish counts.
3 = little hiding cover and good water clarity.

Note: Visibility is a function of anything that can impede your ability to identify and count fish, not just water clarity. Do not snorkel pools that have poor or very poor visibility (0 or 1).

If more than 80% of the pools in a site cannot be snorkeled due to poor visibility or a health concern, discontinue the snorkel survey.

Data Entry

Enter fish counts and visibility rating electronically under the "Electrofishing Entry / Data" tab. Snorkel all pools meeting criteria until the endpoint of the habitat survey is reached.

Logistical considerations

Snorkeling should only be conducted during base-flow conditions. This may differ by monitoring area. Contact your supervisor for more information on the allowable start date for snorkel surveys. In most cases, this will be in the middle or late July. The habitat survey and the snorkel survey should take place simultaneously. If the site cannot be snorkeled during the habitat survey, crews will need to mark during the habitat survey to indicate which pools need to be snorkeled. Markings should indicate the start and end of each snorkel pool and the habitat unit number associated with the pool. The appropriate marking method will depend on location, ownership issues, or other factors. Check with your supervisor for the appropriate method (soapstone or flagging). Snorkeling should take place the following day.

Habitat surveys will be conducted regardless of the snorkel conditions (dry site, poor visibility, or water quality issues). Contact your supervisor if you have any questions.

Snorkel-Only Sites Survey Protocol

Overview: For Snorkel-Only sites, many protocols are the same as for Shared sites. Start at the downstream end and proceed upstream, encompassing the GRTS point. Snorkel all pools that meet criteria (≥20cm deep, ≥6m^2 in surface area), using the same protocol as in Shared sites. Note mussels, amphibians, and wildlife. ***Wood, Metric, Unit 2, and substrate data are not collected*.** Habitat units other than pools meeting snorkel criteria should be combined into a single unit, and ***only the length*** of this combined unit needs to be recorded. There are no restrictions on how long this combined unit can be. Placeholder values are used for unrequired data in order to advance within Survey123.

Detailed Protocol:

1. Locate the start point. Hang a sign if needed. Record UTMs and record temperature.

2. Survey upstream.
    a. Measure the channel length from the start point to the tailout of the first pool that meets snorkel criteria (*≥20cm deep and ≥6m^2 in surface area)* (Figure 1).
    b. Accurately record the channel length in Unit 1 Data using Riffle as the unit type. Record the channel type. Use placeholder values in Table 1 for the following data: Unit Width, Depth, Substrate, and Percent Flow. *Only the length needs to be accurate.* Do not divide this channel length into different units, even if they are present; lump them into a single unit with unlimited length. If starting in a pool, skip to section 2c.
    c. Snorkel the pool, following the protocol in section 3.
    d. Continue upstream, recording the channel length between pools meeting the snorkel criteria, following the protocol in section 2b. Snorkel each pool that meets the criteria and continue to the endpoint.
    e. When on a side channel, maintain this protocol.
    f. Record barrier data following the protocol used in Shared sites.

3. The snorkeling protocol is the same as in Shared sites: Snorkel with a single pass covering all areas of the pool. Accurately record fish counts, visibility, and the snorkeled pools' length, width, maximum depth, and PTC depth. Use the placeholder value of 100% organic for the substrate.
    a. Count all steelhead and cutthroat ≥90mm in fork length and all coho and Chinook regardless of size. Make separate counts of each species.
    b. Note the presence or absence of dace, shiner, and 0-aged trout.
    c. Rate the visibility of each pool on a scale of 0 (the worst) to 3 (the best). Do not snorkel pools with visibility <2, but accurately record the dimensions. *A site is considered complete if ≥20% of the pools are snorkeled.*

Snorkel pools in side-channels and pools displaced from the main channel (Backwaters, Isolated Pools, Alcoves) that meet the snorkel criteria and accurately record the channel type. Tributaries should not be snorkeled.

4. Endpoint. Record UTMs, update description, and hang an end sign, if needed. Record the length from the head of the last pool to the endpoint, following the protocol in section 2b.

5. Complete the Reach form and paper data sheets - Record date, temperature, surveyor names, location, presence of mussels and amphibians, and other notes. Do not include metrics, drawings, or the summarized Channel Form, Valley Form, VWI, Veg Class, or Land Use information. Update site access and driving directions.

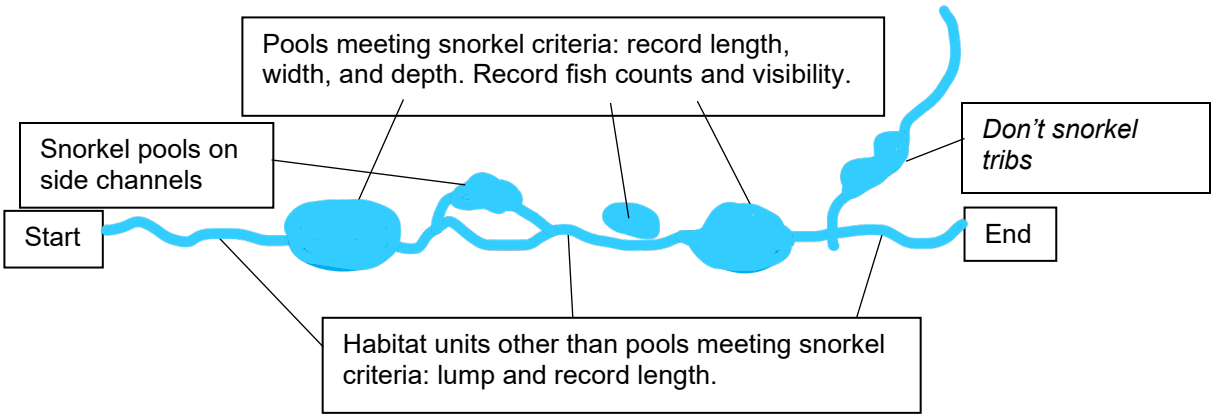


Figure 1. Conceptual drawing of protocols used for Snorkel-Only surveys.

Table 1. Required Data for Snorkel-Only Surveys. Attributes not listed in this table (e.g., Metric, Wood, Substrate, Unit 2) are not required.

Required Data for Snorkel-Only Sites		
	Snorkel Pools (Pools ≥20cm deep and ≥6m^2 in surface area)	Units other than Snorkel Pools
Unit 1 Data		
Unit Information	Accurately record pool type	Always record as a Riffle
Unit Number	Accurately record	Accurately record
Channel Type	Accurately record	Accurately record
Percent Flow	Always = 100%	Always = 100%
Unit Width	Accurately record	Always = 1
Depths (Max, PTC)	Accurately record	Always = 0.01
Length	Accurately record	Accurately record
Substrate	Always = 100% organic	Always = 100% organic
Snorkel Data	Accurately record all fields	N/A
GPS Data	Accurately record Start and End Points	
Barrier Data	Accurately record if a barrier is present.	
Reach Data	Record date, temperature, surveyor names, TRS, mussels, amphibians, and other notes. Update site access and driving directions. Metric information is not required.	

Appendix 4: Tablet and Electronic Entry Protocol

Protocol & Reminders

Handheld Android platform devices will be used as the primary data collection and recording method. These electronic devices are expensive and difficult to replace; please treat them carefully. The models that we currently use are **NOT** waterproof. Thus, waterproof protective cases are used in conjunction with the device. Occasionally, you may have to remove the device from the waterproof case. Please do this away from the creek, preferably on dry ground.

Below are primary device responsibilities, a basic navigation tutorial, and troubleshooting the most commonly encountered errors. For a more detailed tutorial, see the "Introduction to Devices, Survey123, OnX, and Field Maps handout.

1. Data entry – Survey123
2. Data Submission – Wi-Fi
3. Navigation – "Field Maps", onX Hunt
4. Photographs - Camera

Data Entry – Survey123

Data are entered through the AQI Stream Survey Entry in the ArcGIS Survey123 app.

1. Select the Survey123 app.
2. If prompted on the Home page, select the tab "Continue without signing in."
3. This will take you to "My Survey 123." There should be an AQI Stream Survey Forms Icon.
    - If a notification "**Updates available**" appears at the top of the screen. Tap on the arrow in the upper left-hand corner. This will take you to the "Update Surveys" Forms. Select the icon to download any available updates.
    - Once the download has finished, tap the back arrow in the upper left-hand corner.
4. Click on "AQI Stream Survey Forms."
5. To begin a Survey, tap the "Collect" tab.
    - A menu will open with AQI Survey Entry Forms.
    - A *Helpful Tip* when navigating the Survey Entry Menu is to collapse each form by tapping on the arrow to the left of each form. Collapsing each form will allow you to see all the forms simultaneously.
    - Select 'Survey Information."
    - A new menu opens. Before you can enter information into the other forms, you must fill in each highlighted box with the required information.
    - Select the area (GCG-Monitoring Area) and the description of the site (Site ID, Survey Type, and Stream Name). If a site is not listed in the drop-down menu, select an "extra" from the list. You will need to record the stream name and site number in the NOTE field on all forms used (Reach, Riparian, AQI Unit Entry, Wood, Snorkel, and Efish).
    - Once you have entered the Monitoring Area and Survey ID tabs, this info will auto-populate the other Forms to match.
    - Close that tab and continue to the next menu. "Unit Information."
    - Enter the Reach number in the "Reach Key" before entering any other information.
    - Next, enter the same Reach number in the "Reach Number" field. (Same as Reach Key #).
    - Once you have entered the "Reach Number," it will carry over to each new habitat unit.

- Next, enter the “Unit Class” and choose from the drop-down menu. Once a “Unit Class” and “Unit Description” have been selected, a “Unit Type” will auto-fill. Now, move on to other forms that require the Unit Information form. [Forms auto-populated by the Unit Information form are the following: Unit 1 Entry, Unit 2 Entry, Wood Entry, Snorkel Entry, Electrofishing Entry, GPS Entry, Metric Entry, Riparian Entry, Barrier Entry, Reach Entry, Drop-Site Entry.]
- Once you have entered a Unit Information & Unit 1 Entry, advance to the next unit by selecting the **+** symbol in the lower right corner of each menu.
- GPS: The GPS Data form will <u>not</u> auto-populate, and you will need to enter the unit number.
- Select “Reason for GPS.”
- If the location is not auto-populated, tap the GPS acquire target. 
- Take a Photograph of the location. Select the **+** symbol to close out of the GPS menu.

6. When the survey has been completed. Tap on the checkmark in the lower right corner.
    - Select: “Send now,” “Continue this survey,” or “Save in the Outbox.”

Survey123 Reminders

- Record dropped sites using the “Dropped Sites Entry” button. Use the pulldown menu to indicate the reason for dropping the site.

- Record the Reach information under the “AQI REACH ENTRY” button. This is a single, summarized reach based on the metrics collected; this summary must also be completed on the paper reach sheet.

- Some fields are not populated with the pull-down menu and require a scribed or typed numerical value. Be aware of entering the correct value—extra/mistyped decimals, dashes, commas, etc., in a numerical field will not allow data to be synced.

- Ensure you enter data in the correct field.

- When entering text in the NOTE field, <u>DO NOT</u> push the Enter/Return key or make a spaced paragraph. Just type in a continuous line with punctuation. All text will default to uppercase upon completion.

- When acquiring GPS coordinates, select a reason from the “Reason for GPS” pull-down menu.

Data Submission – Wi-Fi

Data are submitted by activating the Wi-Fi on your device and then connecting to a Wi-Fi source. When ready to submit, go to the Outbox tab in Survey123 and “Send” the data.

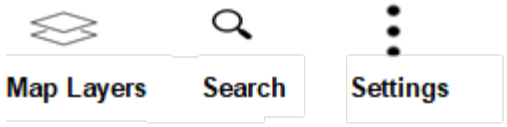
Navigation – Field Maps

When out in the field, use Field Maps to navigate from your current location. It only uses your device's GPS to identify your position. It does not use cell towers or WIFI to determine your location.

1. Tap the Profile icon on the top right of the **Home** screen.
    - Choose "Units".
        - Choose "Measurement units" and select "Metric".
        - Choose "Coordinates" and select "UTM".
        - Choose "Distance" and select "Meters".

To return to the **Home** screen close the **Profile** page.

2. Once on the **Home** screen, choose the appropriate map for the area you will be surveying. Use two fingers to zoom in until the map is visible and Site Numbers become legible. Use this screen to navigate to your survey, acquire UTM's, locate the start of the survey, show your location during the survey, and locate the GRTS point of the survey. The following toolbar will be at the top of the **Map** screen:



3. Once you have located your desired survey, tap on the red survey line, and an information box will appear. Within the information box, select the red (HEM) line. This will add a blue highlight to the red survey line on the map, indicating the survey boundaries. NOTE: There may be multiple red (HEM) lines in the information box. Be sure to look at the correct survey line.

4. To add or remove layers, choose the "Map Layers" icon from the toolbar. Scroll down the list of Map layers and check/uncheck the layers to add or remove.

5. To find your current location, select the "Location" icon on the top right of the map. Your position and bearing will be indicated with an arrowhead icon.

6. Use the Markup tool to mark locations and view UTMs. Choose the "Settings" icon and select "Markup." This will take you to the **Markup** screen. Tap and hold the location on the map where you would like to mark a point. A "Marker" box will appear, allowing you to add a name and/or notes to the point. Close the Marker box and the **Markup** screen to return to the **Map**.

To view UTMs, go to the **Map** screen and tap on a point. A box with UTM coordinates will appear.

See the Field Maps Instructions packet in the Crew Box for more detailed editing instructions.

7. To acquire Google Maps driving directions, tap on the GRTS point, and an information box will appear. Within the information box, tap on the GRTS point. Another information box will appear. Scroll to the bottom of the information box and select “Directions”.

OnX Hunt.

Use OnX to verify your location and avoid trespassing on properties without permission by checking landowner and tax lot information.

Features

- Press the target icon in the lower right-hand corner to locate your current position. 
  Aerial imagery, topography, and layers like property boundaries are downloaded to your mobile device, so when you’re out in the field, it just works. Before you head out, save a map of the area you will be working in to be available offline.
  To do this, select the “Offline Maps” ((x)) icon from the toolbar in the lower-left corner of the home screen. Select “+New Map” and choose the level of Satellite Imagery Detail you require (Low, Medium, or High) resolution. Save your map. Maps saved to your device don’t need to be turned on manually when you’re in the field—use the app normally when you’re offline, and you’ll see all the areas you’ve saved.
  Map size - The clearer the map is up close, the more space it takes up on your phone as an offline map. Different map sizes let you save high-resolution maps in the small areas that count and lower-resolution maps to see the bigger picture. Use some 10-mile or even 5-mile maps in the areas you expect to survey and a 150-mile map around them to place those areas in the larger landscape.
  Map status—If storage is a concern, you can choose which offline maps you’d like to keep on your device. A green checkmark means the area is saved to your phone. It’s a good idea to download map updates for the latest imagery and layer data available. Put your phone in airplane mode to test what you’ll see in the backcountry.

Tools

- On the toolbar at the bottom of the home screen, tap the “Tools” icon to pull up a menu of useful tools.
- Select the “Line Distance” tool to measure a distance.
- Select the“ Add Waypoint” tool to drop a pin on a location.
- Select the “Mark My Location“ tool to mark your current location.
- Select “Compass Mode” to enable a full-screen compass.
- Offline status - Offline mode is automatically enabled when you don’t have cell service, but tapping “Go Offline” manually or using airplane mode is best. This way, the map loads quickly from the device memory instead of trying to load new data over a weak cellular data connection.

Photographs - Camera

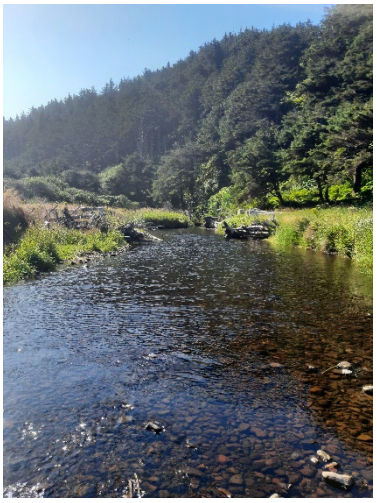
Before starting an Oregon Plan survey, take a picture of the Reach sheet clearly showing the stream name and ID NUM.

After taking the photo, navigate to the Gallery under Apps and select the photo. Rename the photo with the GCG, Site ID, Unit #, and a brief description. Ex: 2_MC_2103_Knowles Cr_U1_Left

Photos will be downloaded at the end of the season after all sites are completed. More details can be found on page 4.

Common Errors – Camera

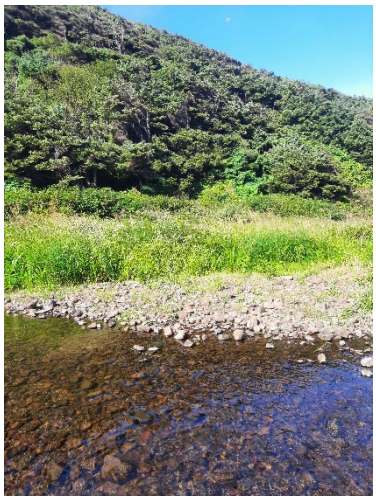
Blurry and unusable photos are the most commonly encountered errors. To prevent this, be aware of light levels and camera flashes, hold the camera as steady as possible, wait until focused, and be mindful of hand location around the lens. Remember to label each photo immediately after taking pictures. This will also allow you to evaluate the quality of each photograph.



2-MC 2738 Big Cr. U1 Up

2-MC 2738 Big Cr. U1 Down

2-MC 2738 Big Cr. U1 Left



2-MC 2738 Big Cr. U1 Right

Appendix 5: Electroshocking Protocols

Introduction

In 1998, the Oregon Plan for Salmon and Watersheds (OPSW) mandated that the Oregon Department of Fish and Wildlife (ODFW) establish annual surveys to monitor stream habitat and juvenile salmonid distribution and abundance in Oregon coastal streams. Juvenile salmonids are primarily monitored by snorkeling (Appendix 3, page 63). In Habitat-only sites and in sites that cannot be snorkeled, electrofishing is used in place of snorkeling

Habitat-only sites: These sites are assumed to be upstream of coho distribution. The purpose of electrofishing habitat-only sites is to test this assumption and assess the composition of the fish species at the site.

Survey Guidelines

- Do not electrofish if the water temperature is above 18ºC. Return to the site when temperatures are cooler, such as later in the season or early in the morning.
- Do not electrofish if adult salmonids are observed.
- Do not electrofish if people, pets, or livestock could rapidly enter the stream.
- Make sure all crew members know that electrofishing is about to begin.
- Use the minimum settings needed to capture fish. These will typically be I5 (60HZ at 6ms) on the mode dials and a voltage of 200 for the 12-B electrofishers in most pools. Decrease the voltage in smaller (<4m wide and <30cm deep) units. Newer electrofishing units (LR-24s) should self-calibrate to appropriate settings.
- Consult with your supervisor to ensure the number of salmonids impacted by electrofishing is within the permit limits.
- Do not “overshock” in areas where fish have good cover. A few seconds should be sufficient.
- Cease electrofishing if mortalities occur.

Fish Safety

Electrofishers discharge pulsed Direct Current. Fish can react to this electric field in many ways, depending on the DC strength and their proximity to the electric field (Table 2). Fish recover the ability to swim quickly after electrofishing if the applied current is not too strong and the amount of time they are exposed to the electrical field is short. Ideally, fish will experience equilibrium loss but will not be injured or escape the electric field. However, the fish may experience physiological stress for several days following shocking. Injury (damage to swim bladders, muscles, and skin; fractured vertebrae; and bleeding have been reported) or death can result if excessive current is applied. The zone of potential fish injury is 0.5m from the anode. Care should be taken in shallow waters, undercut banks, or where fish can be concentrated because, in such areas, the fish are more likely to come into close contact with the anode. The preferred method to prevent accidental mortality is to “attract” fish to the ring rather than “rolling” them. Keep the trigger on while “attracting” or “pulling” fish and netting them. Release the trigger if you are rolling fish before you are able to net them.

Table 2. Common fish responses to electrofishing

Fish Response	Definition	Action Needed
Taxis	Fish swim towards the probe (anode)	None: Desired response
Equilibrium loss	Fish swim towards the probe (anode) but are unconscious or lying on side	None
Not turning	Fish not responding to current.	Increase voltage (i.e. from 200 to 300)
Escapes	Fish are turning but swim out of the field	Increase frequency (Hz)
Narcosis	Fish immobile with slack muscles	Reduce frequency (Hz)
Tetany	Fish immobile and rigid with flared operculum	STOP. Turn down Hz and voltage. If problem persists, stop sampling.
Branding	Hemorrhaging on skin, as shown by dark brands, internal injury	STOP. Turn down Hz and voltage. If problem persists, stop sampling.

Crew members should carefully observe the condition of sampled fish. Dark bands on the body and longer recovery times are signs of injury or handling stress. When such signs are noted, the electrofishing unit settings should be adjusted. *Sampling should be terminated if injuries or abnormally long recovery times occur even after reduced shocker settings*.

Surveyor Safety

The use of electrofishers can be dangerous. Getting shocked is not much fun, and **the electrical energy used in electrofishing is enough to electrocute - meaning to kill with electricity - a human.** Some fatalities have occurred with older electrofishers that lacked tilt switches. Common sense will eliminate most of the potential for injury. Prevent exposure to the electrical field. Use nets with insulated metal handles. Wear leak-free, standard-weight waders and boots. Rubber gloves are required to be worn while electrofishing. Replace ripped or overly worn gloves. Only place bare hands in the water if it is completely understood that the electrical current is off and the probe is removed from the water.

Stunned fish frequently need to be extracted from crevices in the streambed. Before attempting to pick up a fish, have a well-understood convention. For example, the netter saying "off" and having "off" repeated by the electrofisher operator after the current is stopped and the probe lifted from the water. Only place bare hands in the water if it is completely understood that the electrical current is off and the probe is removed from the water. Resume electrofishing only after both parties give an "on" command. When reaching into crevices, use only one hand and keep the other arm well out of the water. This prevents passing an arc of current through your chest. Also, there is a chance of shock if you touch the probe in the “on” position while you are touching the box on the backpack.

To electrofish safely:

- Do not electrofish alone.
- All personnel involved in electrofishing, whether operating the electrofisher or not, must wear non-leaking, insulated waders or a drysuit.
- All personnel must wear black rubber electrician's gloves.
- Avoid contact with the electrodes and surrounding water.
- Do not electrofish in thunderstorms or soaking rain.
- If you need to reach into a stream for any reason, have a well-understood convention with the electrofisher operator, such as saying "off" and having the operator cease electrofishing and then repeat "off."
- Most electrofisher safety features will protect the operator, but do nothing to protect other crew members who may be in the electric field, netting, or bucketing fish. If you feel that you are in danger, especially if you are slipping or falling, speak up loudly so the operator can stop shocking! **Any crew member has the right to decline to participate in electrofishing if they feel unsafe.**

To set up the electrofisher:

- Place the electrofisher upright on the ground
- Place the battery in the housing, but do not connect the wiring
- Connect the Anode (probe) and Cathode (tail)
- Make sure that the unit is turned off
- Make sure that the unit is set to I-5 and 200 volts
- Connect the wiring to the battery
- Place the shocker on the back and adjust the straps

To conduct the survey:

- Enter stream with shocker, just downstream of the pool to be sampled
- Place the tail and the probe in water, about 1-2 meters apart
- Make sure the crew is aware that shocking is about to commence, and everyone is clear of the electrical field
- Turn on the shocker, communicate with your partner, and begin sampling
- Turn off the shocker if not electroshocking
- Do not place the shocker face down. Lay it flat with the pack frame in contact with the ground, or place it upright with the pack frame against a support (tree, boulder, etc)

When the survey is complete:

- Turn the unit off and disconnect the battery before exiting the creek.

Remember: The best way to get fish within an effective radius of the anode probe is to "surprise" them. Position the probe in a new area while it is turned off and turn it on once it is in place. Sweeping a live probe about the stream merely introduces the weak border of the electrical field to new areas, and fish will easily detect and escape the field. The stream should be covered systematically, moving the anode in a herringbone pattern through the water. Do not electrofish an area for an extended period.

Sampling Habitat-Only Sites

Data entry

Electrofishing data from Habitat-Only sites are entered in the tablet under the tab.
"AQI HAB ONLY EFISH ENTRY. "

Protocol

- Ensure the electroshocking encompasses the GRTS point.
- Sample at least 3 pools and 3 fast water units totaling a minimum of 60 meters of stream length.
- Record the fish or amphibian collected in the first pool by species and size using the pre-defined codes (see Fish Form below).
- Sample the fast water unit immediately above the pool and record the fish or amphibian captured.
- Walk upstream to the next pool and sample it and the fast water unit above.
- Consecutive sampling is preferred.
- Continue sampling until 3 pool / fast water sequences and at least 60 meters of stream length have been sampled (see Scenarios below).
- If a fish species or life history stage not observed in the first 4 units is captured in the 5th or 6th unit, sample another pool and fast water unit.

Carefully release netted fish to a slow-water unit approximately 10 meters downstream from the capture site. This allows the fish or amphibian to recover away from the capture site's electrical field. Fish should not be exposed to air for more than a few seconds, or latent mortality will likely occur.

If you cannot identify the fish or amphibian, write a description and take a close-up photo.

If fish were observed but not captured, indicate as much on the datasheet and approximate the length. Do not guess data if movement was seen but body length or size was not. Write a note on the fish sheet to describe the observation. It is easy to confuse the movement of a salamander with that of a fish.

Scenarios

a) You have electroshocked 60 meters but have not encompassed the required 3 pool / fast water sequences. WHAT DO I DO? Walk upstream and electroshock until 6 units have been surveyed.

b) You have electroshocked 3 pool / fast water sequences but have not surveyed at least 60 meters of stream habitat. WHAT DO I DO? Keep surveying sequences until 60m have been surveyed.

c) You are surveying in a small stream with low flow, have walked 60m, and haven't found a pool. WHAT DO I DO? Stop electroshocking. Make notes in the datasheet reflecting the situation.

Electroshocker Troubleshooting

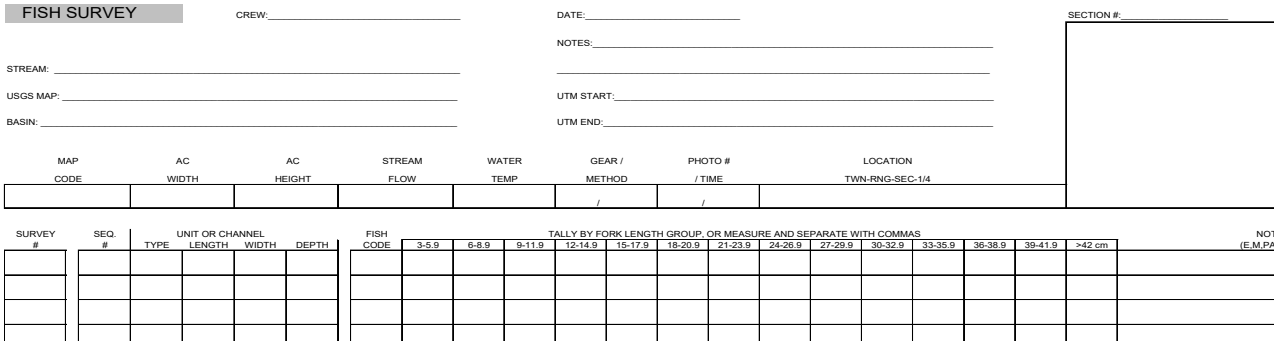
Malfunction of the electrofishing system often occurs in the field and can be very frustrating. Test the electrofisher at the start of the season and before hauling it into remote sites, and make sure the battery is charged. Connect the battery, probe, and tail, and place the mode switches at 1, 5, and 200 volts. Turn the unit on. It should produce a short beep. It should also make a continuous beep when the anode pole switch is depressed. This is a quick initial test of an electrofisher. If this does not work, or if the unit will not shock fish, try the following steps:

1. Turn the power off – disconnect battery.
2. See if all the connections are tight.
3. Be sure that the unit is upright. As a safety feature, electrofishers have a tilt switch that shuts the unit off if it is tilted at too steep of an angle.
4. Be sure the anode (pole) ring is clean and free of oxide coating.
5. Check the Battery/Generator indicator light. If this light is on, there is a problem with the battery. Replace the battery with a known good battery. If the unit begins to work, the battery is the problem. If not, contact your crew lead.
6. Check the self-test indicator. This should be on when the anode (pole) switch is on. If the self-test indicator does not come on, there are three options: a) Redo the connections, b) Swap the cathode "tail" with the tail from a known working electrofisher to see if the problem is with the tail, c) Swap the anode pole and/or the anode pole ring with the pole and/or anode pole ring from a working electrofisher to see if the problem is with the pole. Contact your crew lead as needed to troubleshoot the issue.
7. If the unit overloads, as indicated by the overload light, reduce the voltage setting or move the anode and cathode further away from each other.

A gel cell battery power our Smith-Root backpack electrofishers. Following these simple procedures can prolong a battery's service life:

1. Always place batteries on a wood surface when in use or in storage. If left directly on the ground, the battery will discharge.
2. Occasionally, try to fully discharge and fully charge a gel cell battery. The gel cell battery has a "memory" and requires this type of full discharge/charge cycling.
3. Protect batteries both in use and in storage by periodically charging them during cold weather. Cold temperatures reduce the amount of cranking capacity a battery can offer, so it is best if batteries are not left in the cold.

Fish Survey Form



FISH SURVEY

CREW:_____ DATE:_____ SECTION #:_____

NOTES:_____

STREAM: _____

USGS MAP: _____ UTM START:_____

BASIN: _____ UTM END:_____

MAP CODE	AC WIDTH	AC HEIGHT	STREAM FLOW	WATER TEMP	GEAR / METHOD	PHOTO # / TIME	LOCATION TWN-RNG-SEC-1/4
					/	/	

SURVEY #	SEQ. #	UNIT OR CHANNEL TYPE	LENGTH	WIDTH	DEPTH	FISH CODE	TALLY BY FORK LENGTH GROUP, OR MEASURE AND SEPARATE WITH COMMAS 3-5.9	6-8.9	9-11.9	12-14.9	15-17.9	18-20.9	21-23.9	24-26.9	27-29.9	30-32.9	33-35.9	36-38.9	39-41.9	>42 cm	NOT (E,M,P,A

Crew: First and last names of surveyors.

Stream name: Spell out the complete name of the stream being surveyed. Include the site identification number and gene conservation group (GCG) code.

USGS Map: Name of the USGS. 7.5-minute topographic quad.

Basin: Use the name of the large river commonly used to describe a region. For example, use McKenzie R as the basin name when sampling Lookout Cr, not Willamette or Columbia.

Date: MM/DD/YY.

Notes: Provide additional information concerning the sample site location (particularly relative to culverts or other potential barriers), the type of ownership, and access roads or trails. Also, comment on the weather, cloud cover or precipitation, visibility, and habitat conditions.

UTM Start: Record the UTM coordinates at the beginning point of the fish survey.

UTM End: Record the UTM coordinates at the end point of the fish survey.

Map Code: Record the site's code, including monitoring area and site ID number (UMP-1556 for Umpqua site #1556). Be sure to mark all sites on topo maps and be as accurate as possible when marking sample sites on maps.

Active Channel Width: The distance across the channel at "bank full" annual high flow, estimated from the change in vegetation, slope break, or high-water mark. Sum the width of all active channels in multichannel situations.

Active Channel Height: Vertical distance from the stream bottom to the top of the active channel.

Stream Flow (see page 10 for complete definitions):

DR	Dry	PD	PuDdled	LF	Low Flow	MF	Moderate Flow
HF	High Flow	BF	Bankfull Flow	FF	Flood Flow		

Water Temp: Degrees Centigrade or Fahrenheit; indicate scale used.

Gear/Method: Indicate the sampling method (i.e. snorkel, seining, or electrofishing). When electrofishing, indicate voltage setting of electroshocking units.

Photo number and time: Take a photograph that shows the stream and riparian zone typical of the reach sampled. Record the exposure number and the time displayed on the camera back. This can be the same photo used for the habitat survey.

Location: Township, range, and 1/4 section at the start of the fish survey site. Use the following format: T10S R05W S22 SE. Draw a rough sketch of the stream as it appears in the topo map section in the upper right corner of the data form (see example).

Site Detail and Fish Species Information:

Survey Number: The number of the unit sampled during the habitat survey (if known). This is important and is used to cross-reference the habitat database.

Sequence Number: The sequential number describing the order which channel units were sampled. Sample a minimum of 6 units (3 fast water and 3 slow water) and at least 60 meters.

Unit Type: Use the habitat types listed in the physical habitat survey methods.

Unit Length: Estimated length of each habitat unit or channel type sampled.

Depth: Maximum depth in pools, modal depth in glides, and other fast water habitat unit types.

Fish Code: Use the standard codes for the following species.

Salmon and trout:

AS	Atlantic salmon
BR	brown trout
BT	brook trout
BTH	brook/bull hybrid
BUT	bull trout
CH	Chinook salmon
CO	coho salmon
CS	chum salmon
CT	cutthroat trout
CTH	cutthroat hybrid
LCT	Lahontan cutthroat trout
PS	pink salmon
RB	rainbow trout
RT	redband trout
SF	salmonid fry (age 0+)
SS	sockeye salmon
ST	steelhead
TF	trout fry (age 0+)
US	unknown salmonid
UT	unknown trout
WF	mountain whitefish

Minnow:

BG	bluegill
BD	black dace
CLM	chiselmouth
CP	carp
D	dace
LND	longnose dace
NPM	northern pike minnow
OC	Oregon chub
PM	peamouth
RO	roach
RSS	redside shiner
SH	shiner species
SPD	speckled dace
TC	tui chub

Amphibian:

ATF	adult tailed frog
BF	American bull frog
FRG	frog (species unknown)
LTS	long-toed salamander
NWS	Northwest salamander
PGS	Pacific giant salamander
RLF	red-legged frog
RSN	rough skin newt
SAL	salamander
TFT	tailed frog tadpole
YLF	yellow-legged frog

miscellaneous:

AM	ammocoetes
BLB	black bullhead
BRB	brown bullhead
BSU	bridgelip sucker
C	crappie
CC	channel catfish
CF	crayfish
COT	sculpin
CSU	largescale sucker
JSU	Jenny lake sucker
LAM	lamprey
LB	largemouth bass
MF	western mosquitofish
MMS	Malheur mottled sculpin
MS	mottled sculpin
MSU	mountain sucker
PK	pumpkinseed
RTS	reticulate sculpin
SKB	stickleback
SNF	sunfish
SB	smallmouth bass
SR	sandroller
SU	sucker
YP	yellow perch
X	no fish found

If a species is not on the list and a code needs to be invented, the code must be explained in the Note column and on every data form where it is used.

Do not use Fish codes in the Comment Code field (Unit 2 datasheet). Fish codes can be used in the Notes section but should be defined at least once within the survey.

Count Tally of the number of fish grouped by species and size class.

Note: In the comments column, indicate whether the length was estimated (E) or measured (M). Write measured lengths in all columns as needed. Also, indicate the pass number when separate passes are made within a single habitat unit (e.g., E-1 for estimated 1st pass).

References

Methods for Stream Fish Inventories. 1998. Oregon Department of Fish and Wildlife-Aquatic Inventories Project, Natural Production Section, Corvallis, Oregon. Version 7.1, July 1998.

NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act. 2000. National Marine Fisheries Service, National Oceanic, and Atmospheric Administration.

Rodgers, Jeff. 2002. Protocols for Conducting Juvenile Coho Salmon Surveys in Oregon Coastal Streams. Oregon Department of Fish and Wildlife, Corvallis, Oregon.

Rodgers, Jeff. 2001. Personal Communication.

Smith-Root Backpack Electrofishers. 1998. Smith-Root, Inc. Vancouver, WA Rev. 03.

Appendix 6: Crayfish, Amphibian, and Mussel Inventory Protocols

Introduction

The Aquatic Inventories Program began collecting information on amphibians in 2006 and on mussels and crayfish in 2011. The purpose of the amphibian, mussel, and crayfish surveys is to collect occurrence information useful in determining the current distribution of these species encountered in Oregon river basins.

Crayfish

Precautions

Use care when handling crayfish. Place them back in the same vicinity where they were collected.

Survey Guidelines

Record observations of crayfish in the NOTE field of the data form. If possible, indicate the species observed. Refer to the crayfish handout in your file box to help identify invasive species you may encounter (Ringed, Rusty, and Red Swamp). Photograph unknown species.

Signal crayfish (*Pacifastacus leniusculus)* - *Native to the Pacific Northwest*

Identification: Claws are smooth, lack bumps, and have a white 'signal' spot on the claw pivot. The body plate on the back is wide.

Rusty crayfish (*Orconectes rusticus)*
Identification: Claws have bumps—large reddish/rusty spots on the sides of body plates.
Thin body plate on the back.

Red swamp crayfish (*Procambarus clarkia)*
Identification: Large bumps located on body plates and claws. Lacks a body plate located on the back entirely.

Ringed crayfish (*Orconectes neglectus)*
Identification: Claws have orange tips and black bands. Thin body plate. Dark markings on tail sides.

Amphibians

Precautions

Crews should recognize that amphibians are fragile creatures, and overhandling an individual can harm or kill them. Amphibian skin absorbs lotion, bug spray, perfume, cologne, and other chemicals. Care should be taken not to disturb the habitat used by amphibians. Poisonous toxins released from some species' skin can make you sick and, in some cases, be fatal. Wash your hands thoroughly after handling amphibians.

Survey Guidelines

The following guide is meant to be a quick look at some of the Western Oregon species that may be encountered during stream habitat surveys. This is not a complete list of Oregon amphibians, and species that aren't described on the list below may be encountered while on a stream survey. A professional amphibian identification guide should be used in conjunction with this guide. Record observations in the NOTE field of the data forms and the Oregon Plan Reach sheet (yes/no box). If possible, take a picture of the unknown species for later identification.

Amphibian information to be gathered includes

- Species (use these abbreviations for the more common species):

LTS	long-toed salamander	ATF	adult tailed frog
NWS	Northwest salamander	BF	American bullfrog
PGS	Pacific giant salamander	RLF	red-legged frog
RSN	rough skin newt	TFT	tailed frog tadpole
SAL	salamander (unknown)	YLF	yellow-legged frog
		FRG	frog (species unknown)

- Substrate under the observed amphibian (log, moss, rock, mud, etc.)
- Activity (breeding, calling, feeding, etc. – if it can be determined)
- Photograph (especially if the ID is questionable)
- Time of day (am or pm)

Salamanders

Pacific Giant Salamander (*Dicamptodon tenebrous*)

This is a very large, bulky salamander common throughout Western Oregon from the Cascades to the coast. It is the largest salamander in the region and has a broad, thick head, a muscular body, and limbs. Juveniles and Non-metamorphosed adults have very bushy gills, usually without visible stalks, and are dark brown in color. The head is generally wider than the body, and they have a laterally compressed tail that starts near the hind limbs. Juveniles and Non-metamorphosed adults can reach 14 inches in length. Metamorphosed adults of this species can also be found near streams and are often black or gray with striking mottled, brassy, or coppery patterns that interconnect over the body. Metamorphosed adults can reach 7 ½ inches in length.

Pacific Giant Salamanders are quick and can deliver a painful bite – handle with care.

Rough-Skinned Newt (*Taricha granulosa*)

Adults are extremely common in Western Oregon ponds, streams, and forests from the Cascades through the coast range. Adults are easily identified, as they are dark brown on the backs and sides and orange to yellow on the underside. Juveniles and adults have a pale-yellow eye crossed with a dark bar. Their skin can often appear dry and rough, although the skin of individuals found in water will often appear smooth. This species does not have grooves on the sides of the body. Adults can reach nearly 8 inches in length.
Surveyors should take care when handling this species, as they are the most toxic of all Oregon's amphibians. It is highly recommended that you wash your hands after handling this species.

Western Red-Backed Salamander (*Plethodon vehiculum*)

This is a small salamander that can be found on the edges of streams through most of Western Oregon from Coos and Douglas Counties North. They have long, thin bodies with short legs. They are dark brown in color with a yellow, green, or red stripe down the back. This stripe is very distinct with sharp edges and extends all the way to the end of the tail—length up to just over 4 inches.

Northwestern Salamander (*Ambystoma gracile*)

Juvenile and Non-metamorphosed adults are abundant in Western Oregon ponds and streams from the cascades through the coast range. Juveniles have gills that protrude from the head on long stalks and have the appearance of ostrich feathers. Typically, black to olive green in color. Metamorphosed adults are typically brown to black and have a fat, robust appearance. Key features include deep grooves along the body and large glands at the back of the head. Adults can reach 7 ¼ inches in length.

Long-toed Salamander (*Ambystoma macrodactylum*)

This species is typically found throughout the Willamette Valley, in the coast range North of the Rogue River, throughout the Cascades, and much of Eastern Oregon. They are widespread throughout the state, existing in many different habitats. During aquatic habitat surveys, they will be most frequently encountered in shallow to deep ponds and marshy environments. Juveniles of this species develop rapidly and should metamorphose early in the summer. Adults are black to dark gray and often have a mottled dark mustard-colored stripe down the back. The defining characteristic is the presence of a long fourth toe on each hind foot. Adults can reach 6 ¼ inches in length.

Dunn's Salamander (*Plethodon dunni*)

A small salamander often identified because it actively runs to escape human contact and can be found throughout Western Oregon, often right along the sides of streams but rarely in the water. They have long, thin bodies with short legs. They are dark brown in color with a yellow-to-green stripe down the back. This stripe does not extend to the end of the tail and is ragged on the sides. The speckles of the color of the stripe can typically be seen on the sides of these individuals. Length up to 6 inches.

Frogs and Toads

Tailed Frogs (*Ascaphus truei*)

This frog lives in cool, fast-moving streams in Oregon's Cascades and Coast Range. Tadpoles of this species have a mouth that allows them to cling to rocks in fast-moving water. Tadpoles can be

observed clinging to rocks in riffles and rapids. Adults are small with long legs, flat hind toes, and a large head. Individuals are typically mottled tan or brown, with a tan triangle on the head between the eyes and the end of the snout. The eye has a vertical pupil. Their skin can often be grainy. Males have short, broad tails. Adults can be up to 2 inches in length.

Western Toad (*Bufo boreas*)

This species can be found in ponds, marshes, and along the edges of streams throughout Oregon except within the Willamette Valley and the coast range, although they can be found along the coast. This toad is large and robust. Color can vary from cream to brown and is typically covered in darker blotches. There is almost always a light-colored, thin stripe down the back. The skin is bumpy and often dry. Adults can be up to 5 inches in length.

Pacific Treefrog (*Pseudacris regilla*)

This frog is very common and abundant throughout Oregon. Adults are small. The key characteristic of this species is toe pads on the ends of the toes. This species is wildly variable in color but is often observed as green, gray, or tan, with darker mottling on the sides and back. They have a dark stripe or mask extending from the snout's tip through the eye and shoulder. Adults are typically under 2 inches in length.

Cascades Frog (*Rana cascadae*)

This frog is limited to the Cascade Range and is typically found in and around streams, marshes, and ponds above 2000 feet in elevation. It is typically honey-to-olive-green in color and has sharp-edged black spots on its back. Two folds extend from the eyes towards the tail, which are usually raised and lighter in color. The groin area is usually a solid color without mottling. Adults are typically around 3 inches in length.

Red-Legged Frog (*Rana aurora*)

This frog is common in streams, ponds, and marshes west of the Cascades. It is green to brown or reddish-brown and sometimes has black spots or mottling over its back. The undersides of the legs of these frogs are red, and this color can often continue over the belly. The groin at the hind leg is mottled with cream and black blotches. Adults range from 2 ¾ inches up to 4 inches in length.

Foothill Yellow-Legged Frog (*Rana boylii*)

This frog is found in and along streams and rivers along the west slope of the Cascades from the Santiam basin south and throughout the south coast. These frogs prefer low-gradient streams with bedrock or gravel substrates. They are typically olive, gray, or brown in color, and their skin appears rough. The undersides of the hind legs are often yellow but sometimes cream-colored. The throat usually has darker mottling. Adults can reach up to 3 inches in length.

American Bullfrog (*Rana catesbeiana*)

This introduced species has found its way all over western Oregon. They are large light to dark olive-green frogs with darker spots and blotches. They have large, golden-colored eyes and a ridge that extends behind the eye, over the eardrum, and down to the throat. Their eardrums are distinct and at least as large as their eyes but can be larger in males. The undersides are cream-colored with dark mottling.

Mussels

Precautions

When possible, avoid stepping on or crushing mussel beds. Do not dig or pry live mussels out of the gravel.

Survey Guidelines

On the REACH form, record observations of mussels within the following bins: 0 = No mussels observed, 1 = Few mussels observed (1-50), 2 = Many mussels observed (51-200), and 3 = Dense mussel beds. Record size class: <40cm, 40-100cm, >100cm.
Record the UTM coordinates of mussel beds and shells in the NOTES field. Indicate bed size as above. Collect samples of shells (dead mussels) if possible. Place the shells in a Ziploc bag and label with the monitoring area, site ID number, stream name, basin, date, crew initials, and UTM coordinates. Although both crew members should be aware of the presence of mussels, the snorkeler will have better opportunities to see mussels embedded within gravel substrate.

Western pearlshell (*Margaritifera falcate)*

Oregon's longest-lived mussel, Western pearlshell mussels may live 100 years or more. This species is considered a host fish specialist for juvenile or resident salmonids. It is found in urban and remote streams. Its preferred habitat includes areas with low velocity, shear stress, and gradient, often consisting of boulders, gravel, sand, silt, or clay. The species may inhabit undercut banks, shallow fringes, thalweg, and depths of several meters.
The papillae appear fleshy and tree-like along the inhalant aperture.
This species is ranked as Near Threatened.

Western Ridged Mussel (*Gonidea angulate)*

Also known as the Rocky Mountain Ridged Mussel, this species may live 30 years or more. It is found in lake, river, and stream habitats. The preferred habitat is well-oxygenated, stable areas among boulders, sand, silt, and cobble. It is often found tightly wedged between boulders or cobble or against steeper banks, though it can be found along sand and gravel bars. It may be difficult to observe because it may be burrowed flush with the stream or lake bottom. The distinct papillae are branched and non-uniform along the inhalant aperture.
This species is ranked as Vulnerable.

Floater mussels (genus *Anodonta* or *Sinanodonta)*

These mussels are challenging to identify due to a lack of obvious shell characteristics. They are found in rivers, lakes, and ponds, where muddy and sandy sediment is used for burrowing. Floaters typically live 10-20 years and use a variety of host fish.
The papillae are singular and finger-like along the inhalant aperture.

Reference & photos: *Blevins, E.L. et al, 2017. Xerces Society for Invertebrate Conservation Best Management Practices for Protecting Native Western Freshwater Mussels*

Appendix 7: Gear Disinfection Protocol

Background

Aquatic pathogens (bacteria, viruses, parasites, and invasive species such as New Zealand Mud Snails (NZMS)) can adhere to or be trapped in field gear such as boots, waders, drysuits, nets, coolers, boats, etc. New Zealand mudsnails (*Potamopyrgus antipodarum*) are an introduced species that is spreading rapidly among rivers and streams in the western United States. Since they were reported in the Snake River in Idaho in the 1980s, the snails have been discovered in at least ten western states. NZ mudsnails are parthenogenic, so a single introduced snail has the potential to start a new population. In Oregon, NZ, mudsnails have been found in tributaries of the lower Columbia River, Devil's Lake on the central coast, Garrison Lake near Port Orford, Deschutes River, and several sites in the Snake River basin. Mudsnails are resistant to desiccation and may survive for days out of the water on wet waders and sampling gear.

In the western U.S., mudsnails can reach a max. length of 6mm.

Researchers believe recreational anglers may be a primary vector for mudsnails' transportation among streams. The ODFW Fish Health Management Policy (635-007-0965) states that the Department's responsibility is to restrict the introduction, amplification, and dissemination of disease agents in the natural environment.

Prevent Mudsnail Transport Between Watersheds

Crews should avoid surveying more than one major river basin (e.g., Yaquina, Applegate, McKenzie) per day. To avoid mud snail and pathogen transport among basins, crews should sanitize waders and boots daily at the duty station (e.g., district office) or between sites if they must survey two major basins during one day.

Procedure*

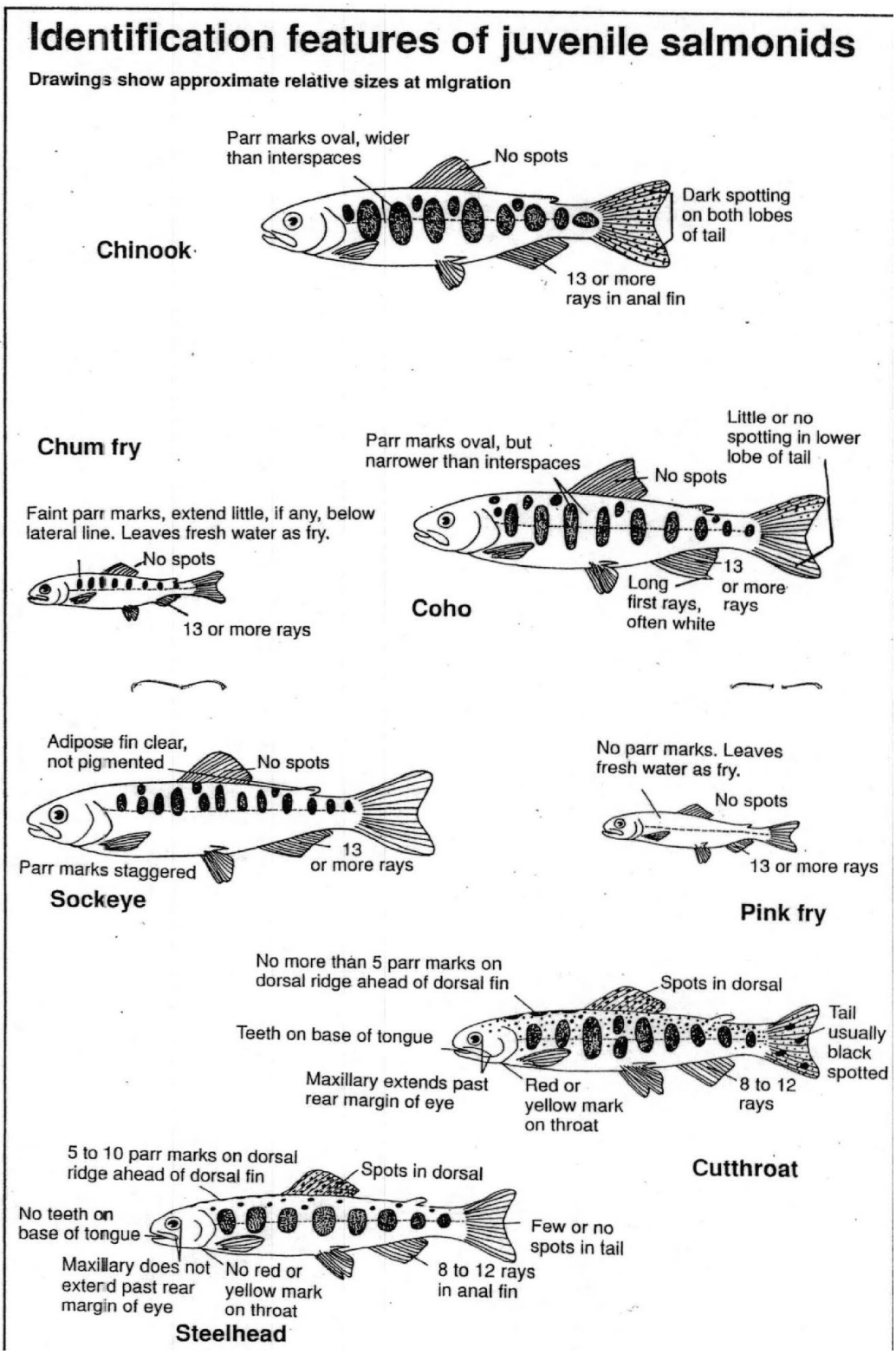
Required equipment:

- Formula 409® (100% solution)
- Clean water supply (not stream water)
- Dishwashing gloves
- Scrub brush

1. Remove waders, boots, and drysuits, and remove insoles from wading boots when possible.
2. Use the scrub brush to clean loose dirt or mud off boots, waders, and field gear.
3. Use a spray bottle of Formula 409® cleaning solution (do not dilute), spray waders, wading boots, boot insoles, and the streambed contact end of the wading staff with the cleaning solution to the point of saturation. Treat the inside and outside of wading boots, paying special attention to bootlace grommets, seams, felt soles, and places where mudsnails might cling. Do not spray 409 on the drysuit booties; they will be damaged.
4. Allow treated gear to sit for ten minutes.
5. Rinse gear in clean water. DO NOT USE STREAM WATER**.** Ideal rinse stations are outdoor hoses at ODFW district offices. When sanitizing gear in the field, a separate spray bottle filled with tap water should be used for rinsing, and the process should occur at least 100m from any waterway or runoff drain.

   Crews should wear gloves while handling Formula 409® to minimize contact with skin.

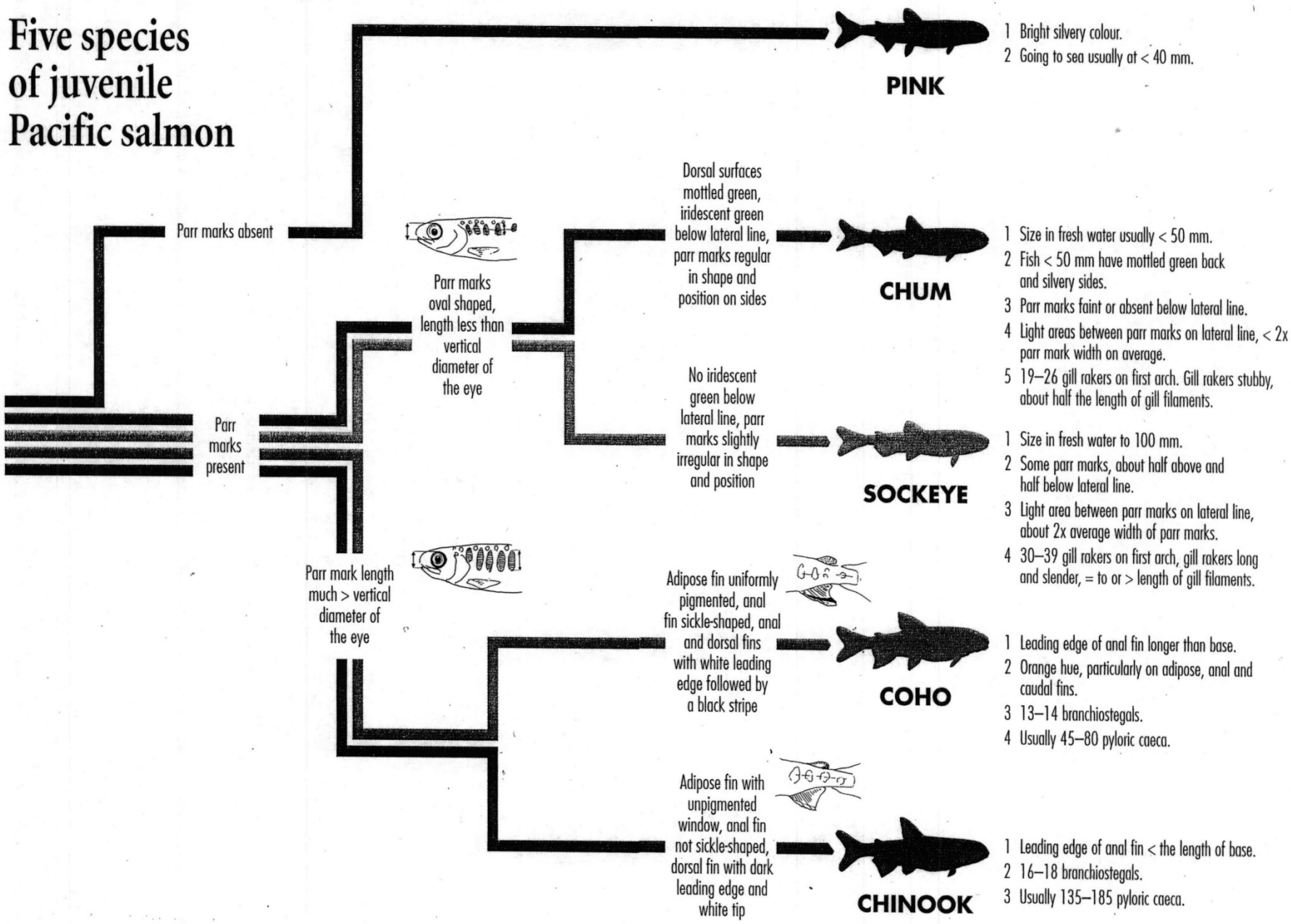
**Hosea, R.C. and B. Finlayson. 2005. Controlling the spread of New Zealand mudsnails on wading gear. California Department of Fish and Game Administrative Report 2005-02.*



From: Field Identification of Coastal Juvenile Salmonids, W.R. Pollard et al., Harbour Publishing

IDENTIFICATION CHART

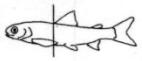
Five species of juvenile Pacific salmon



IDENTIFICATION CHART

Juvenile trout and Dolly Varden

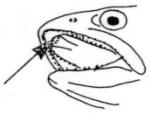
Pectoral fin as long as depressed dorsal fin, and reaches to a vertical line through the anterior insertion of the dorsal fin



ATLANTIC

1 Red dots on lateral line on larger fish.
2 Adipose fin not orange.

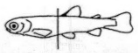
Parr marks large and irregular in shape and position, dorsal leading margin faintly edged in black, vomerine teeth on the head of vomer only



DOLLY VARDEN or BULL TROUT

1 No black spots on back or sides. ■
2 Width of parr marks on lateral line greater than light areas.
3 Small triangle-shaped pigment spot at base of caudal fin.*

Pectoral fin not as long as depressed dorsal fin, and does not reach to a vertical line through anterior insertion of dorsal fin



Parr marks regular in shape and position, distinct dark spots once fish reach 8 cm, teeth on head and shaft of of vomer

Adipose fin orange, orange spots on or near lateral line in larger juveniles

BROWN TROUT

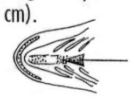
1 Adipose fin orange.
2 Small black spots above and below lateral line.
3 9–12 parr marks, greater than diameter of eye.
4 Orange spots, if present, are close to lateral line.

Adipose fin not orange, distinct dark pigment on lower part of first dorsal fin ray in fish 40 mm. or less

Maxillary reaches past the posterior margin of the eye in fish over 8 cm. Red or orange hyoid colour usually present once fish reach 8–10 cm

CUTTHROAT

1 Caudal fin melanophores tend to form in lines along fin rays in fish < 50 mm.* ■
2 Mid-dorsal parr-like marks usually absent.
3 White tip on dorsal covers 3 or fewer ray interspaces.
4 Maxillary reaches past posterior margin of eye (does not separate in trout less than 8 cm).
5 Hyoid teeth present.



Fish over 8 cm maxillary reaches to back of eye or less, no hyoid red or orange on any juvenile fish, even those over 10 cm long

STEELHEAD/ RAINBOW

1 Caudal fin melanophores are evenly distributed in fish < 50 mm.* ■
2 Fish > 50 mm. median dorsal parr marks usually present.
3 White tip of dorsal covers 3–5 ray interspaces.
4 Hyoid teeth absent.

Note: You may encounter juvenile mountain whitefish in some mainland rivers, especially those that penetrate the coastal mountains to interior regions. Juvenile mountain whitefish have an adipose fin and parr marks; however, their bodies are more slender and pencil-shaped than trout or char. The mouth of a juvenile whitefish is positioned lower down on the jaw and is smaller than that of trout or char. Juvenile mountain whitefish have fewer and thus larger scales than trout or char. Whitefish have 70–90 oblique rows of scales across the lateral line, compared to 100 or more rows on trout or char.

* Need for 10x hand lens or binocular microscope.

■ Melanophores are small black pigment cells about the size of fine pepper. Spots on fish are an accumulation of melanophores. Small black melanophores often show on recently emerged fry but these are not what we refer to as spots.

● Examining fish for features marked in red can harm or kill the specimen, and may require 10x or binocular microscope.

Notes

Notes

Quick reference for habitat / Reach characteristics

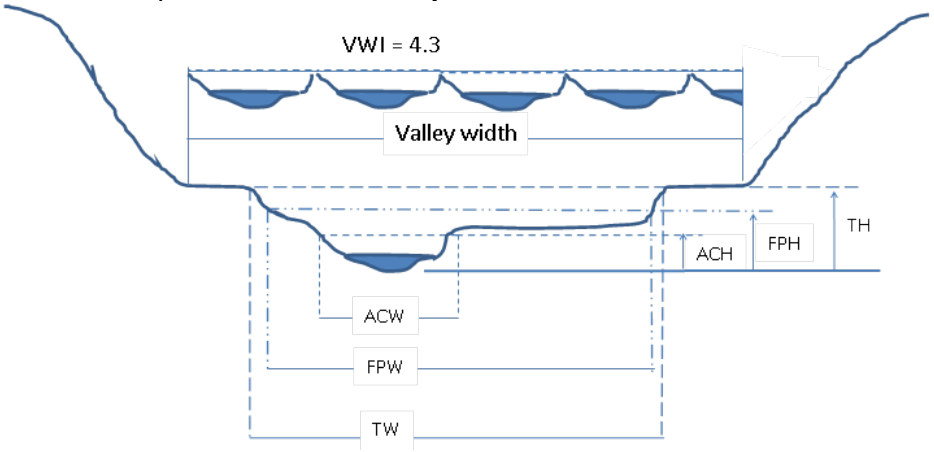
Reach Calls (pg. 5-8, 11-12)

Channel and Valley Combinations (pg. 33-36)

CHANNEL FORM	VALLEY FORM					
	VWI < 2.5 NARROW VALLEY FLOOR			VWI > 2.5 BROAD VALLEY FLOOR		
CONSTRAINED CHANNEL	STEEP V (SV)	MODERATE V (MV)	OPEN V (OV)	HIGH TERRACE (CT)	MULTIPLE TERRACE (MT)	FLOODPLAIN (WF)
BEDROCK (CB)	CB - SV	CB - MV	CB - OV			
HILLSLOPE (CH)	CH - SV	CH - MV	CH - OV			
ALTERNATING HILLSLOPE TERR. (CA)				≤ 2.5 x ACW within FPW		
HIGH TERRACE (CT)				CA - CT	CA - MT	
LAND USE (CL)				CT - CT	CT - MT	
				CL - CT	CL - MT	CL - WF
UNCONSTRAINED CHANNEL				≥ 2.5 x ACW within FPW		
SINGLE CHANNEL (US)					US - MT	US - WF
ANASTOMOSING (UA)					UA - MT	UA - WF
BRAIDED CHANNEL (UB)					UB - MT	UB - WF

Channel Metrics (pg. 11-12, 37-39)

VWI (Valley Width Index) **= valley floor width ÷ ACW** (Active Channel Width)



Land use (pg. 9)

EX = EXclosure / fencing, **LG** = Light Grazing, **HG** = Heavy Grazing, **MI** = MIning, FF = Forest Fire, **AG** = AGricultural / dairy, **TH** = Timber Harvest, **PT** = Partial-cut Timber, **YT** = Young Trees (<15cm), **ST** = Second-growth Timber (15-30cm), LT = Large Timber (30-50cm), **MT** = Mature Timber (50- 90cm), **OG** = Old Growth trees (>90cm dbh), **BK** = Bug Kill, **CR** = Conservation area or wildlife Refuge, **WA** = Wilderness Area or wilderness study area, **WS** = Wild and Scenic area, **GN** = GreeNway – designated city/county/state park, **WL** = WetLand, **DW** = Domestic Water, **GF** = GolF course, **IN** = INdustrial, **UR** = URban, **RR** = Rural Residential

Streamside Vegetation (Veg Class) (pg. 8)

Vegetation Type**: N** bare, **B** sagebrush, **G** annual grasses/herbs, **P** perennial ferns/sedges, **S** shrubs, **D** deciduous, C coniferous, **M** mixed (same diameter class).

Vegetation Class (cm at dbh): **1**-3cm seedlings, **3**-15cm young trees, **15**-30cm second growth, **30**-50cm large trees, **50**-90cm mature timber, **90+**cm old growth

Channel Type (pg. 17-18)

00 = single channel, **01** = primary channel, **02** = side channel / braid, **10** = isolated pool, backwater, or alcove, 11 = tributary, **12** = tributary side channel

Salmonids

Salmon: No spots on dorsal. Count all regardless of size while snorkeling.

Coho: No spots on dorsal; anal fin is sickle-shaped with a leading edge longer than base; anal and dorsal fins have a stripe of white pigment followed by a stripe of black pigment.

Chinook: No spots on dorsal; base of anal fin is longer than leading edge; anal and dorsal fins only have white pigment stripe.

Trout: Spots on dorsal. Count if fork length ≥90mm.

Steelhead: Spots on dorsal; rounded head/snout; jaw does not extend past rear margin of eye; parr marks superimposed on spots; longer stripe of white pigment on tip of dorsal fin; 3-5 medial-dorsal parr marks.

Cutthroat: Spots on dorsal; pointed head/snout; jaw extends past rear margin of eye; spots superimposed on parr marks; shorter stripe of white pigment on tip of dorsal fin; usually no medial-dorsal parr marks.

Photos: Bruce Miller, ODFW