



DEPARTMENT OF
ECOLOGY
State of Washington

Standard Operating Procedure EAP121, Version 1.1

Watershed Health Monitoring: Standard Operating Procedures for Counting Large Woody Debris

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Purpose of this document

The Washington State Department of Ecology develops Standard Operating Procedures (SOPs) to document agency practices related to sampling, field and laboratory analysis, and other aspects of the agency's technical operations.

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SIGNATURES AVAILABLE UPON REQUEST

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.

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

SOP Revision History

Revision Date	Revision History	Summary of changes	Sections	Reviser(s)
3/1//17	1.1	Changed title, added reviewers and footers, updated glossary terms, references, general formatting and edits	All	Meghan Rosewood-Thurman
3/7/17	1.1	Added cite: rivers manual Cite both SOPS: 105 and 106 Replaced “extends” with “occurs” LWD is now the term defined Simplified, grammar Replaced 2010 policy with 2016 SOP Greater than 5 m Greater than 3 m Added comma Added comma Added SOP 070, year to 2016 Added: rivers manual	2.2 2.3 3.1 3.10 4.5 5.1 6.2.1.1.2 6.2.1.1.4 6.2.4 6.2.5 10.9 10.10	Glenn Merritt
3/10/17	1.1	General Formatting	All	Meghan Rosewood-Thurman
3/14/17	1.1	Initial approval		Kammin
4/26/19	1.1	Formatted and edited for accessibility; updated links	All	J. Ponzetti

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for counting pieces of Large Woody Debris (LWD) in rivers and streams for the Watershed Health Monitoring program (WHM).

2.0 Applicability

2.1 This SOP contributes to both WHM protocols: Narrow and Wide.

2.1.1 For the Narrow Protocol, this SOP applies to the entire main channel of the sample site.

2.1.2 For the Wide Protocol, this SOP applies to 11 stations within the sample site, each centered on a major transect, and each residing on just one of the two banks.

2.2 This SOP was adapted from field methods of the Environmental Protection Agency's Environmental Monitoring and Assessment Program (Peck et al. 2005, 2006).

2.3 This SOP requires that the appropriate WHM site verification and layout SOP (Merritt 2017 or Hartman 2017) has already been performed.

2.4 The sizes of LWD pieces that are tallied depend upon the Status and Trends Region (STR) in which the sample site resides. We count smaller pieces when in eastern Washington STRs.

2.5 Data collected using this SOP help us to calculate metrics that quantify LWD frequency and volume at a site (Janisch 2013). LWD volume is also a component of Relative Bed Stability calculations.

3.0 Definitions

3.1 Above-channel LWD: Piece of large woody debris that occurs horizontally above the bankfull channel, but does not extend vertically into the bankfull channel.

3.2 Bankfull margin: A term used to describe the limit of the stream channel. It is a line on the bank that coincides with the water's elevation during bankfull flow.

3.3 Bankfull stage: This stage is delineated by the elevation point of incipient flooding, indicated by deposits of sand or silt at the active scour mark, break in stream bank slope, perennial vegetation limit, rock discoloration, and root hair exposure (Endreny 2003).

3.4 Bankfull width: Horizontal distance between the bankfull stage on the left bank and the bankfull stage on the right bank. For WHM, this is measured to the nearest tenth of a meter.

3.5 DCE: The *Data Collection Event* is the sampling event for the given protocol. Data for a DCE are indexed using a code which includes the site ID followed by the year, month, day, and the time (military) for the start time of the sampling event. For example: WAM06600-000222-DCE-YYYY-MMDD-HH:MM. One DCE should be completed within one working day, lasting 4 to 6 hours, on average.

3.6 Diameter: The diameter of a LWD piece is based on the thickest diameter of the log.

3.7 EAP: Environmental Assessment Program

- 3.8 Ecology: The Washington State Department of Ecology
- 3.9 Index Station: The distinct point location mapped by the site coordinates obtained from the Washington Master Sample List. The index station is called “X” and is generally located at major transect F; however, the point may occur at any elevation in the stream between transects A and K.
- 3.10 LWD (Large Woody Debris): Dead fallen wood of at least 10 cm diameter and at least 1 meter long (eastern regions) or at least 2 meters long (western regions). Some tree species may still remain partly alive while the majority of the fallen trunk lies dead in or over the stream (e.g., crack willow, *Salix fragilis*). If the only living features of the fallen tree are small resprouted stems (<minimum LWD size class), these "live" nurse trees should still be considered LWD.
- 3.11 LWD Plot: This is one of 11 areas in a site where LWD pieces are counted for the Wide Protocol. Each is centered on a major transect (Figure 3). Each extends across 20 meters of stream length. The top of the plot is at bankfull stage. The wetted portion of the plot extends 10 meters horizontally into the wetted channel. Only one bank per transect has a LWD Plot.
- 3.12 Main Channel: Channels in a stream are divided by islands (dry ground that rises above bankfull stage). Main channels contain the greatest proportion of flow.
- 3.13 Major transect: One of 11 equidistant transects across the length of a site. These transects run perpendicular to the thalweg and are labeled as follows: A (furthest downstream), B, C, D, E, F, G, H, I, J, and K (furthest upstream).
- 3.14 Narrow Protocol: The set of Watershed Health Monitoring SOPs that describes data collection at wadeable sites with an average bankfull width of less than 25 m at the index station.
- 3.15 QAMP: Quality Assurance Monitoring Plan. The QAMP for WHM is Cusimano et al. (2006). An updated version is in the early stages of development.
- 3.16 Segment: Wetted stream area that is defined between major transects. There are 10 segments in each site.
- 3.17 Site: A site is defined by the coordinates provided to a sampling crew and the boundaries established by the protocol’s site layout method. See Hartman (2017 [SOP EAP105]) for the Wide Protocol and Merritt (2017 [SOP EAP106]) for the Narrow Protocol). Typically, a site is centered on the index station and equal in length to 20 times the average of five bankfull width measurements. Sites cannot be longer than 2 km nor shorter than 150 m. Narrow protocol sites range from 150 m to 500 m long. Wide Protocol sites are up to 2 km long and frequently longer than 500 m. The most downstream end of a site coincides with major transect A; the most upstream end coincides with major transect K.

3.18 STR: Status and Trends Regions (STRs) are based on Salmon Recovery Regions (SRRs) that were described by the Governor’s Salmon Recovery Office (JNRC 1999). Membership is as follows:

- Puget STR_____Puget Sound & Hood Canal/Puget Sound SRRs
- Coastal STR_____Coastal SRR
- Lower Columbia STR___Lower Columbia SRR
- Mid Columbia STR___Mid Columbia SRR
- Upper Columbia STR___Upper Columbia SRR
- Snake STR_____Snake SRR
- Northeast Wash. STR___Northeast Washington SRR
- Unlisted STR_____No SRR identified

3.19 WHM: Watershed Health Monitoring, a status and trends monitoring program within the Environmental Assessment Program at the Washington State Department of Ecology.

3.20 Wide Protocol: The set of WHM SOPs that describes the sample and data collection at non-wadeable sites or sites wider than 25 m bankfull width. It is an abbreviated version of the Narrow Protocol and is typically accomplished by use of rafts.

3.21 Within-channel LWD: Piece of large woody debris that extends at least partially into the bankfull channel, below the bankfull stage.

4.0 Personnel Qualifications/Responsibilities

4.1 This SOP pertains to trained field staff in Ecology’s Environmental Assessment Program.

4.2 All field staff must comply with the requirements of the EAP Safety Manual (Ecology 2019).

4.3 All field staff must have completed the annual WHM program field training session. This includes a briefing on project objectives, details of the project Quality Assurance Monitoring Plan (QAMP), and both field protocols.

4.4 All field staff must be familiar with the electronic data recording tablet and the WHM web-based field forms.

4.5 All field staff must comply with Ecology SOP EAP070, “Standard Operating Procedures to Minimize the Spread of Aquatic Invasive Species” (Parsons et al. 2016).

5.0 Equipment, Reagents, and Supplies

5.1 Access gear (boats, or waders and boots). This should be precleaned to avoid the spread of invasive species. See EAP SOP070 (Parsons et al., 2016) for more information.

5.2 Clean measuring device, such as calipers or meter stick.

5.3 Fully-charged field tablet, electronic field forms.

6.0 Summary of Procedure

6.1 Determine the appropriate protocol

6.1.1 Use the WHM Narrow Protocol for wadeable streams that are less than 25 m bankfull width near the index station.

6.1.2 Use the WHM Wide Protocol for rivers or streams that are either wider than 25 m or non-wadeable.

6.2 Narrow Protocol Method (entire channel)

6.2.1 Visually estimate the diameter and length of each piece of LWD and tally the pieces within each stream segment according to the size classes on the WHM web-based field forms. For the first LWD piece encountered in each size class, estimate the diameter and length, then physically measure the piece to help calibrate estimates.

6.2.1.1 Be aware that LWD size classes differ slightly from Eastern and Western Washington. The WHM electronic field forms are designed to display the correct size categories based on your location.

6.2.1.1.1 Western diameter classes are 10–30 cm, 31–60 cm, 61–80 cm and >80 cm.

6.2.1.1.2 Western length classes are **2–5 m**, **>5–15 m**, and **>15 m**.

6.2.1.1.3 Eastern diameter classes are 10–15 cm, 16–30 cm, 31–60 cm, and >60 cm.

6.2.1.1.4 Eastern length classes are **1–3 m**, **>3–6 m**, and **>6 m**.

6.2.2 Only count LWD that is located in the main channel.

6.2.3 If a piece of LWD falls within two stream segments, count it only once.

6.2.4 **Count *within-channel* LWD pieces.** Count each piece of LWD that is at least partially within the bankfull channel (Zone 1 in Figure 1). Tally each piece of LWD based on its size class, in the “Within Bankfull Counts” section under the Large Woody Debris tab located on the Thalweg page (Figure 2).

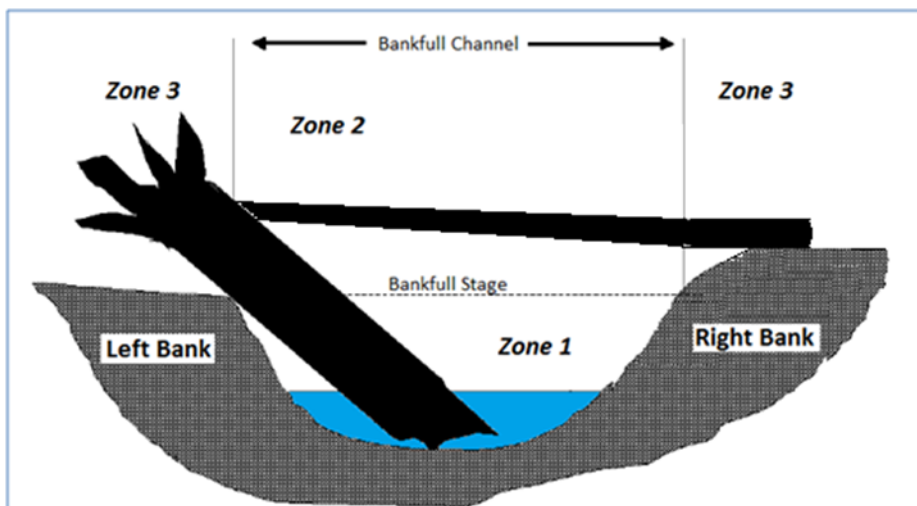


Figure 1. Zones for tallying LWD (modified from Peck et al. 2006).

Main WAM06600-EAST01-DCE-2014-1204-12:25 Save Navigate

Thalweg A Thalweg Large Woody Debris Habitat Units

Mark Uncounted As Zero

- Within Bankfull Counts

	1-3 m long	3-6 m long	>6 m long
10-15 cm diameter	1 + -	0 + -	0 + -
16-30 cm diameter	0 + -	0 + -	0 + -
31-60 cm diameter	0 + -	0 + -	0 + -
>60 cm diameter	0 + -	0 + -	0 + -

+ Above Bankfull Counts

Note:

Figure 2. Electronic data form showing LWD size classes for the Eastern Washington regions.

- 6.2.5 **Count *above-channel* LWD pieces** (Zone 2 in Figure 1). Tally each piece of LWD based on its size class, in the “Above Bankfull Counts” section under the Large Woody Debris tab.
- 6.2.6 **Assign zero values** for unobserved sizes. When you have finished tallying LWD for a stream segment, click the “Mark Uncounted As Zero” button.
- 6.3 Wide Protocol Method (subsample using 11 LWD Plots)
- 6.3.1 At each of the 11 transects, count LWD located within the LWD Plot (Figure 3). These counts will only be recorded for one side of the stream per transect. The side is determined by the WHM Site Verification and Layout SOP EAP106 (Merritt 2017).
- 6.3.1.1 **Count *within-channel* LWD** in the plot. Estimate the diameter and length of each piece and tally it according to the size classes on the electronic forms.
- 6.3.1.2 **Count *above-channel* LWD pieces.** Tally pieces that enter the LWD Plot horizontally, but not vertically below the bankfull stage.
- 6.3.1.3 **Assign zero values** for unobserved sizes. When you have finished tallying LWD for a LWD Plot, click the “Mark Uncounted As Zero” button.

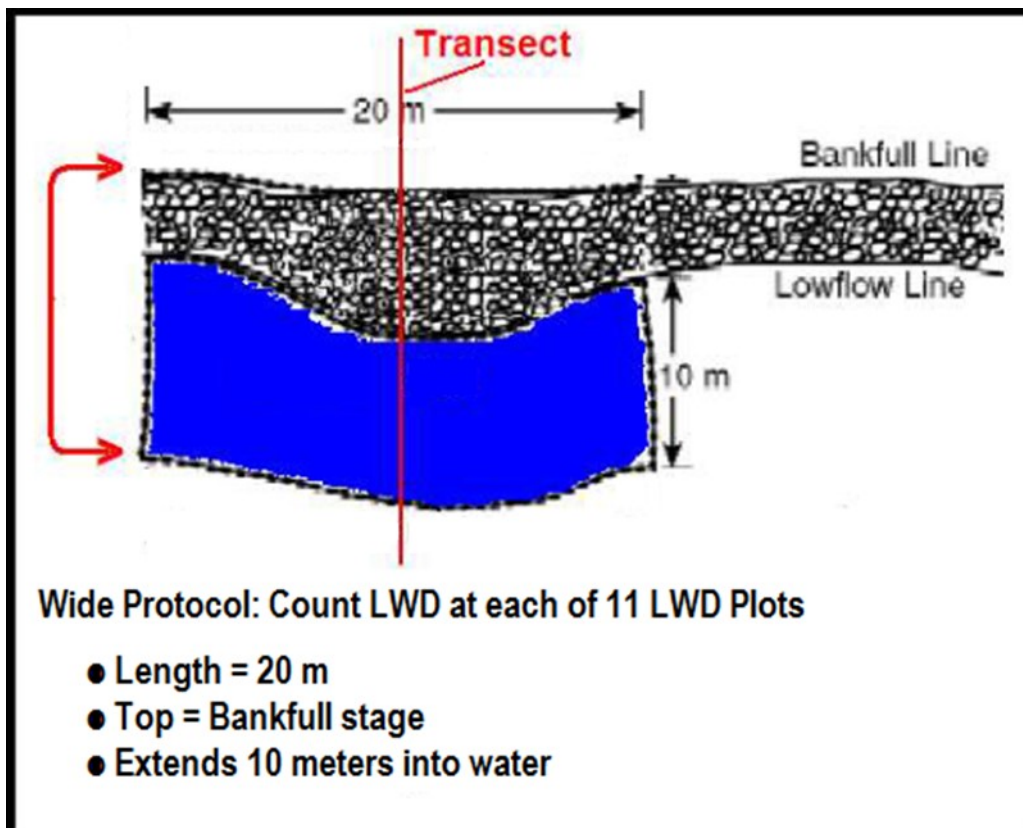


Figure 3. LWD Plot for the Wide Protocol.

7.0 Records Management

7.1 Refer to the SOP titled “Managing Electronic Data Form Functionality for Watershed Health Studies using a Mobile Data-Collection Device” (Janisch 2017).

8.0 Quality Control and Quality Assurance

8.1 Project QA/QC are discussed in the Quality Assurance Monitoring Plan (Cusimano et al. 2006), which is currently being updated.

9.0 Safety

9.1 All field staff must comply with the requirements of the EAP Safety Manual (Ecology 2015).

10.0 References

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