Washington State Department of Ecology

Environmental Assessment Program

Standard Operating Procedures for Estimating Large Woody Debris Loads intersecting Headwaters Channels

Version 1.0

Author – Jack Janisch, Non-point Studies
Date - November 08, 2006

Reviewer – Darrel Anderson
Date -

QA Approval – Bill Kammin, Ecology Quality Assurance Officer
Date -

EAP 021

APPROVED: December 19, 2006

Recertified May 2, 2010

Signatures on File

Please note that the Washington State Department of Ecology's Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by the Department of Ecology.

Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Rev number	Summary of changes	Sections	Reviser(s)
5/2/2010	1	Recertified	All	Kammin

Environmental Assessment Program

Standard Operating Procedure for Surveying Large Woody Debris intersecting Small Stream Channels

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for surveying large woody debris (LWD) intersecting the bankfull zone (BFZ) of headwaters channels.

1.2 These methods adapt two earlier publications for surveying LWD of uplands and large streams (Schuett-Hames et al., 1999; Harmon and Sexton,1996) to headwaters streams. It is simplified relative to the Schuett-Hames et al. methodology in that only two zones are considered—the bankfull zone (Zone A) and adjacent banks/uplands (Zone B)—but retains coding for orientation relative to the channel, as well as separating suspended and downed LWD. It also both extends Schuett-Hames et al. methodology to include species and decomposition class, and applies the position definitions and volume calculation methods used by Harmon and Sexton. Prior to measuring LWD, each stream channel can be sub-divided by gradient (see EAP SOP, Surface Flow Methods) or other explanatory variable to be used in the analysis. The resultant data set describes each piece of LWD encountered such that volume can be estimated. Using this methodology, a crew of three can survey 300+ m of channel in approximately six-eight hours. For the purpose of this survey *Acer circinatum* (ACCI) is considered to be a shrub.

2.0 Applicability

2.1 Headwaters or other low-order streams as needed to summarize small channel LWD metrics such as diameter distribution, volume, species, type, and decomposition class. The methodology requires definition of a surface channel. If the channel is undefined or sub-surface without clear boundaries, no data is collected.

3.0 Definitions

3.1 Bankfull: if the stream is entrenched then a scour line, bench, or top of the point bar. if the stream is not entrenched, then the top of the bank.

3.2 Bankfull Zone: width of the channel between bankfull marks on opposite banks. It is essentially a belt transect of variable width. Where the channel is undefined or subsurface no data is collected. In this survey, Zone A equals the bankfull zone.

3.3 Fine Woody Debris (FWD): <10cm maximum diameter. Diameter may be with or without bark.

3.4 Green Wood: Logs or snags retaining green foliage or cambium but believed to be dead or dying due to breakage, windthrow, girdling, insect attack, or harvest damage. Note: Windthrown (uprooted) red cedar may survive. Other conifers usually die but hardwoods may resprout.

3.5 Large Woody Debris (LWD): >=10cm minimum diameter and >=1 m long. Diameter may be with or without bark. Ten cm is the break point between fine woody debris and large (coarse) woody debris. A 1 m length breakpoint is a lower practical limit, adjustable if short sections of bole such as those left by bucking and felling are to be measured. Most forestry studies define LWD as coarse woody debris (CWD).

3.6 Woody Debris: woody stems and bark from trees and shrubs which have died or are green but dying due to windthrow or other causes. Sloughed bark is not counted.

4.0 Personnel Qualifications/Responsibilities

4.1 Prior experience measuring forest variables. Ability to identify trees to species by bark, wood, and other characteristics. Ability to navigate on unimproved roads with maps and compass. Familiarity with international plant codes. Ability to work safely and efficiently on steep forested slopes. First aid training.

4.2 Typical Job Class: aptitude for field tasks is more relevant than job class

5.0 Equipment, Reagents, and Supplies

5.1 Equipment: aluminum log calipers (100cm minimum spread), 50 m tape, hipchain, clipboard, decomposition definitions, gradient unit descriptions.

5.2 Reagents: None.

5.3 Supplies: data sheets, pencils, paint markers, flagging

6.0 Summary of Procedure

6.1 LWD found in stream channels can be described categorically as either stumps, snags, logs, root wads, or blobs. As the intent is to estimate total LWD volume, data from all categories is collected for the entire basin. Measurements are designed such that for each piece of LWD encountered, volume can be approximated using formula for various geometric shapes. Thus each category of LWD is handled somewhat differently. Our initial test of whether a piece of LWD is counted is whether it intersects the BFZ. If so, all LWD (excluding ACCI) >10 cm diameter and >1 m are measured, excluding that originating as lateral growth to the bole. Branches are not counted, only boles. Woody material < 10cm diameter is considered FWD. Minimum length criteria can be adjusted relative to project objectives but the relevance of such data to methods used by other studies should be considered if data sets are to be compared. Harvest of study basins both adds and removes channel LWD so revisions to methodology should also be consistent and applicable before and after logging. If LWD loads will be related to channel gradient, sub-divide the channel prior to the survey (EAP SOP Channel Morphology). For each piece of LWD, record gradient unit ID, species, position, class, and orientation (see below) as well as dimensions as described in Section 6.3. Indicate green wood by checking Green on the data sheet. If a piece of LWD extends across multiple stream segments, indicate in the GU and % Each Seg data sheet columns. For example, GU= 3/4 and % Each Seg= 40/60 means the piece spans segments 3 and 4, 40% volume in segment 3, 60% in segment 4. Record hollow dimensions and % channel influence in the Misc section of the data sheet.

6.1.1 For small streams, minimally 100 m of channel should be surveyed to stabilize the volume estimate. If surveying the entire basin, begin the survey at the confluence with the larger channel into which the study stream drains. Proceed upslope; it is easiest to work up.

6.2 DESCRIPTIVE FIELD CODES: This section defines data sheet codes.

6.2.1 GU (gradient unit)

1-2 digit identification of gradient segment (see EAP SOP Channel Morphology)

6.2.2

SPEC (species)

Four-character standard vegetation survey species code (e.g., PSME). See References for link to standardized codes.

6.2.3 POS (position)

L: (log) non-self supporting complete or partial bole that influences flow at bank full.

U: (suspended log) non-self-supporting complete or partial bole that does not influence flow at bank full

N: (snag) self-supporting but dead or dying bole

S: (stump) tree bole showing a cut surface
R: (root wad) dead root discs, including those of stumps and snags

6.2.4 DECOMP_CLASS

1-5: (1=least decomposed) definitions described earlier by Solins (1984) are used

6.2.5 SEG_PER

if a piece of LWD spans more than one gradient segment, percent length in each segment

6.2.6 GREEN

categorical variable used for freshly-downed logs

6.2.7 Orientation

A: parallel to channel, +-~22 degrees
B: perpendicular to channel, +-~22 degrees
C: all other orientations

6.3 MEASUREMENTS

6.3.1 Logs and Suspended Logs

6.3.1.1 Diameters: measured to nearest 1 cm. When entirely within the BFZ (Zone A), collect mid-point and end diameters (three measurements). When spanning Zone A and Zone B, Zone B midpoint and end diameters are collected. Proceed analogously if a piece of LWD spans both banks. Where a log is distinctly elliptical in cross section, estimate both long and short axis of the cross section. Where a log has split, attempt to estimate its intact dimension. Where a log is hollow, measure hollow ID at each end.

6.3.1.2 Length: measured to nearest 0.1 m. Measure the length of each zonal section using hip chains, calipers, or other methods.

6.3.2 Stumps

6.3.2.1 Diameters: measured to nearest 1 cm. Measure top (cut surface) and base diameter (at root collar). If the stump is >= 1.4 m in height, measure diameter at 1.4 m and record as DBH. As with logs, measure long and short cross section axis if distinctly elliptical. If the stump is hollow measure hollow dimensions at top of stump.

6.3.2.2 Height: measured to nearest 0.1 m. Measure vertical distance from cut surface to root collar.

6.3.2.3 Record dimensions in the Zone A section of the data sheet, height as length.

6.3.2.4 % Channel influence: consider the total stump volume. Record estimated % volume which is modifying the BF channel.

6.3.3 Snags

6.3.3.1 As for stumps except that top diameter and height (length) must often be estimated. Height can be estimated by a range finder or by trigonometry. For example, hold a stick at 90° to your arm such that the length above your hand equals your reach. Then back away from the snag until the length of stick above your hand and snag height appear equal. Distance from the snag equals snag height. Record dimensions in Zone A.

6.3.4 Root Balls

6.3.4.1 Diameter: measured to nearest 1 cm. Measure both long and short axis.

6.3.4.2 Thickness: estimate average thickness of the root disc from the base to the root collar.

6.3.4.3 % Channel influence: consider root ball total volume. Record % volume which is modifying the BF channel.

6.3.4.4 Record dimensions in the Zone A section of the data sheet, thickness as length.

6.3.5 Blobs

6.3.5.1 This is highly decomposed wood that has lost structural integrity. Coniferous wood disintegrates into mounds of reddish, cubically fractured material which may persist for centuries. Flow will scour out this material but it is sometimes present when logs are buried by sediment or wasting.

6.3.5.2 Diameter: measured to nearest 1 cm. Measure long and short axis of visible surface material or estimated extent of buried material.

6.3.5.3 Thickness: measured to nearest 0.1 m. Shove the graduated end of the caliper vertically into the material until it meets resistance or soil.

6.3.5.4 Record dimensions in the Zone A section of the data sheet, thickness as length.

7.0 Records Management

7.1 Woody Debris Survey Form. Attached as Appendix 1.

8.0 Quality Control and Quality Assurance Section

8.1 Data Collection: 1) Each staff member must understand the data sheet and various codes. Species codes and other detail are defined on the data sheet. 2) Each record is checked for accuracy when recorded. The data recorder prompts to confirm measurement of each piece is complete.

8.2 Data Entry: 1) After transfer of data to a db file or spreadsheet, each entry of each record is proofed twice (separate staff). Alternatively the data can be double punched and the tables compared. 2) Data is then filtered categorically on each field to validate format.

8.3 Volume: Volume is hand calculated for a subset of records spanning the range of field combinations possible. These results are compared to those exported from volume calculation code.

9.0 Safety

9.1 As needed be aware of slash and forest undergrowth, steep slopes, large animals and bees, fire, potholes, washboards, road dust, log trucks, target practice, and hunters.

10.0 References

10.1 Harmon, M.E., and J. Sexton. 1996. Guidelines for measurements of woody detritus in forest ecosystems. LTER Network Publication No. 20. Univ. Washington. Seattle, WA, 91 p.

10.2 Natural Resources Conservation Service species codes. 2006. http://plants.nrcs.usda.gov/cgi_bin/topics.cgi?earl=dl_all.html. US Department of Agriculture.

10.3 Schuett-Hames, D., A. Pleus, J. Ward, M. Fox, and J. Light. 1999. Method Manual for the large woody debris survey. Timber, Fish and Wildlife Monitoring Program. Publication No. TFW-AM9-99-004

10.4 Sollins, P. 1982. Input and decay of coarse woody debris in coniferous stands in western Oregon and Washington. Can. J. For. Res. 12: 18-28.

Appendix 1: Headwaters channel coarse woody debris survey form

CWD 07 **PROJECT:** DNR T5 /USFS HW REGION ____________ SITE ____________ SEG ______

LEVEL 3 MODIFIED DATE ________ CREW ____________ RECORDER ____________ Pg __ of __

							ZONE B1		ZONE A			ZONE B2		MISC.		
GU	SPECIES	Position	CLASS	% EACH SEG	GREEN	ORIENTATION	DIAM 3 (cm) (X x Y)	LENGTH (m)	DIAM 1 (cm) (X x Y)	LENGTH (m)	DIAM 2 (cm) (X x Y)	LENGTH (m)	DIAM 4 (cm) (X x Y)	DBH (cm) (X x Y)	HOLLOW (cm) (X x Y)	% CHANNEL INFLUENCE
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				
								\		\		\				

SPECIES: PSME (Douglas-fir) TSHE (western hemlock) THPL (red cedar) UNKN (unknown) ALRU (red alder) PICE (sitka spruce) ACMA (big leaf maple) PRSP (prunus) ABSP (abies species) POTR (black cottonwood) TABR (western yew) CONU (western dogwood) SASP (willow)

(**L**) **LOG**: non self-supporting
(**S**) **STUMP**: shows cut surface
(**N**) **SNAG**: self-supporting
(**R**) **ROOT**: rootball (**RM**): multiple boles
(**U**) **SUSPENDED LOGS**: above bankfull

ZONE B1 = RR ZONE A = channel Zone B2 = RL

LOGS
ZONE A:2-4 diams, LENGTH
ZONE B1: 1-2 diams, LENGTH
ZONE B2: 1-2 diams, LENGTH
ORIENTATION

STUMPS/SNAGS:
TOP AND BASE DIAMETER
HEIGHT (eg, length)
DBH, D1 X D2
HOLLOW DIAMETER, D1 X D2
% CHANNEL INFLUENCE

ROOTBALLS:
LONG AXIS (DIAM)
SHORT AX. (DIAM)
THICKNESS (eg, length)
% CHANNEL INFL.
V (vertical) or H (horizontal)