DEPARTMENT OF
ECOLOGY
State of Washington

Standard Operating Procedure EAP117, Version 1.2

Watershed Health Monitoring: Assessing Riparian Vegetation Structure

May 2018

Publication No. 18-03-222

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.

Publication information

This SOP is available on the Department of Ecology's website at
https://fortress.wa.gov/ecy/publications/SummaryPages/1803222.html

Ecology's Activity Tracker Code for this SOP is 18-045.

Contact information

For more information contact:

Communications Consultant
Environmental Assessment Program
P.O. Box 47600, Olympia, WA 98504-7600
Phone: 360-407-7680

Washington State Department of Ecology – https://ecology.wa.gov

Location of Ecology Office	Phone
Headquarters, Lacey	360-407-6000
Northwest Regional Office, Bellevue	425-649-7000
Southwest Regional Office, Lacey	360-407-6300
Central Regional Office, Union Gap	509-575-2490
Eastern Regional Office, Spokane	509-329-3400

Washington State Department of Ecology

Environmental Assessment Program

Watershed Health Monitoring: Standard Operating Procedures for Assessing Riparian Vegetation Structure

Version 1.2

Author - Chris Hartman
Date -

Reviewer - Welles Bretherton, George Onwumere, Glenn Merritt, and Meghan Rosewood-Thurman
Date -

QA Approval - William R. Kammin, Ecology Quality Assurance Officer
Date -

EAP117

APPROVED: 02/23/2017

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 the Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Rev number	Summary of changes	Sections	Reviser(s)
4/16/15	1.0	A few small changes	All	Chris Hartman
2/22/17	1.1	Added footers, changed title, general formatting, updated glossary terms updated references	All	Meghan Rosewood-Thurman
2/23/17	1.2	Edited language Added reference to SOP EAP105 Spelling fix Removed extra “Index Station:” Removed italics Edited next-to-last sentence Removed italics Janisch, 2017 Added reference to SOP EAP105 Added Hartman, 2017 EAP105 Added spaces after initials Updated link	1.2 2.2 3.3 3.8 3.12 3.14 3.17 4.4 9.4 11.4 11.8 11.9	Glenn Merritt
2/23/17	1.2	Certified	All	Tom Gries

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for visually assessing riparian vegetation structure during a Data Collection Event (DCE) for the Watershed Health Monitoring (WHM) program.

1.2 This SOP includes procedures for sites sampled with either of the Watershed Health Monitoring protocols: the Narrow Protocol or the Wide Protocol.

2.0 Applicability

2.1 This SOP was adapted from wadeable and non-wadeable field methods of the Environmental Protection Agency's Environmental Monitoring and Assessment Program (see the field manuals cited in Stoddard et al., 2005).

2.2 This SOP is used in combination with other SOPs to complete a DCE for the WHM program. This method is applied to right and left banks of the main channel at all 11 major transects. Use this SOP only after completing the site verification and layout, SOP EAP106 (Merritt, 2017), or SOP EAP105 (Hartman, 2017).

2.3 Data collected with the method outlined in this SOP are used to calculate physical habitat metrics that characterize the riparian vegetation structure at a site (Janisch, 2013).

3.0 Definitions

3.1 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.

3.2 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).

3.3 Cover: The estimated amount of shadow cast in the riparian plot by vegetation when the sun is directly overhead. Cover is evaluated independently for each of three layers: groundcover, understory and canopy. This requires assessing cover from objects that are located in the vertical zone between the layer in question and the next higher layer (i.e., imagine trimming vegetation at/above the next higher layer before assessing).

3.4 Cover layers: Groundcover, understory and canopy cover layers all have designated vertical positions within a riparian plot (see Table 1 and Figure 1).

Table 1. Cover layers within a riparian plot.

Layer	Vegetation vertical position
Canopy	**≥ 5 m**
Understory	**≥ 0.5 m but < 5 m**
Ground Cover	**< 0.5 m**

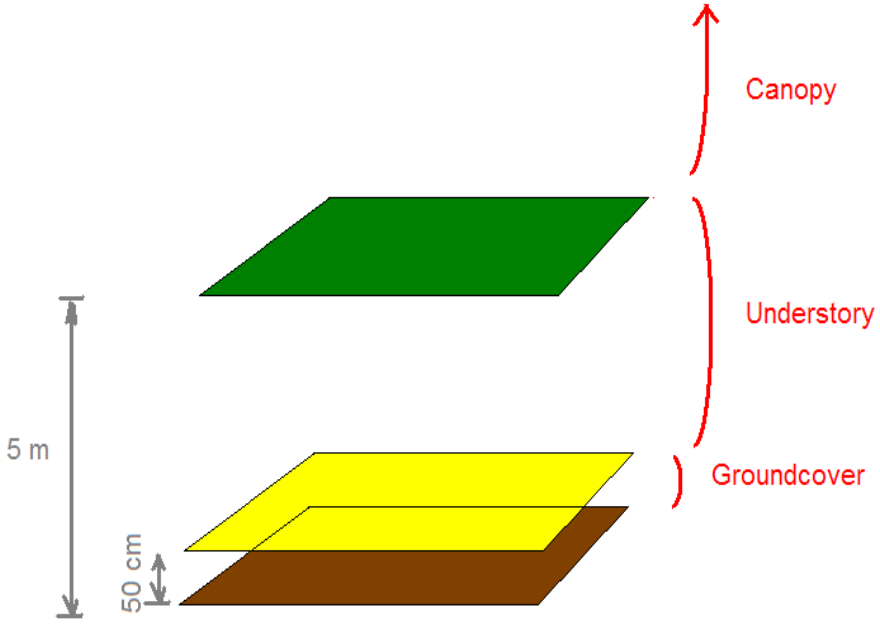

Figure 1. Cover layers within a riparian plot.

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 4-6 hours, on average.

3.6 EAP: Environmental Assessment Program

3.7 Ecology: The Washington State Department of Ecology

3.8 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.

3.9 Left bank: A person facing downstream will have the left bank on their left side.

3.10 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.

3.11 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).

3.12 Narrow protocol: 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).

3.13 Right bank: For WHM, a person facing downstream will have the right bank on their right side.

3.14 Riparian plot: (See Figure 2) A station on each bank and centered on each major transect of the main channel. Its upstream/downstream length varies by protocol:

- For the *Narrow Protocol* it extends 5 meters downstream and 5 meters upstream.
- For the *Wide Protocol* it extends 10 meters downstream and 10 meters upstream.

Note: There are 22 riparian plots per site, 2 per major transect.

Note: On steeply sloping channel margins, estimate the plot boundaries as if they are projected down from an aerial view.

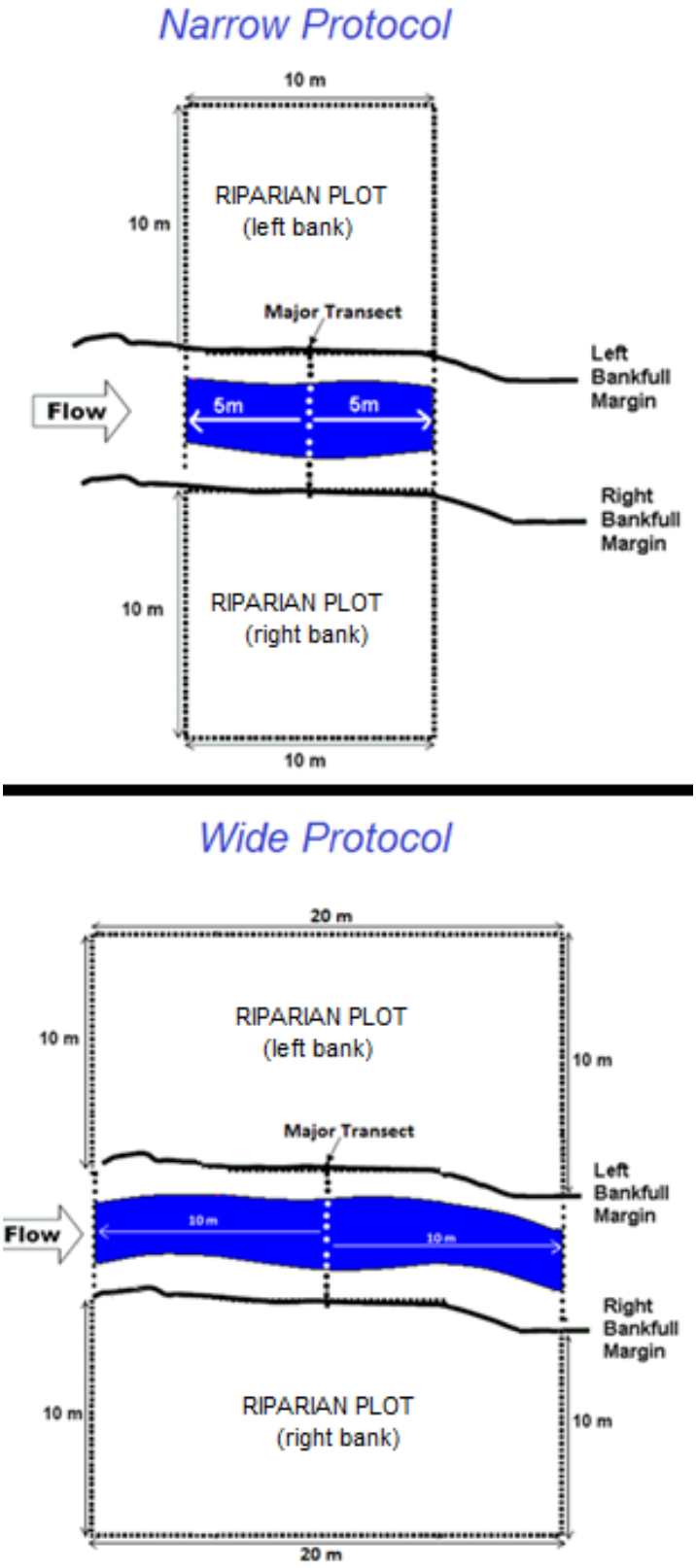

Figure 2. Riparian plots for *Narrow* and *Wide* protocols.

3.15 QAMP: Quality Assurance Monitoring Plan. The QAMP for WHM is Cusimano et al., (2006). An updated version is in early stages of development.

3.14 Site: A site is defined by the coordinates provided to a sampling crew and the boundaries established by the protocol's site layout method: SOP EAP105 (Hartman, 2017) for the Wide Protocol and SOP EAP106 (Merritt, 2017) for the Narrow Protocol. Typically, a site is centered on the index station and equal in length to 20 times the average of 5 bankfull width measurements. Sites cannot be longer than 2km nor shorter than 150m. Narrow protocol sites range from 150m to 500m long. Wide Protocol sites are up to 2km long and most frequently longer than 500m. The most downstream end of a site coincides with major transect A; the most upstream end coincides with major transect K.

3.15 Vegetation types: See Table 2.

Table 2. Vegetation types by layer.

Layer	Vegetation type	Description
Ground	**Duff**	Organic matter in various stages of decomposition on the floor of the forest.
Ground	**Barren**	Without vegetation of any kind.
Ground or Understory	**Woody**	Live perennials, such as trees and shrubs, which have persistent woody stems and branches. EXCLUDE vines and subshrubs that don't become shrubs (USDA, 2013).
Ground or Understory	**Non-Woody**	Live annuals or biennials, such as herbs, grasses, forbs, ferns, or mosses; which may have non-persistent, pith-filled stems and branches.
Understory or Canopy	**Deciduous**	Non-coniferous trees that shed their leaves annually. Examples include alder, oak, maple, and cottonwood.
Understory or Canopy	**Coniferous**	Any of various, mostly needle-leaved or scale-leaved, chiefly evergreen, cone-bearing gymnospermous trees or shrubs such as pines, spruces, and firs. This includes larch.
Understory or Canopy	**Broadleaf Evergreen**	Non-coniferous trees that maintain foliage throughout the seasons. A native example for Washington is the Pacific madrona (Arbutus menziesii)

Understory or Canopy	**Mixed**	Where > 10% of the cover is made up of a second type.
Canopy	**Big Trees**	Trees with a diameter at breast height ≥ 0.3 m
Canopy	**Small Trees**	Trees with a diameter at breast height < 0.3 m

Note: *Some common **non-woody** plants: devils club, English ivy, purple loosestrife, Japanese knotweed, Rubus Sp. (blackberry, salmonberry, raspberry, thimbleberry), ferns.*

Note: *Some common **woody** plants: poison oak, kinnikinnick, salal, snowberry, Vaccinium sp. (huckleberry, blueberry).*

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

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

4.0 Personnel Qualifications/Responsibilities

4.1 This SOP pertains to all Environmental Assessment Program field staff collecting and entering data for the Watershed Health Monitoring Program and related projects.

4.2 All field staff must comply with the requirements of the EAP Safety Manual (Ecology, 2017).

4.3 All field staff must have completed the annual Watershed Health Monitoring Program field training and should be familiar with the appropriate protocol for the DCE.

4.4 All field staff must be familiar with their electronic data recording tablet and web-based field forms (see SOP EAP125 Janisch, 2017).

4.5 The field lead directing sample collection must be knowledgeable of all aspects of the project's Quality Assurance Monitoring Plan (QAMP) to ensure that credible and useable data are collected. All field staff should be briefed by the field lead or project manager on the sampling goals and objectives prior to arriving to the site.

4.6 All field staff must comply with SOP EAP070 (Parsons et al., 2016) *Minimizing the Spread of Invasive Species*.

5.0 Equipment, Reagents, and Supplies

5.1 Paper version of forms (on weather-proof paper), with pencil and clipboard

5.2 Field tablet (charged), with latest electronic field forms (see Janisch, 2017)

5.3 Access gear (e.g. waders/boots, raft) that has been pre-cleaned of organisms (see Parsons et al., 2016)

6.0 Summary of Procedure

At each of 22 riparian plots (Figure 2), evaluate riparian cover within each of three layers (Table 1 and Figure 1). Evaluate vegetation types (Table 2) and visually estimate cover classes. Interpretation of cover classes can be assisted with the help of Figure 3.

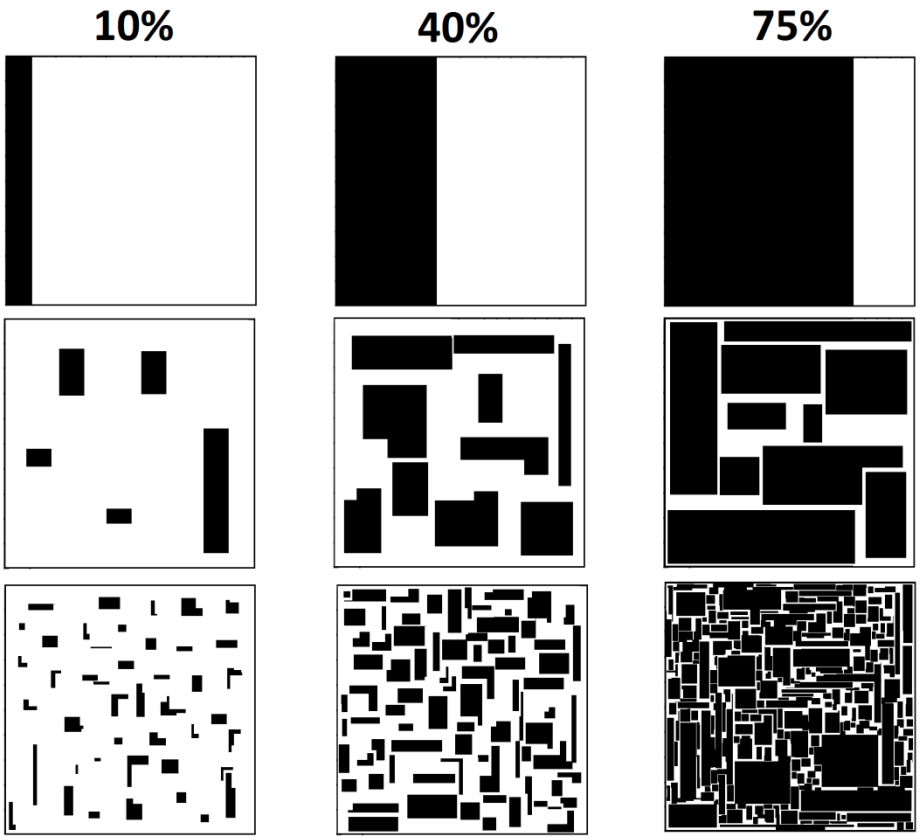

Figure 3. Comparison diagram for percent cover estimation.

6.1 <u>For each major transect, complete the Riparian Vegetation Form</u>

6.1.1 Find the Transect Page (Figure 4)

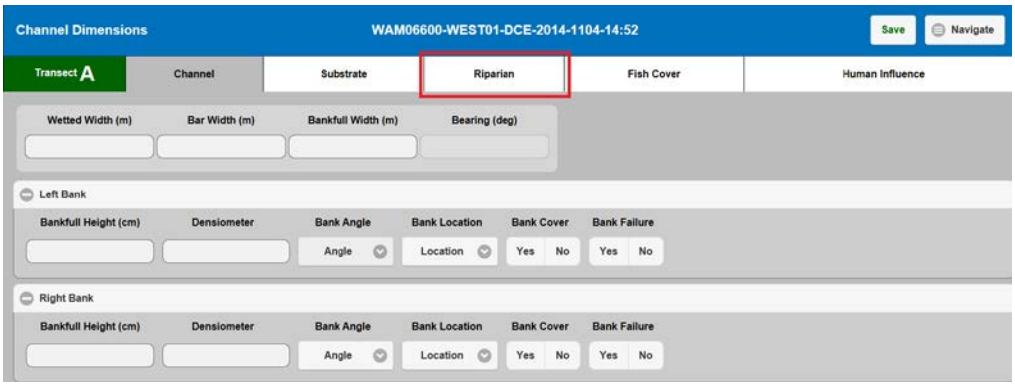

Figure 4: The *Transect Page* for major transect A, showing the tab (in red box) for the *Riparian Vegetation Form*.

6.1.2 Find the *Riparian Vegetation Form* (Figure 5).

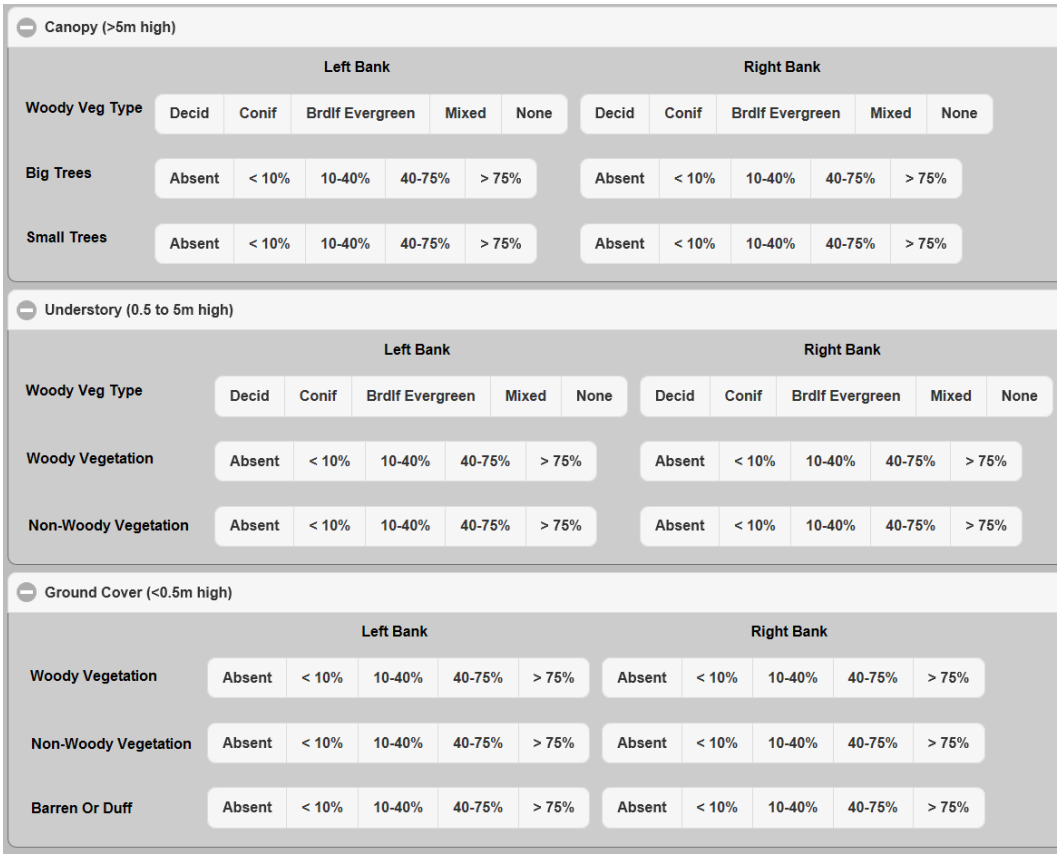

Figure 5. The *Riparian Vegetation Form*.

6.1.3 Characterize the **canopy** on both banks.

6.1.3.1 Choose the **woody vegetation type** (see Table 1), and use one of these choices.

- Deciduous
- Coniferous
- Broadleaf evergreen
- Mixed
- None

6.1.3.2 Estimate the cover class for **big trees** (see Table 1), and use one of these choices:

- Absent
- <10%
- 10-40%
- 40-75%
- >75%

Note: *Figure 3 may help to calibrate your estimation.*

6.1.3.3 Estimate the cover class for **small trees** (see Table 1), and use one of these choices:

- Absent
- <10%
- 10-40%
- 40-75%
- >75%

Note: *Figure 3 may help to calibrate your estimation.*

6.1.4 Characterize the **understory** on both banks.

6.1.4.1 Choose the **woody vegetation type** (see Table 1), and use one of these choices:

- Deciduous
- Coniferous
- Broadleaf evergreen
- Mixed
- None

6.1.4.2 Estimate the cover class for **woody** vegetation (see Table 1), and use one of these choices:

- Absent
- <10%
- 10-40%
- 40-75%
- >75%

Note: *Figure 3 may help to calibrate your estimation.*

6.1.4.3 Estimate the cover class for **non-woody** vegetation (see Table 1), and use one of these choices:

- Absent
- <10%
- 10-40%
- 40-75%
- >75%

Note: *Figure 3 may help to calibrate your estimation.*

6.1.5 Characterize the **ground cover** on both banks.

6.1.5.1 Estimate the cover class for **woody** vegetation (see Table 1), and use one of these choices:

- Absent
- <10%
- 10-40%
- 40-75%
- >75%

Note: *Figure 3 may help to calibrate your estimation.*

6.1.5.2 Estimate the cover class for **non-woody** vegetation (see Table 1), and use one of these choices:

- Absent
- <10%
- 10-40%
- 40-75%
- >75%

Note: *Figure 3 may help to calibrate your estimation.*

6.1.5.3 Estimate the cover class for **barren dirt or duff** (see Table 1), and use one of these choices:

- Absent
- <10%
- 10-40%
- 40-75%
- >75%

Note: *Figure 3 may help to calibrate your estimation.*

Notes on sums:
1) *Sum of cover per layer cannot exceed 100%. Therefore, within a layer, up to two cover types can be rated as 40-75% and no more than one cover type can be rated >75%.*

2) *Sum of ground cover **must** equal 100%.*

7.0 Records Management

7.1 Refer to SOP EAP125 (Janisch, 2017), which describes the process for validating, loading, and committing completed WHM electronic field forms to the WHM database.

8.0 Quality Control and Quality Assurance Section

9.1 PROJECT QA/QC is discussed in the Quality Assurance Monitoring Plan (Cusimano et al., 2006) procedures are addressed thoroughly in the QAMP for this project.

9.2 SAMPLING PRECISION: Repeat the sampling for 10% of all sites per year per Status and Trends Region. Timing of replicates should be several weeks or more after initial samples (as far apart in time as possible, but within the same index period).

9.3 SAMPLING ACCURACY: Persons using this SOP must either attend the annual training event (June) or be trained by someone who did. Data must be submitted to the Watershed Health database through electronic field forms (see Janisch, 2017). These should be completed while on-site so that the electronic forms can perform real-time data quality checks for accuracy.

9.4 REPRESENTATIVENESS: Verify and layout the site using SOP EAP106 (Merritt, 2017) or SOP EAP105 (Hartman, 2017).

10.0 Safety

10.1 All field staff must comply with the requirements of the EAP Safety Manual (Ecology, 2017).

11.0 References

11.1 Armantrout, N.B., compiler, 1998. Glossary of aquatic habitat inventory terminology. American Fisheries Society, Bethesda, Maryland.

11.2 Ecology, 2015. Environmental Assessment Program Safety Manual. Washington State Department of Ecology. Olympia, WA. http://teams/sites/EAP/Pages/safety.aspx

11.3 Endreny, T.A. 2009. Fluvial Geomorphology Modules, State University of New York College of Environmental Science and Forestry, National Oceanic and Atmospheric Administration, and the University Corporation for Atmospheric Research. www.fgmorph.com

11.4 Hartman, C. 2017. Watershed Health Monitoring: Standard Operating Procedures for GIS-Based Verification, Layout, and Data Collection (Wide Protocol) EAP105. Washington State Department of Ecology, Environmental Assessment Program, Olympia. http://www.ecology.wa.gov/programs/eap/quality.html

11.5 Janisch, J. 2013. Dictionary of Metrics for Physical Habitat: *Definitions and Calculations Used for Watershed Health Monitoring and Related Studies*. Washington State Department of Ecology. https://fortress.wa.gov/ecy/publications/SummaryPages/1303033.html

11.6 Janisch, J. 2017. Watershed Health Monitoring: Standard Operating Procedures for Managing Electronic Data Forms with a Mobile Data-Collection Device. SOP EAP125. Washington State Department of Ecology, Environmental Assessment Program, Olympia. http://www.ecology.wa.gov/programs/eap/quality.html

11.7 Merritt, G. 2017. Watershed Health Monitoring: Standard Operating Procedures for Verification and Layout of Sites (Narrow Protocol) SOP EAP106. Washington State Department of Ecology, Environmental Assessment Program, Olympia. http://www.ecology.wa.gov/programs/eap/quality.html

11.8 Parsons, J., D. Hallock, K. Seiders, B. Ward, C. Coffin, E. Newell, C. Deligeannis, and K. Welch 2016. Standard Operating Procedures to Minimize the Spread of Invasive Species, EAP 070. Washington State Department of Ecology, Environmental Assessment Program, Olympia. Version 2.1 http://www.ecology.wa.gov/programs/eap/quality.html

11.9 Stoddard, J. L., D. V. Peck, S. G. Paulsen, J. Van Sickle, C. P. Hawkins, A. T. Herlihy, R. M. Hughes, P. R. Kaufmann, D. P. Larsen, G. Lomnicky, A. R. Olsen, S. A. Peterson, P. L. Ringold, and T. R. Whittier. 2005. *An Ecological Assessment of Western Streams and Rivers*. EPA 620/R-05/005, U.S. Environmental Protection Agency, Washington, DC. https://archive.epa.gov/emap/archive-emap/web/html/wstriv.html

11.10 USDA. 2013. PLANTS Database. United States Department of Agriculture, Natural Resources Conservation Service. Internet page last modified 03/23/2015. http://plants.usda.gov