Rapid Aquatic Habitat Assessment Protocol:

Methods for Stream Inventory Surveys

Yakima/Klickitat Fisheries Project

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Yakama Klickitat Fisheries Project
Yakama Nation Fisheries

Introduction

The Rapid Aquatic Habitat Assessment Protocol (RAHAP) is designed to provide quantitative information on stream habitat and fish distribution at the watershed scale. Data collected from the stream inventory surveys are used to provide baseline information for fisheries biologists, hydrologists, and foresters to guide natural resources management and land use practices on Yakama Nation lands.

The Monitoring and Evaluation Program (M&E) and Klickitat Watershed Enhancement Project (KWEP) initiated the RAHAP stream inventory pilot study in 2009. Prior to 2009, habitat inventories were conducted using the Timber Fish Wildlife (TFW) monitoring methodology (Plues et al. 1999). The TFW methodology focuses on intensive monitoring of discrete sections (~450 meters) of stream over time. Yakama Nation Fisheries personnel designed a rapid stream inventory protocol for spatially continuous sampling of stream habitat and fish distribution. This protocol establishes spatial context and fish habitat relationships at habitat unit, reach, and basin scales. The spatially continuous method is useful when the scale(s) necessary to detect pattern are unknown. This level of pattern detection provides an advantage for refined study designs, enhancement project location identification, prioritization, and reference conditions for project design. Existing stream inventory protocols were reviewed during the development of the RAHAP methodology. Upon review, two widely used Pacific Northwest stream classification systems, TFW and the Aquatic Inventory Project (AIP), were incorporated into the RAHAP methodology (Moore et al. 2010, Pleus et al. 1999, and Schuett-Hames et al. 1999).

RAHAP quantifies both the abiotic and biotic state of aquatic habitat. The abiotic components are: geomorphic reach segments, habitat units, spawn patches, bedrock features, wood pieces, wood jams, and streamflow. These physical parameters are coupled with a separate one-pass fish survey that ties fish abundance to habitat. The geomorphic reach and habitat unit level delineation methodology was derived primarily from AIP (Moore et al. 2010). The wood piece and wood jam inventories follow protocols established by Schuett-Hames et al. 1999. Yakama Nation Fisheries personnel identified spawning patch and bedrock features as habitat of interest and subsequently developed survey methodologies.

Field crews are comprised of two people collectively responsible for quantifying reach delineations, habitat units, spawning patches, bedrock features, wood pieces, and wood jams. Tasks should be

assigned in a manner that will maximize data collection efficiency of each crew. A crew may not switch responsibilities or tasks within a reach survey but may change at the start of a new reach.

Geomorphic Reach

A geomorphic reach is defined as a segment of stream bounded by tributary junctions, major waterfalls, or a change in valley type (Frissell et.al 1986). Reaches are characterized by relatively uniform slope throughout their length. Geo-fluvial forces influence reaches on spatio-temporal scales of ≥ 300 meters and thousands of years. In the case of project specific effectiveness monitoring or some other non-geomorphic reach delineation an administrative reach break may be imposed at the upstream and downstream bounds of the area of interest.

Begin a new habitat datasheet each time a new geomorphic reach is delineated and enter the reach forming agents (start and end agent) as well as all the corresponding header information. Continue the sequential numbering system and cumulative length from the previous reach to habitat units delineated in the new reach. Reach forming agents include the following options:

TJ **T**ributary **J**unction

WF **W**ater**f**alls

VT **V**alley **T**ransition

PB **P**roject **B**oundary

Begin a new reach at the confluence of each named tributary. Also delineate a new reach at any unnamed tributary that contributes ≥15% of the total flow based on a visual estimate. Do not name unnamed tributaries. Identify the tributary by the river kilometer where it enters the parent steam. For example, if a tributary enters the parent stream at river kilometer 2.0 than the following naming convention would apply:

TJ2.0 **TJ** = Tributary Junction, **2.0** = Enters parent stream at River Kilometer 2

Delineate a new reach when a major waterfall is identified. A waterfall must meet two criteria to distinguish temporary obstructions (raised culvert outlets, debris jams, head cuts, etc.) from geologic barriers. First, a waterfall must act as a barrier to upstream fish movement. A 3.7 meter waterfall is typically considered a barrier to anadromous fish (WDFW 2009). For resident fish species the waterfall height may be significantly less. **Second, the barrier must be tall enough to restrict gene flow to a downstream direction resulting in genetic isolation of fish population(s) above the barrier.** Fish presence or absence will be verified via the Fish Barrier Survey component of RAHAP (see separate YKFP Protocol). In the case where a separate fish barrier survey is not performed, visually confirm fish presence or absence above each waterfall before continuing or discontinuing the habitat survey. **End the habitat survey if fish absence is verified either visually or via electrofishing above a waterfall.** Otherwise, delineate a new reach and continue habitat mapping to the end of fish distribution. Do not name unnamed waterfalls. For example, if a waterfall is encountered at river kilometer 2.0 than the following naming convention would apply:

WF2.0 WF = Waterfall, **2.0** = River Kilometer identifying waterfall location

Delineate a new reach at a valley transition. For example, a common valley type transition in the Klickitat River sub-basin is from a broad valley to a narrow valley. Examples of broad valley types include: meadows and wide forested floodplains. Examples of narrow valley types include V-shaped valleys and canyons. A typical landscape feature that denotes a reach break is a hill-slope bottleneck.

A similar naming convention as described above is used to identify valley type transitions. For example, if a valley transition is encountered at river kilometer 2.0 than the following naming convention would apply:

VT2.0 VT = Valley Type, **2.0** = River Kilometer identifying valley type transition location

A new reach may be delineated for administrative purposes. The upstream and downstream project boundaries will be defined by the area of interest. For example, fisheries enhancement project boundaries are defined during the enhancement project planning phase and will hence forth define the reach for future RAHAP surveys. A similar naming convention as described above shall be employed for administrative project boundaries. For example, if a fisheries enhancement project boundary is located at river kilometer 2.0 than the following naming convention would apply:

PB2.0 PB = Project Boundary, **2.0** = River Kilometer identifying project boundary location

Flagging is used to mark the beginning and end of each reach. The flag should denote the following information: stream name, reach name, and date. Flagging will be used to locate specific reaches for repeat habitat surveys.

Habitat Unit Survey

The channel habitat unit is the primary metric used to characterize streams for RAHAP surveys. The habitat unit is the basic level of notation used to describe discrete geomorphic units. Geomorphic habitat units are relatively homogonous areas of stream influenced by channel bedform, flow characteristics, and water surface elevation (Moore et al. 2010). Physical processes that influence geomorphic habitat unit formation include the interaction of discharge, sediment load, and channel roughness.

Data collection tasks during a habitat survey are either completed by a single individual or with the help of the other crew member. Members of a crew may not switch responsibilities or tasks within a reach. Begin each survey at a designated point. Conduct foot surveys in an upstream direction and boat surveys in a downstream direction. Regardless of survey type (either foot or boat), **left and right bank are always identified based on a downstream orientation.** Fill out the header information on the survey form at the beginning of each survey event or start of a new reach. The following sequence corresponds to the listing of variables on the header section of the data sheet:

1. **Stream Name.** Record the name of the survey stream.
2. **Date.** Record the survey event date.

3. **Reach.** Record the name of the survey reach. Reaches consist of numerous habitat units. Determined by encountering a (**TJ**) tributary junction, (**WF**) waterfall, valley transition (**VT**), or project boundary **(PB)**. Record whether the reach starting agent is the result of **TJ**, **WF**, **VT**, or **PB** at the downstream end of the reach.
4.
5. **GPS ID.** Record the unique GPS unit identification code.
6. **Camera ID.** Record the unique camera identification code.
7. **Crew.** Record the initials of person(s) collecting data.
8. **Recorder** Record the initials of the person recording the data.

The following sequence corresponds to the listing of variables collected during a habitat survey:

1. **Unit Number.** A sequential numbering system is used to describe the order of channel habitat units. Always begin the sequential number system with "1" at the beginning of a new stream. If multiple crews are surveying the same stream simultaneously, upstream crews should begin the sequential numbering system with a large enough number to ensure that habitat unit numbers do not overlap between crews. For example, in a situation where three crews are simultaneously mapping three distinct and adjacent reaches in a stream, the crew at the lower reach should begin with "1", the middle crew with "300", and the upstream most crew with "600". Unit numbers will be renumbered to run sequentially from downstream to upstream after completion of the habitat unit survey. A hierarchical naming convention is used to describe units located in primary, secondary, and side channels. Habitat units located in a primary channel are always numbered sequentially with an integer. A decimal system is used to describe habitat units located in secondary and side channels. Numbers to the left of a decimal identify the unit that the secondary or side channel outlet flows into. Numbers to the right of a decimal string indicate the sequence of numbers describing the order of habitat units in a given secondary or side channel (Fig. 1). Start a new sequential numbering system for each side channel surveyed. Identify the unit number and habitat type by hanging a strip of flagging at the downstream boundary of each habitat unit. These flags will be used to locate specific units for fish sampling at a later date.
2. **Unit Type.** The habitat type is the basic level of notation for this survey methodology. Bedform, gradient, and substrate are the primary metrics used to differentiate habitat types. The length of a unit must be ≥ than the wetted width in order to be classified as a distinct habitat type. All channel portions (wetted or dry) must be assigned one of the fourteen unit type categories described below. Record a two letter habitat type code in the *Habitat Type* column.

    PL **Pool.** An area characterized by a section of stream channel where water is impounded within a closed topographical depression, the unit is longer than it is wide, contains a gradient of 0% slope, has a channel spanning hydraulic control, and a residual pool depth.

GL **Glide.** An area characterized by generally uniform depth, flow with minimal to no surface turbulence, lack of structure, and a gradient of 0-1% slope.

RN **Run.** A portion of stream characterized by relatively fast-moving, bank-to-bank, non-turbulent flow. A run is usually too deep to be considered a riffle, but water velocity is too fast to be a glide. The channel bathymetry is usually a uniform flat plane.

RF **Riffle.** Fast, turbulent, shallow flow over submerged or partially submerged gravel or cobble substrates (0.5-2.0% gradient). May also contain sub-unit size pools or pocket water created by scour around small boulders or wood. Sub-unit sized pools can comprise 20% or greater of the total unit area.

RA **Rapid.** An area characterized by swift, turbulent flow including chutes and some hydraulic jumps swirling around boulders. Exposed substrate composed of individual boulders, boulder clusters, and partial bars. Characterized by moderate gradient; usually 2.0-4.0% slope, occasionally 7.0-8.0%.

CA **Cascade**. A section of stream with high velocity and turbulent flow that contains many hydraulic jumps or chutes resulting in white water over 30-80% of the area.

FA **Falls**. Geomorphic feature characterized by a vertical to near vertical discrete break in channel gradient.

WL **Wetland**. An area of land that is regularly wet or flooded but does not contain a distinct channel, such as a marsh or swamp.

OB **Obscure.** A section of stream where measurement is not possible due to portions of the channel not being visible or accessible.

IP **Isolated Pool.** Pool of water bounded by dry channel that may dry up or be dependent on hypereic flow during late summer.

DC **Dry Channel.** Characterized by a section of stream where the channel becomes dry across its entire width.

ST **Step.** Steps are abrupt, discrete breaks in channel gradient. With the exception of waterfalls, steps are usually not channel spanning. Steps can separate sequential units of the same type (e.g. pools).

CV **Culvert.** Stream flowing through a culvert.

AL **Alcove.** An off-channel backwater with no identifiable surface inlet flow.

3. **Channel Location Category (CAT).** Record the unit's channel location in the *CAT* column as Primary (**1**), Secondary (**2**), Side channel (**3**), or (**4**) Sub-unit. It is critical that each delineated habitat unit be identified with the proper channel location code because this information is used to calculate primary, secondary, and side channel length. Record a numerical code in the *CAT* column (Fig. 1).

   01 **Category 1.** These Include channel habitat units located in a primary channel. In a split channel, the primary channel is defined as a channel that contains > 50% of the flow.

02 **Category 2.** These Include channel habitat units located in a secondary channel of a split channel. A secondary channel contains < 50% of the flow and is separated from the main channel by a dry gravel bar. Bar may be vegetated by herbaceous or emergent woody vegetation but does not persist at higher flows.

03 **Category 3.** These Include channel habitat units located in a side channel. Side channel that is separated from the main channel by an island covered with established woody vegetation.

04 **Category 4.** These include sub-units adjacent to principal units in the main, primary, or secondary channel (ie., Alcoves).

4. **Secondary/Side Channel Bank Location (SC Bank).** Record the bank location of the secondary/side channel as left bank (**LB**) or right bank (**RB**) based on a downstream orientation (Fig 1).
5. **Secondary/Side Channel Inlet Primary Unit Location (SC Inlet Unit #).** Record the unit that the secondary/side channel originates from (Fig 1).
6. **Secondary/Side Channel Inlet GPS Point (SC Inlet WP).** Record a GPS waypoint at the inlet of each surveyed secondary/side channel.
7. **Unit GPS Waypoint.** Record a GPS waypoint at the beginning of each habitat unit. Use the same GPS unit throughout the entire length of a reach level survey. Only change GPS units due to mechanical issues, damage, or loss.
8. **Start Length.** The length of each reach is based on the cumulative length of the primary units. Use a walking chain or rangefinder to measure or estimate habitat unit lengths for foot and boat surveys, respectively. The starting length of the first habitat unit in a new reach should begin with the end length of the last habitat from the previous reach. The end length of a habitat unit is always the beginning length of the next habitat unit. Start a new cumulative length for each newly identified category 2, 3 or 4 channel while maintaining the cumulative length of the primary channel. The length of the first habitat unit in a category 2 or 3 channel should always begin with zero.
9. **End Length.** Record the end value for each delineated habitat unit in the *End Length* column.
10. **Wetted Width Measurements.** Measure or estimate wetted widths for each habitat unit. Record a minimum of two wetted widths in short units (≤6 m) and up to six in longer units (>6 m). Use a measuring tape, stadia rod, or rangefinder to measure/estimate wetted widths. Always calibrate a rangefinder before each sampling event. The surveyor must verify the instrument has an accuracy of ±0.3 meters per 30 meters prior to use.
11. **Substrate Composition.** Visually estimate the percent substrate composition by area from six substrate size classes. Estimate percent substrate composition of the habitat unit area that is wetted. Estimate each substrate category to the nearest 5 percent. The six size classes are:

    Fines - silt and fine organic matter
    Sand - sand grain sized particles (0.06-2mm)
    Gravel - pea to baseball sized particles (2-64mm)
    Cobble - baseball to bowling ball sized particles (64-256mm)

Boulders - particles greater in size than a bowling ball (>256mm)
Bedrock - consolidated rock

12. **Pool Max Depth.** Measure the maximum depth of each pool to the nearest 0.01 meter where possible. Probe the bottom with a depth staff to find the deepest point. Small differences in pool depth may be significant therefore accurately locate the deepest point.
13. **Pool Outlet Depth.** Measure and record the pool outlet depth to the nearest 0.01 meter at the pool tail crest of every pool habitat unit. The pool tail crest marks the downstream end of a pool unit and functions as the hydraulic control. Use the following criteria as a guideline to determine if a habitat unit qualifies as a pool: the unit has 1) 0% surface gradient, 2) a channel spanning hydraulic control, and 3) a residual pool depth. Calculate minimum residual pool depth by subtracting the *Pool Outlet Depth* from the *Maximum Pool Depth*.
14. **Pool Forming Agent.** Record a maximum of two pool-forming agents from the pool forming agent code list. Record the primary code first when a secondary pool-forming agent is identified.

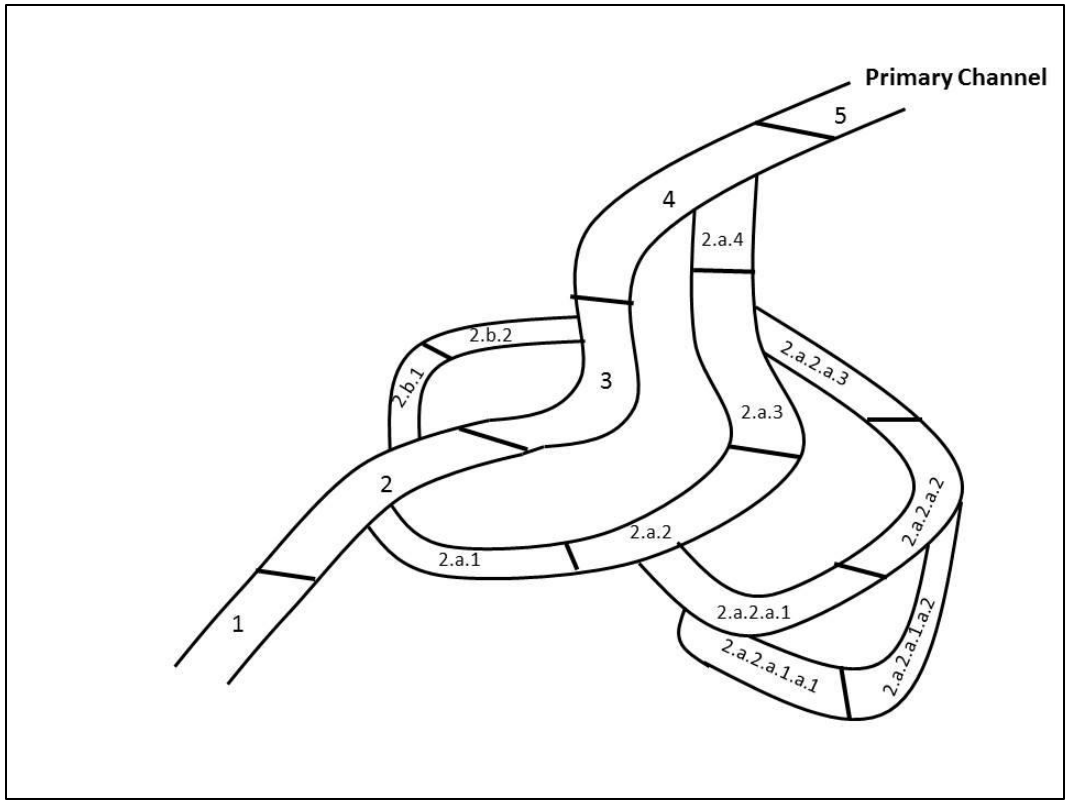
01	Large Woody Debris (LWD) log(s)
02	LWD rootwad(s)
03	LWD jams
04	Roots of standing trees or stumps
05	Boulders
06	Bedrock
07	Channel bedform
08	Scour resistant bank
09	Artificial bank
10	Beaver Dam
11	Other/Unknown

15. **Percent Undercut Banks (% UCB).** For each habitat unit, visually estimate the percent of the bank composed of undercuts. An undercut must be ≥ 0.3 meters deep in order to classify as an undercut bank.
16. **Undercut Bank Location (UC Bank).** Record the bank location of the undercut as either left bank (**LB**) or right bank (**RB**). Bank location is based on a downstream orientation.
17. **Bankfull.** Distance across the stream channel that the stream flow attains every 1.5 years on average. Although identification of bankfull may be difficult to determine, use changes in vegetation, slope breaks, and high water marks as indicators. **At the very least, take bankfull width measurements in every riffle habitat unit but attempt to measure bankfull width in every delineated habitat unit.** Record multiple bankfull widths for habitat units ≥30 meters.
18. **Step Height.** Record the height of each delineated step. Steps are abrupt, discrete breaks in channel gradient.

19. **Percent Canopy (% Canopy).** Visually estimate the percent canopy extending over the wetted channel.
20. **Dominant and Sub-dominant Canopy Cover (Sub/Dom).** Record the two-digit code identifying the dominant and subdominant canopy cover (Table 1).
21. **Photo Number.** Take a maximum of two photo(s) of each delineated habitat unit. Record the number stamped on the photo in the *Photo #* column. Use the same camera throughout the entire length of a reach level survey. Only change cameras due to mechanical issues, damage, or loss.
22. **Photo Direction.** For each photo, record whether the photo was taken looking upstream (**US**), downstream (**DS**), or cross sectional (**XS**). Attempt to photograph in the upstream orientation whenever possible.
23. **Temperature ^{o}C.** Record a temperature at tributary junctions (above and below), isolated pools, or any notable feature during a survey. Record temperature in Celsius with a hand held thermometer.
24. **Field Notes.** Use this field to record any important features, observations, or comments during the course of the habitat unit survey.

Table 1. List of canopy codes used to describe dominant and sub-dominant canopy species.

Tree Species	Species Code	Tree Species	Species Code
Ponderosa Pine	PP	Red Alder	RA
Grand Fir	GF	Cottonwood	CW
White Pine	WP	Scouler's Willow	SW
Western Red Cedar	RC	Coyote Willow	CW
Douglas Fir	DF	Red Osier Dogwood	RD
Western Larch	WL	Pacific Dogwood	PD
Lodgepole Pine	LP	Oregon White Oak	OW
Sitka Spruce	SP	Spirea	SP
Big-Leaf Maple	BM	Elderberry	EB
Vine Maple	VM	Salmonberry	SM



Unit #	Unit Type	CAT	SC Bank	SC Inlet Unit #
1	RF	1		
2	GL	1		
2.1	RF	3	LB	7
2.2	GL	3	LB	7
2.3	PL	3	LB	7
2.4	RF	3	LB	7
2.5	GL	3	LB	7
2.6	PL	3	LB	7
2.7	RF	3	LB	7
2.4.1	GL	3	RB	6
2.4.2	PL	3	RB	6
2.4.3	RF	3	RB	6
3	PL	1		
4	RF	1		
4.1	GL	2	RB	5
4.2	RF	2	RB	5
5	PL	1		
6	RF	1		
7	GL	1		

Figure 1. Hypothetical example illustrating habitat unit mapping, channel identification, and channel location for a channel island complex.

Spawn Patch Survey

The purpose of a spawning survey is to quantify the distribution and area of suitable spawning habitat. Although water depth and velocity are important variables to consider when assessing salmonid spawning habitat, the timing of the survey (occurring outside of the spawning window) and hydraulic conditions (low-flow period) restricts the spawning habitat assessment to quantifying suitable spawning substrate (Table 2). Further studies may be required during the spawning window to verify the suitability of the defined spawning areas.

Table 2. General spawn patch criteria based on particle size range, salmonid body size, and salmonid use (Schuett-Hames et al. 1999).

Particle Size Class	Size Range (mm)	Usage Based on Body Size	Species Usage
Small Spawning Gravel	≥8 - 64	All Salmonids	Resident Rainbow Trout, Westslope Cutthroat Trout, Bull Trout, Steelhead, Chinook, and Coho
Large Spawning Gravel	≥64 - 128	Large Bodied Salmonids	Steelhead, Chinook, and Coho

Start a new datasheet at the start of each new reach or event. Complete the header information on the survey form prior to beginning the survey. The following sequence corresponds to the listing of variables on the header section of the data sheet:

1. **Stream Name.** Record the name of the survey stream.
2. **Date.** Record the survey event date.
3. **Reach.** Record the name of the survey reach name. The name of the reach should be the same as recorded on the habitat unit survey form.
4. **GPS Unit Number.** Record the unique GPS unit identification code. Use the same GPS unit throughout the entire length of a reach level survey. Only change GPs units due to mechanical issues, damage, or loss.
5. **Unit of Measure.** Record the unit of measure as feet or meters.
6. **Camera Number.** Record the unique camera identification code.
7. **Surveyor.** Record the initials of the person conducting the survey.

The following sequence corresponds to the listing of variables collected during a spawn patch survey:

1. **Patch Number.** Use a sequential numbering system to describe the order of spawning patch units. Always begin the sequential number system with "1" at the start of a new stream. Begin a new data sheet for each event but continue the numbering sequence from the previous day. If multiple crews are surveying the same reach simultaneously, upstream crews should begin the sequential numbering system with a large enough number to ensure that patch numbers do not overlap between crews. For example, in a situation where three

crews are simultaneously mapping a long reach, the crew at the start of the reach should begin with "1", the middle crew with "200", and the upstream most crew with "400". Patch numbers will be renumbered to run sequentially from downstream to upstream after completion of the spawn patch survey

2. **Unit Number(s).** Record the habitat unit number(s) that contains the spawn patch. Linking spawning patches to delineated habitat units is critical for geo-referencing.
3. **GPS Waypoint.** Record a GPS waypoint at the downstream end of each identified spawning patch. A GPS waypoint is critical information for geo-referencing and developing a spawning habitat distribution layer in GIS.
4. **Length.** Measure and record the length of the spawning patch with a measuring tape, stadia rod, or rangefinder.
5. **Width.** Measure and record the width of the spawning patch with a measuring tape, stadia rod, or rangefinder. Length and width measurements will be used to calculate spawning patch area.
6. **% Area Outside Wetted Channel.** Record the percent area of a spawn patch that is outside the wetted channel.
7. **Field Notes.** Use this field to record any important features, observations, or comments during the course of the spawn patch survey.

Bedrock Feature Survey

Bedrock outcroppings are an important pool-forming feature. The objective of these surveys is to quantify the distribution, function, and length of bedrock features. Bedrock distribution data collected from these surveys will be used to correlate the occurrence of bedrock outcroppings to pool frequency. Additionally, this baseline information potentially provides justification for reconnecting bedrock features that are currently isolated from the active channel. Start a new datasheet at the start of each new reach or event. Fill out the header information on the bedrock survey form prior to beginning the survey. The following sequence corresponds to the listing of variables on the header section of the data sheet:

1. **Stream Name.** Record the name of the survey stream.
2. **Date.** Record the survey event date.
3. **Reach.** Record the name of the survey reach. The name of the reach should be the same as recorded on the habitat-unit survey form.
4. **GPS Unit ID.** Record the unique GPS unit identification code. Use the same GPS unit throughout the entire length of a reach level survey. Only change GPs units due to mechanical issues, damage, or loss.
5. **Unit of Measure.** Record the unit of measure as feet or meters.
6. **Camera Number.** Record the unique camera identification code.
7. **Surveyor(s).** Record the initial(s) of the person conducting the survey.

The following sequence corresponds to the listing of variables collected during a bedrock feature survey:

1. **ID.** Use a sequential numbering system to describe the order of identified bedrock features. Always begin the sequential number system with "1" at the start of a new reach. Begin a new data sheet for each event but continue the number sequence from the previous day. If multiple crews are simultaneously surveying the same reach, upstream crews should begin the sequential numbering system with a large enough number to ensure that bedrock feature ID numbers do not overlap between crews. For example, in a situation where three crews are simultaneously mapping a long reach, the crew at the start of the reach should begin with "1", the middle crew with "200", and the upstream most crew with "400". Bedrock ID numbers will be renumbered to run sequentially from downstream to upstream after completion of the bedrock feature survey
2. **Waypoint.** Record a GPS waypoint at the downstream, midpoint, or upstream end of each identified bedrock feature. A GPS waypoint is critical information for geo-referencing and developing a bedrock distribution GIS layer.
3. **Related Habitat Unit(s).** Record the habitat unit number(s) that a bedrock feature spans. Linking bedrock features to delineated habitat units is important information for geo-referencing purposes.
4. **GPS Position.** Identifies the GPS waypoint location (as upstream, midpoint, or downstream) along the length of the bedrock feature. Circle the GPS waypoint location of the bedrock feature in the *GPS Position* column as **US** (upstream end), **MP** (midpoint), or **DS** (downstream end).
5. **Channel Location.** Circle applicable bank location(s) of the bedrock feature as **LB** (left bank), **CB** (channel bottom), or **RB** (right bank) based on a downstream orientation.
6. **Bedrock Length.** Measure the longitudinal length of the bedrock feature with a measuring tape, stadia rod, or rangefinder**.**
7. **Cross-Sectional Shape.** Record the cross-sectional shape of the bedrock feature as **ledge** ($\leq 15^o$), **slope** (15^o to 60^o), or **cliff** ($>60^o$). If uncertain, use a clinometer (in degrees on the left side in the viewfinder) to measure the gradient of the bedrock feature. Place a stadia rod on the surface of the bedrock feature. Set the clinometer on the surface of the stadia rod and record the gradient of the bedrock in degrees.
8. **Planform Shape.** Circle the planform shape of the bedrock feature as **Prj** (projecting) or **nPrj** (non-projecting). A projecting bedrock feature extends into the stream channel. A non-projecting bedrock feature does not extend into the channel and is limited to the channel margin.
9. **Surface Control.** Circle a **Y** (yes) or **N** (no) to indicate if the bedrock feature is the vertical control of surface flow.
10. **Comments.** Use this field to record any important features, observations, or comments during the course of the bedrock survey.

Wood Pieces Survey

The Wood Pieces Survey provides a standard method for assessing and monitoring the quantity and quality of large woody debris. The survey quantifies the density and volume of large woody debris at the habitat unit scale. The survey methodology collects detailed information on individual pieces including data on piece count, category, bankfull channel zone, whether it is deciduous or conifer, stability, size and function. The purpose of the Wood Pieces Survey is to:

1. Provide a means of accurately documenting the current abundance, distribution, characteristics, and function of large woody debris pieces in stream channels.

2. Provide a repeatable methodology to monitor changes in the distribution and quantity of large woody debris pieces over time.

There are two types of LWD (logs and rootwads) described in a wood piece survey. Below is a detailed description of each type to assist with field identification.

Log Identification Criteria

A log is defined as a tree or section of tree and may or may not include a root system. To qualify as LWD, a log must meet four criteria:

1. *Dead:* No life evident at time of survey or no chance of survival to the next survey season. Determining chance of survival requires specific knowledge of tree species and their ability to regenerate.
2. *Root System:* The root system (if present) is wholly or partially detached from the ground to the point where it is **no longer capable of supporting the weight of the stem/bole**.
3. Minimum diameter of 0.2 meter with total length of ≥2 meters; and
4. Minimum 0.1 meter of length extending into or above the bankfull channel. To determine if the piece extends into the bankfull channel, refer to the "Channel Zone Identification" sub-section.

Rootwad Identification Criteria

A rootwad is defined as a dead section of tree with a recognizable bole and root system. Rootwads are typically recruited into the stream channels through bank cutting and erosion. This process gradually exposes the roots of standing stumps until they are detached and all or part of their length are within the bankfull channel. To qualify as a LWD, a rootwad must meet *all four* of the following criteria:

1. Dead;
2. Root system detached from original position;
3. *Root System:* The root system (if present) is wholly or partially detached from the ground to the point where it is **capable of supporting the weight of the stem/bole**;
4. Minimum diameter of 0.2 meters with total length of ≥2 meters.

Rootwads must have an identifiable root system and bole. Rootwads become LWD when they have fully detached from their original floodplain or terrace locations. This is an important distinction defining its function as channel debris. Exposed roots that are within the bankfull channel may have an influence on channel morphology and provide habitat for salmonids, but they do not have the ability to move along the length of the channel and hence are not yet "debris."

Detachment can be difficult to determine especially if the rootwad is still in an upright position and the root system is buried. Count the piece if it can be determined that it was originally anchored at a higher level or if the bole is lower than the root system. If you are unsure that the rootwad has moved from its original location, do not count it. If the bole has fallen into the bankfull channel, the root system has obviously become detached and the piece is counted.

A Wood Pieces Survey is conducted by one person working in conjunction with an individual carrying out the stream habitat mapping survey. Begin each survey at a designated point. Surveys conducted by foot should always be conducted in an upstream direction while surveys conducted by boat in a downstream direction. Regardless of survey type (either foot or boat), **left and right bank are always identified based on a downstream orientation.** Fill out the header information on the survey form at the beginning of each survey event or start of a new reach.

The following sequence corresponds to the listing of variables on the header section of the data sheet:

1. **Stream Name.** Record the name of the survey stream.
2. **Date.** Record the survey event date.
3. **Reach.** Record the name of the survey reach. The name of the reach should be the same as recorded on the habitat unit survey form.
4. **GPS Unit Number.** Record the unique GPS unit identification code. Use the same GPS unit throughout the entire length of a reach level survey. Only change GPs units due to mechanical issues, damage, or loss.
5. **Unit of Measure.** Record the unit of measure as feet or meters.
6. **Stream Survey Type.** Record if the survey was conducted by foot or boat.
7. **Crew Lead.** Record the initial of the person leading the wood piece survey.
8. **Observers.** Record the initials of person(s) collecting data.
9. **Recorder.** Record the initial of the person recording the data.

The following sequence corresponds to the listing of variables collected during a wood piece survey:

1. **Piece Number.** Use a sequential numbering system to describe the order of qualifying wood pieces. Assign each qualifying wood piece a unique number, beginning with "1" and continuing sequentially upstream to the last piece in the surveyed portion of the stream. Begin a new data sheet for each event and start of a new reach but continue the numbering sequence from the previous day or reach. If multiple crews are surveying the same reach simultaneously, upstream crews should begin the sequential numbering system with a large enough number to ensure that wood piece numbers do not overlap between crews. For

example, in a situation where three crews are simultaneously mapping a long reach, the crew at the start of the reach should begin with "1", the middle crew with "200", and the upstream most crew with "400". Piece numbers will be renumbered to run sequentially from downstream to upstream after completion of the wood piece survey.

2. **Channel Location.** Record the bank location of the wood piece as left bank (**LB**), right bank (**RB**), channel spanning (**SP**), or within the wetted channel (**WC**) based on a downstream orientation.
3. **Habitat Unit (s).** Record the habitat unit number(s) that a piece of wood spans. Linking wood pieces to delineated habitat units is important information for geo-referencing purposes.
4. **GPS Waypoint.** Record a GPS waypoint at the location of each enumerated piece of wood. A single GPS waypoint can be used to geo-reference clusters of wood (within a 15-meter radius). A GPS waypoint is critical information for generating a wood piece distribution GIS layer.
5. **Log/Rootwad Identification.** Record either (**L**) for Log or (**R**) for Rootwad in the *Piece Cat L/R* column.
6. **Channel Zone Indentification.** LWD channel locations are characterized by four zones (Figure 2). Record a check mark (**√**) in column(s) *Zone 1, Zone 2, Zone 3, or Zone 4* if a wood piece spans any of the zones described below (Figure 3):

    - **Zone 1.** The portion of the bankfull channel that is wetted at the time of the survey, regardless of whether the water is flowing or stagnant.
    - **Zone 2.** The area between the bankfull channel edges, below an imaginary line that connects those points, and above the wetted channel surface.
    - **Zone 3.** The area found directly above Zone 2 (bankfull channel). This zone typically includes pieces that completely or partially span the bankfull channel and are likely to be recruited to the stream channel.
    - **Zone 4.** Defined as the area outside of the bankfull channel and includes the floodplain, terrace, and/or riparian areas. *Pieces that are completely in Zone 4 are never counted*.

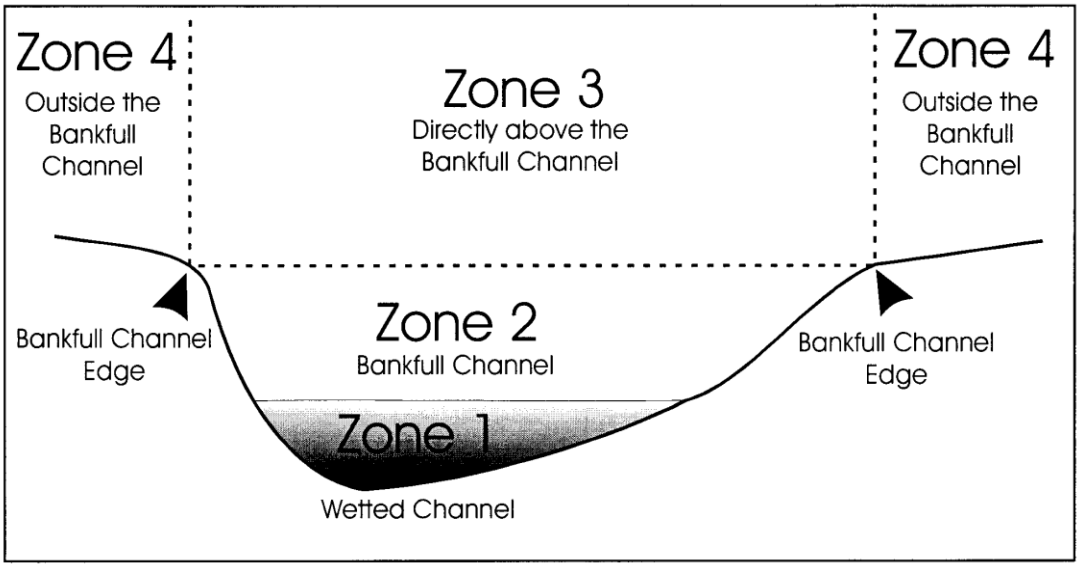


Figure 2. Criteria for channel zone identification (Schuett-Hames et al. 1999).

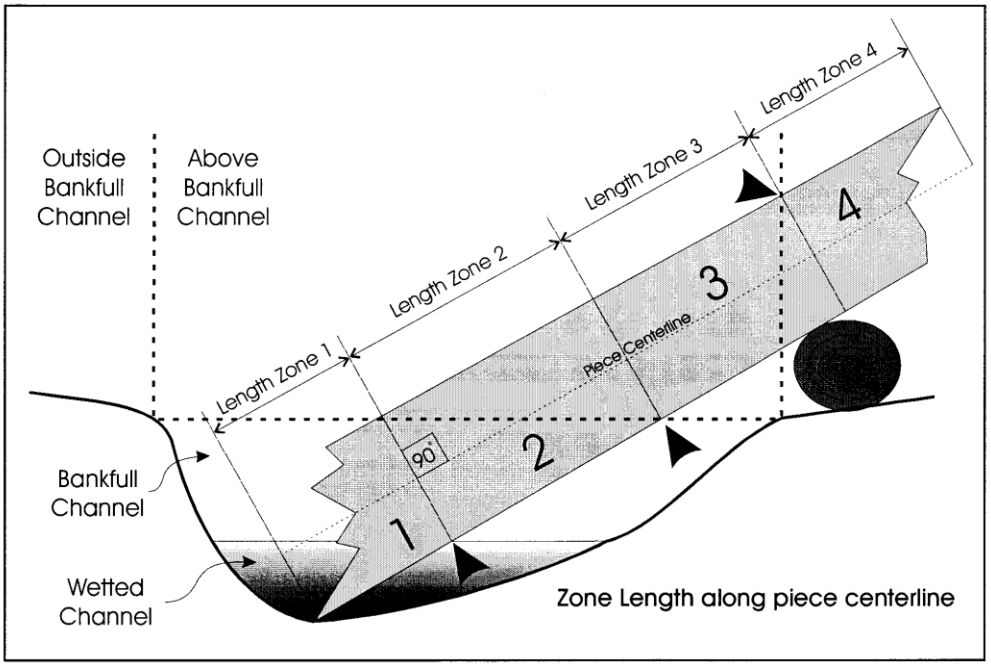


Figure 3. Measuring Zone 1,2,3, and 4 lengths along a piece of LWD (Schuett-Hames et al. 1999).

7. **Tree Species Category.** Record the tree type category using **C** for Conifer, **D** for Deciduous, or **U** for Unknown in the *Species CAT C/D/U* column.
8. **Stability Factors.** Record a check mark (**√)** for up to three of the applicable stability factors for the piece in the following columns: ***R*** (for root system), ***B*** (for buried), ***P*** (for pinned or pegged), or ***U*** (for unstable).
    - A root system is defined as one or more identifiable roots projecting from the root-ball of the piece.

- Buried stability is defined as the complete burial of either end or lateral burial of 50% or more of the diameter along some portion of the piece's length.
- Pinned/pegged stability is defined as having another qualifying LWD piece on top of it, or due to being pegged between other logs, standing trees, boulders, or bedrock.
- Unstable is defined as having none of the above factors present.

9. **Pool Forming Function.** Record **Y** (Yes) or **N** (No) in the *Pool FF Y/N* column if the log or rootwad contributes to the formation of a qualifying pool.
10. **Channel Orientation.** Record the orientation of each piece within the bankfull channel as either **A** for parallel, **B** for perpendicular, **C** for downstream or **D** for upstream (Figure 4).

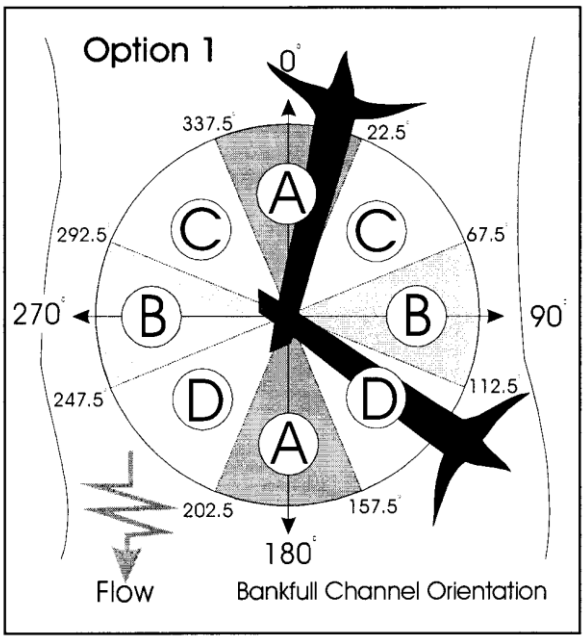


Figure 4. LWD orientation based on (Bilby and Ward 1991).

11. **Piece Length.** Measure the length of each qualifying piece to the nearest 0.1 meter from the base of the log (excluding roots) to the furthest extent of the log. Measure the length at the midpoint of the visible portion of the bole in situations where the locating the end of a piece is difficult due to an obstruction (water, sediment, debris, or vegetation). Quick excavation by probing or surface debris removal to check for parameter dimensions is acceptable. When a piece of wood forks into numerous small branches, such as the branches at the top of a tree, measure the length to the point where the main bole is no longer distinctly larger than the branches forking off of it. Record the measurement in the *Length* column.
12. **Piece Diameter.** Measure the diameter of each qualifying piece to the nearest 0.01 meter at the bole mid-point of each log. Record the average of two measurements for irregularly shaped pieces where the bole is not round. Use the Field Notes column to record calculations. If a branch obscures the midpoint of the log, take the diameter measurement

at the next un-obscured point on the root end. Measure the diameter at the midpoint of the visible portion of the bole in situations where the locating the end of a piece is difficult due to an obstruction (water, sediment, debris, or vegetation). Quick excavation by probing or surface debris removal to check for parameter dimensions is acceptable. When a piece of wood forks into numerous small branches, such as the branches at the top of a tree, measure the diameter at the midpoint between the base of the bole and where the bole is no longer distinctly larger than the branches forking off of it. Record the diameter measurement in the *Diameter* column.

13. **Sediment Storage.** Assign each piece either a "**Y**" for yes or "**N**" for no in the *Sediment Storage Y/N* column if it is *directly* associated with sediment storage. Sediment storage is defined as meeting all of the following criteria: 1) a minimum 1 square meter surface area deposit of coarse or fine substrate; 2) retained within the bankfull width of the stream channel; and 3) by direct association with the LWD piece. Without the presence of the identified piece, sediment would not likely accumulate in that location, or it would become mobilized if the wood was removed. This means that the stored sediment has to be at a higher elevation than the corresponding channel sediment level. Sediment sizes in storage deposits are often of a different size class than the predominant bed material. The boundaries of stored sediment are typically defined by breaks in channel gradient and differences in composition of bed materials.
14. **Field Notes.** Use this field to record any important features, observations, or comments during the course of the wood piece survey.

Wood Jam Survey

The Wood Jam Survey provides a standard method for assessing and monitoring the quantity and quality of large woody debris jams. The survey quantifies the density and volume of wood jams at the habitat unit scale. The survey methodology collects detailed information on the number of jams, jam bankfull channel location, and number of pieces per jam by size class categories. The purpose of the Wood Jam Survey is to:

1. Provide a means of accurately documenting the current abundance, distribution, characteristics, and function of large woody debris jams in stream channels.

2. Provide a repeatable methodology that can be used to monitor changes in the quantity and distribution of large woody debris jams over time.

The following sequence corresponds to the listing of variables on the header section of the data sheet:

1. **Stream Name.** Record the name of the survey stream.
2. **Reach.** Record the name of the survey reach. The name of the reach should be the same as recorded on the habitat unit survey form.
3. **Date.** Record the event survey date.

4. **GPS Unit Number.** Record the unique GPS unit identification code. Use the same GPS unit throughout the entire length of a reach level survey. Only change GPs units due to mechanical issues, damage, or loss.
5. **Camera Number.** Record the unique camera identification code.
6. **Unit of Measure.** Record the unit of measure as feet or meters.
7. **Stream Survey Type.** Record if the survey was conducted by foot or boat.
8. **Crew Lead.** Record the initial of the person leading the survey.
9. **Observers.** Record the initials of person(s) collecting data.
10. **Recorder.** Record the initial of the person recording the data.

The following sequence corresponds to the listing of variables collected during a wood jam survey:

1. **Jam Number.** Use a sequential numbering system to describe the order of qualifying wood jams. Assign each qualifying wood jam a unique number, beginning with "1" and continuing sequentially upstream to the last jam in the stream reach. Begin a new data sheet for each event and start of a new reach but continue the numbering sequence from the previous day or reach. If multiple crews are surveying the same reach simultaneously, upstream crews should begin the sequential numbering system with a large enough number to ensure that wood jam numbers do not overlap between crews. For example, in a situation where three crews are mapping a long reach simultaneously, the crew at the start of the reach should begin with "1", the middle crew with "200", and the upstream most crew with "400". Jam numbers will be renumbered to run sequentially from downstream to upstream after completion of the wood piece survey.
2. **Channel Location.** Record the bank location of the wood jam as left bank (**LB**), right bank (**RB**), channel spanning (**SP**), or within the wetted channel (**WC**) based on a downstream orientation.
3. **Habitat Unit (s).** Record the habitat unit number(s) that a wood jam spans. Linking wood jams to delineated habitat units is important information for geo-referencing purposes.
4. **GPS Waypoint.** Record a GPS waypoint at the location of each enumerated wood jam. A GPS waypoint is critical information for geo-referencing and developing a LWD pieces GIS distribution layer.
5. **Low Zone (1-3).** Record the jam's lowest channel zone. Assign the jam to Zone 1 if at least one of its wood pieces extends a minimum 0.1 meters into the water (Figure 2). Assign a jam to Zone 2 if at least one of its LWD pieces extends 0.1 meters into the bankfull channel area, but none of the pieces has a measurable length in Zone 1. Assign a jam to Zone 3 if at least one of its LWD pieces extends 0.1 meters above the bankfull channel area, but none of the pieces has a measurable length in Zone 1 or Zone 2 (Figure 2).
6. **Pool Forming Function.** Record "***Y***" for Yes or "***N***" for No in the *Pool FF* column if the jam contributes to the formation of a qualifying pool. For a given pool, one or more jam pieces may contribute to pool formation through direct or indirect means. This includes pool forming flow modifications from water plunging over the top, scouring underneath or to the side, and damming.

7. **Rootwad Diameter Tally.** Tally the number of rootwads in a jam that have diameter ≥0.2 meters. Record the tally marks in the *Rtwd Dia ≥0.2 m* column.
8. **Small Log Diameter Tally.** Tally the number of small logs in a jam that have a diameter ≥0.1 to 0.2 meters. Record the tally marks in the *Small Log ≥0.1 to 0.2 m* column.
9. **Medium Log Diameter Tally.** Tally the number of medium logs in a jam that have a diameter ≥0.2 to 0.5 meters. Record the tally marks in the *Medium Log ≥0.2 to 0.5 m* column.
10. **Large Log Diameter Tally.** Tally the number of large logs in a jam that have diameter ≥0.5 meters. Record the tally marks in the *Large Log ≥0.50 m* column.
11. **Key Pieces.** Record the number of key pieces relative to the bankfull width. Table 3 provides the criteria used to determine if a log or rootwad classifies as a key piece of wood. The method uses a scaling criterion relative to bankfull width. The first step is to select the bankfull width (BFW) category that corresponds with the bankfull width at the location of the wood piece. Next, measure the diameter of the candidate piece and round the result to the nearest 0.05 meter. Locate the diameter in the left-hand column and follow the row across until it intersects with the appropriate bankfull width category. The number on that row is the minimum length required to meet key piece criteria.
12. **Photo Number.** Take photo(s) of each quantified wood jam. Record the number stamped on the photo in the *Photo #* column. Use the same camera throughout the entire length of a reach level survey. Only change cameras due to mechanical issues, damage, or loss.
13. **Photo Direction.** For each photo, record whether the photo was taken looking upstream (**US**), downstream (**DS**), or cross sectional (**CS**).
14. **Field Notes.** Record comments identifying any important features or observations during the course of a survey.

Table 3. Key piece criteria based on bankfull width and wood piece diameter and length (Schuett-Hames et al. 1999).

Min. Dia. (m)	BFW 0 to 5	BFW 5 to 10	BFW 10 to 15	BFW 15 to 20
	Min Length (m)			
0.50	6	13	31	
0.55	5	11	26	
0.60	4	9	22	32
0.65	3	8	19	28
0.70	3	7	19	24
0.75	3	6	14	21

References

Bilby, R.E. and J.W. Ward. 1991. Characteristics and function of large woody debris in streams draining old-growth, clear-cut, and second growth forests in southwestern Washington. Canadian Journal of Fisheries and Aquatic Sciences 48: 2499-2508.

Frissell, C.A., W.J. Liss, C.E. Warren, and M.D. Hurley. 1986. A Hierarchical Framework for Stream Classificaton: Viewing Streams in a Watershed Context.

Moore, K. K. Jones, J. Dambacher, and C. Stein. 2010. Aquatic Inventories Project: Methods for Stream Habitat Surveys. Oregon Department of Fish and Wildlife, Aquatic Inventories Project, Conservation and Recovery Program, Corvallis, OR 97333.

Plues, A.E., D. Schuette Hames, and L. Bullchild. 1999. TFW Monitoring Program methods manual for the habitat unit survey. Prepared for the Washington State Dept. of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-00-003. DNR #105.

Schuett-Hames, D., A.E. Pleuse, J. Ward, M. Fox, and J. Light. 1999. TFW Monitoring Program method manual for the large woody debris survey. Prepared for the Washington Stare Dept. of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-00-004. DNR #106.

Schuett-Hames, D., A.E. Pleuse, and D. Smith. 1999. TFW Monitoring Program method manual for the salmonid spawning habitat availability survey. Prepared for the Washington Stare Dept. of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-00-007. DNR #109. November.

Technical Supplement 3E. 2007. Rosgen Stream Classification Technique-Supplemental Materials. Part 654 National Engineering Handbook.

Washington Department of Fish and Wildlife. 2009. Fish Passage and Surface Water Diversion Screening Assessment and Prioritization Manual. Washington Department of Fish and Wildlife. Olympia, Washington

Habitat Survey Equipment Checklist

	Check (√)
➢ Rapid Aquatic Habitat Assessment Protocol	_____
➢ Field Note Book	_____
➢ Walking Chain (in meters)	_____
➢ Kevlar Reel Measuring Tape (≥30 meters)	_____
➢ Stadia Rod (in meters)	_____
➢ GPS Unit	_____
➢ Range Finder	_____
➢ Digital Camera	_____
➢ Extra Batteries (AAA and AA)	_____
➢ Flagging	_____
➢ Sharpies	_____
➢ Pencils	_____
➢ USGS Quad Map	_____
➢ Pocket Thermometer (^{o}C)	_____
➢ Survey Vest	_____
➢ First Aid Kit	_____
➢ Habitat Unit Data Sheets	_____
➢ Spawning Patch Data Sheets	_____
➢ Bedrock Feature Data Sheets	_____

Wood Survey Equipment Checklist

	Check (√)
➢ Rapid Aquatic Habitat Assessment Protocol	_____
➢ Field Note Book	_____
➢ Loggers Tape (in meters)	_____
➢ Stadia Rod (in meters)	_____
➢ GPS Unit	_____
➢ Digital Camera	_____
➢ Extra Batteries (AAA and AA)	_____
➢ Flagging	_____
➢ Sharpies	_____
➢ Pencils	_____
➢ USGS Quad Map	_____
➢ Survey Vest	_____
➢ First Aid Kit	_____
➢ Wood Piece Data Sheets	_____
➢ Wood Jam Data Sheets	_____

Appendix 1: Habitat Unit Data Sheet A & B

Master Copy

YKFP RAHAP Habitat Unit Survey Form A

Stream Name: Example

gps ID:

Reach:

Date:

				side channel													Pool									
e-fish	Unit #	Unit Type	CAT	SC Bank (L/R)	SC Inlet Unit #	SC Inlet WP	Start Unit GPS WP	End Unit GPS WP	Start Length	End Length	Wet Width						Pool Max Depth	Pool Out Depth	Pool Form Agent A	Pool Form Agent B	Bankfull Width				Step Height	FieldNotes
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YKFP RAHAP Habitat Unit Survey Form B

Stream Name: _____ camera Id: _____ Reach: _____ Date: _____

	Undercut		Canopy			Photos					% Substrate							
Unit #	% LB	% RB	% Canopy	Dominant Species	Sub-Dom. Species	Pic A #	Pic pnt (US/DS/CS)	Pic B #	Pic pnt (US/DS/CS)	Temp °C	Fines	Sand	Gravel	Cobble	Boulders	Bedrock	Adult Holding (%)	FieldNotes

Entry by: _____ Entry Date: _____ QAQC by: _____ QAQC Date: _____ Page: _____ of: _____

Appendix 2: Spawning Patch Data Sheet

Master Copy

YKFP RAHAP Spawning Patch Survey Form

Stream Name: Gps Id: Reach: Date:

Patch #	Habitat Unit A #	Habitat Unit B #	GPS Pt.	Length	Width	% Area Outside Wetted Channel	Field Notes

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Appendix 3: Bedrock Features Data Sheet

Master Copy

YKFP RAHAP Stream-Bedrock Contact Data Sheet

Stream: ____ Gps Id: ____ Reach: ____ Date: ____

Rock #	Way point	Starting Hab Unit	Ending Hab Unit	GPS Position	Chanel Location	Rock Length	Cross Sectional Shape	Project	Surface Control	Comments
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GPS Position: US = upstream MP = midpoint DS = downstream

Channel Location (looking downstream): LB = left bank RB = right bank CB = channel bottom

Cross-Sectional Shape: *Ledge* = <15° 15° < *Slope* < 60° *Cliff* >60°

Surface Control: exposure controls vertical surface flow (i.e. acts as riffle crest)

Planform Shape: Checked = exposure projects into stream planform Not Checked = exposure does not project inot planforml; more or less regular along channel boundary

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Appendix 4: Wood Pieces Data Sheet

Master Copy

YKFP RAHAP LWD Survey Form

Stream Name: ______ **Date:** ______ **Gps Id** ______ **Reach:** ______

													Piece Stability									
Piece #	Channel Location (LB, RB, SP, WC)	Hab Unit A	Hab Unit B	Hab Unit C	Hab Unit D	GPS Pt.	Piece CAT (L-R)	Zone 1	Zone 2	Zone 3	Zone 4	Species CAT (C-D-U)	Rooted	Burried	Pinned	Unstable	Pool Former	Channel Orient	Length (m)	Diameter (m)	Sediment Storage	Field Notes
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Appendix 5: Wood Jam Data Sheet

Master Copy

YKFP RAHAP LWD Jam Survey Form

Stream Name: ______ Date: ______ Reach: ______ GPS Id ______ Camera ______

Jam #	Channel Location (LB, RB, SP, WC)	Hab unit A	Hab unit B	Hab unit C	Hab unit D	GPS Pt	Low Zone (1-3)	Pool Former	Rtwd Dia ≥ 0.2m	# Rtwd Key Pieces	# Small-Logs ≥ 0.1 to 0.2 m	# Medium Logs ≥ 0.2 to 0.5 m	# Large-Logs ≥ 0.5 m	# Log Key Pieces	Pic A #	Pic A Direction (US, DS, CS)	Pic B #	Pic B Direction (US, DS, CS)	Field Notes
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FISHERIES
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