

Washington State Department of Ecology

Environmental Assessment Program

Standard Operating Procedure for Determining Channel Dimensions in Streams and Rivers for the
Extensive Riparian Status and Trends Monitoring Program

Version 1.0

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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) |
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| 5/23/2009 | 1 | Numerous edits | All | Liz Werner |
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Environmental Assessment Program

Standard Operating Procedure for Determining Channel Dimensions in Streams and Rivers for the Extensive Riparian Status and Trends Monitoring Program

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for determining channel dimensions in streams and rivers at an established Extensive Riparian Status and Trends (ERST) monitoring program site.

1.2 Gradient and width measurements are taken at six transects on a reach of determined length in order to establish a general idea of channel geometry. The dimensions are gathered as a covariate of stream temperature in the reach.

By measuring covariates of stream temperature such as gradient, bankfull width, and wetted width and modeling their impact on temperature, temperature changes can be explained in terms of such covariates, and may be linked to forest management. This is used to inform the Forest and Fish Rules adaptive management program.

2.0 Applicability

2.1 This procedure was adapted, in part, from the Environmental Monitoring and Assessment Program Field Operations Manual for Wadeable Streams (Peck et al., 2003) for use on streams in the Extensive Riparian Status and Trends monitoring program. The methods were simplified for time efficiency, ease of use, and maximum repeatability while maintaining consistency in results across personnel. Due to its simplified nature, it may or may not be a reasonable method for use on other surveys. This procedure assumes that transects have already been identified.

3.0 Definitions

3.1 Bank: any land surface above the bankfull edges that adjoins a body of water and contains it except during large-scale flood events; banks form above the bankfull edges as a conglomeration of vegetation, roots, rocks, and other structures.

3.2 Bankfull depth: vertical distance between the deepest point of the stream (thalweg) and the point above which water enters the flood plain or intersects a terrace or hillslope.

3.3 Bankfull edge: the line on the bank that coincides with the water's elevation during bankfull stage.

3.4 Bankfull height: vertical distance between the water's surface and the point above which water enters the flood plain or intersects a terrace or hillslope.

- 3.5 Bankfull stage: the point at which a river or stream completely fills its channel, just before water begins to flow into the flood plain; bankfull stage is defined by the flow during moderate-sized floods that occur an average of every 1.5 years.
- 3.6 Bankfull width: the distance between bankfull edges at a given point perpendicular to flow; if a channel is dry, measure distance perpendicular to perceived flow.
- 3.7 Bar: a conglomeration of substrate within the wetted width that is elevated above the water surface but below the bankfull height.
- 3.8 Braided channel: a stream whose flow follows numerous smaller channels rather than one main channel.
- 3.9 Flood plain: land immediately surrounding a channel that becomes inundated during periods of high flow.
- 3.9.1 Note: Often streams located higher in the watershed (which have higher gradients than streams located in lowland flood plains) do not have well-defined flood plains.
- 3.10 Gradient: the slope or rate of change in vertical elevation per unit of horizontal distance of the water surface of a flowing stream.
- 3.11 Island: a stream feature of consolidated material that is elevated above the bankfull zone; an island is confined by a side channel and the main channel.
- 3.12 Main channel: when a stream is divided by an island the main channel is the portion of the channel with the greatest flow.
- 3.13 Point bar: a bank deposit on the inside curve of a meandering stream; a point bar is formed when sediments drop from the bedload as water velocity slows.
- 3.14 Side channel: when a stream is divided by an island the side channel is the portion or portions of the channel that do not have the greatest flow.
- 3.15 Site: the area in which the study is being conducted; determined by the location of the randomly selected point on the stream.
- 3.16 Undercut bank: bank which has been eroded by the stream so that a protrusion of the upper portion of the bank (i.e. bank above the bankfull edge) overhangs the water surface.
- 3.17 Wetted edge: the point on a stream channel at which substrate particles are no longer surrounded by free water.
- 3.18 Wetted width: the horizontal distance between the left and right wetted edges.

4.0 Background Information on Identifying Bankfull Features

- 4.1 Scouring and inundation from flows at bankfull stage create features that are used to identify bankfull edges. Some of these features are slope breaks, stain or scour lines, changes in substrate or vegetation, point bars and debris lines.
- 4.2 Look for the highest point of point bars and stacks of debris including LWD at the lowest possible bankfull stage. This is generally where the flood plain is being constructed. Also indicative are areas where vegetation changes from perennial to annual, and where it goes from matted and dense to sparse. Willow, alder and dogwood are often present at the edge of the bank.
- 4.3 Changes from a vertical bank to a more horizontal bank are often the best indicator of the transition from channel to flood plain. Many low-gradient meandering streams have multiple slope breaks, defining old flood plains. Do not confuse these terraces, characterized by perennial vegetation and definite soil structure, with the current flood plain which is defined by the bankfull edges.
- 4.4 Additionally, look for breaks from coarse substrate to more fine sediment. Fine substrate may define the channel bed, where larger particles make up the edge of the flood plain.

5.0 Personnel Qualifications/Responsibilities

- 5.1 Knowledge of the contents of all SOP's related to the Extensive Riparian Status and Trends monitoring program.
- 5.2 Data collection: Staff members must understand the notations on the datasheet (Appendix A). Each staff member should be adequately trained to recognize bankfull edges.
- 5.3 The staff member's aptitude for field tasks is more important than job class.

6.0 Equipment and Supplies

- 6.1 Stadia rod
- 6.2 50m measuring tape
- 6.3 String box
- 6.4 Clinometer
- 6.5 Waterproof "Transect Dimensions, Canopy Cover, Riparian Vegetation" datasheet (Appendix A)
- 6.6 Waterproof "Channel Form, LWD, Discharge, Gradient, Tributaries" datasheet (Appendix B)
- 6.7 Waterproof field notebook
- 6.8 Pencils
- 6.9 Wading Boots and Chest Waders

7.0 Summary of Procedure

7.1 Determine Bankfull width

7.1.1 Determine the bankfull edges on the transect line perpendicular to stream flow and measure the distance between them in meters with a stadia rod or 50m tape. To identify bankfull edges look for indicative features including slope breaks, stain or scour lines, changes in substrate or vegetation, point bars, debris lines, and other features created by bankfull stage flows. Record this measurement in the appropriate “BFW” cell on the datasheet (Appendix A).

7.2 Determine Wetted width

7.2.1 On the transect line perpendicular to streamflow, identify points on both sides of the channel where the substrate particles are no longer surrounded by free moving water. These are the wetted edges. Measure the distance between the wetted edges in meters and record it in the appropriate “WW” cell on the datasheet (Appendix A). It is possible for the wetted width to be greater than the bankfull width if the bank is undercut. The presence of a bar does not alter the wetted width.

7.3 Determine Bar width

7.3.1 If a bar exists at the transect, record the width of the bar in meters in the appropriate “BAR” cell on the datasheet (Appendix A).

7.4 Determine Island width

7.4.1 An island has flow on both sides and creates a side channel. If an island exists at the transect, determine the main channel and measure the wetted width across it. If both channels appear to have equal flow, determine the main channel using your best judgment. Record the presence of a side channel in the appropriate “SC” cell on the “Channel Form, LWD, Discharge, Gradient, Tributaries” datasheet and note the width of the island in the “Notes” section (Appendix B).

7.5 Determine Braided Channel width

7.5.1 If multiple bars are present, record the entire channel width and indicate the presence of multiple bars on the datasheet. Record the sum total width of all the bars. If islands are present in the braided channel, measure the width of the main stream and indicate the presence of side channels. Note the width of the island(s) on the datasheet in the “Notes” section (Appendix B).

- 7.6 Determine Gradient
- 7.6.1 Gradient measurements are recorded over each segment unit from transect to transect. One person stands at the downstream transect and the other stands at the upstream transect. Once a line of sight is visible between the two transects, the downstream person aims the clinometer at the upstream person's approximate eye height. Both people stand at the water's edge. Gradient is recorded as a percent. Multiple measurements may be required if a direct line of sight cannot be established.
- 7.7 Determine Thalweg
- 7.7.1 To determine thalweg location along the transect, find the water depth at the deepest point along the transect with the stadia rod or graduated PVC pole. Record this depth measurement to the nearest 1 cm in the appropriate "THD" cell on the datasheet (Appendix A).
- 7.8 Repeat procedures in sections 6.1 through 6.6 for each remaining transect.
- 7.9 Review all field data for completeness before leaving the site.
- 8.0 Records Management**
- 8.1 Blank datasheets available to print are located in
Y:\SHARED Files\Engeness\ERST\Data Sheets
- 8.2 All completed datasheet hard copies from a specific site are filed together.
- 8.3 Datasheets are scanned and saved in folders according to year of survey and site type (Type N or Type F). These folders are located in

Y:\SHARED Files\Engeness\ERST\Type F07E
Y:\SHARED Files\Engeness\ERST\Type F08W
Y:\SHARED Files\Engeness\ERST\Type N08W
Y:\SHARED Files\Engeness\ERST\Type N09E
- 8.4 Data is entered into Access Database tables. These databases are located in
Y:\SHARED Files\Engeness\ERST\Database Stuff\ERST_DATABASES
- 9.0 Quality Control and Quality Assurance Section**
- 9.1 Data collection
- 9.1.1 Select 10% of the total number of sites for QA and take all field measurements twice; the second time with a different staff member collecting data. Record the QA

measurements on separate data sheets. For the sake of efficiency, reassess the site immediately after the first assessment.

9.1.2 Ensure data sheets are completely filled out.

9.2 Data entry: After transferring data to a database file, two staff members check each entry of each record. Alternatively, enter the data twice and compare the tables.

10.0 Safety

10.1 Safety Equipment

10.1.1 Hard hat

10.1.2 Field vest

10.1.3 Wading Boots / Chest Waders

10.1.4 Compass

10.1.5 Whistle

10.1.6 First aid kit

10.1.7 Weather protection (i.e., raingear, sun protection, extra clothing)

10.2 Field team must always consist of at least two staff members.

10.3 Applicable Ecology Safety Policies

10.3.1 Accessing Private Property: Follow Ecology Executive Policy 1-11.

10.3.2 Field work Notification Procedures: Follow procedure outlined in EAP Safety Manual on pages 1-19 through 1-22.

10.3.3 Working in Rivers and Streams: Follow procedure outlined on pages 1-35 and 1-36.

10.4 Use a CB radio to communicate with traffic on logging roads.

11.0 References

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11.4 Janisch, J. 2006. Standard Operating Procedure (SOP) for estimating large woody debris loads intersecting headwaters, version 1.0. Washington State Department of Ecology, Olympia, WA.

http://www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP_SOP_HEADWATERS_LARGE_WOODY_DEBRIS_v1_0.pdf.

- 11.5 Kaufmann, P., Robison, E. 1998. Physical Habitat Assessment. pp 77-118 In Environmental Monitoring and Assessment Program – Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Wadeable Streams. EPA/620/R-94/004F. U.S. Environmental Protection Agency, Washington D.C.
- 11.6 MDT, 2002. Monitoring Design for the Forestry Module of the Governor’s Salmon Recovery Plan. Monitoring Design Team.
http://www.dnr.wa.gov/Publications/fp_am_mdt_rprt_final_118Jul02.pdf.
- 11.7 Moberg, J. 2007. A Field Manual for the Habitat Protocols of the Upper Columbia Monitoring Strategy, version 5.0. Draft. Prepared for Bonneville Power Administration’s Integrated Status and Effectiveness Monitoring Program. Wauconda, WA: Terraqua, Inc.
- 11.8 Peck, D., J.M. Lazorchak, and D.J. Klemm (editors), 2003. Environmental Monitoring and Assessment Program-Surface Waters: Western Pilot Study Field Operations Manual for Wadeable Streams. U.S. Environmental Protection Agency, Western Ecology Division, Corvallis, OR.
<http://www.epa.gov/emap/html/pubs/docs/groupdocs/surfwatr/field/ewwsm01.pdf>

12.0 Appendices

12.1 Appendix A. Datasheet for recording bankfull width and wetted width for each transect

ERST TYPE N F Westside MM/DD _____ 2009 CREW _____ Site ID # _____

| Transect Dimensions, Canopy Closure, Riparian Vegetation Cover | | | | | | | | | | | | | | | |
|--|---------------|-----|-----|----------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Tr. | DIMENSIONS(m) | | | | CANOPY CLOSURE | | | | Notes: | | | | | | |
| | WW | BFW | BAR | THD | Up | Left | Down | Right | | | | | | | |
| 1 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | |
| RIPARIAN VEGETATION COVER | | | | T - 1 LB | T - 1 RB | T - 2 LB | T - 2 RB | T - 3 LB | T - 3 RB | T - 4 LB | T - 4 RB | T - 5 LB | T - 5 RB | T - 6 LB | T - 6 RB |
| Vegetation Type (> 5m) | | | | | | | | | | | | | | | |
| Big Trees (> 5m) | | | | | | | | | | | | | | | |
| Small Trees (> 5m) | | | | | | | | | | | | | | | |
| Vegetation Type (5 - 0.5m) | | | | | | | | | | | | | | | |
| Woody Plants (0.5 - 5m) | | | | | | | | | | | | | | | |
| Non-Woody Plants (0.5 - 5m) | | | | | | | | | | | | | | | |
| Woody Plants (< 0.5m) | | | | | | | | | | | | | | | |
| Non-Woody (< 0.5m) | | | | | | | | | | | | | | | |
| Barren, Bare Dirt or Duff | | | | | | | | | | | | | | | |
| Unstable Bank (%) | | | | | | | | | | | | | | | |

Vegetation Type (D = deciduous, C = coniferous, E = broadleaf evergreen, M = mixed, N = none). For big/small trees, woody/non-woody dirt/duff use: 0 = Absent (0%), 1 = Sparse (<10%), 2 = Moderate (10-40%), 3 = Heavy (40-75%), 4 = Very Heavy (>75%)

12.2 Appendix B. Datasheet for recording presence of side channel and notes (including widths of islands)

ERST TYPE N F Westside MM/DD _____ 2009 CREW _____ Site ID # _____

| Channel Form, LWD, Discharge, Gradient, Tributaries | | | | | | | | | | | | | |
|---|----------------------------|-----|-----|-------|--------------------|-----------|------|---|---------|------|--------|----------------|----|
| SEG. | CHANNEL FORM | | | | LARGE WOODY DEBRIS | | | DISCHARGE MEASUREMENTS: | | | | | |
| | SC | BW | W | Morph | Downed | Suspended | Jams | Transect ____ intersects discharge reach at ____ m. | | | | | |
| 1 | Y N | Y N | Y N | | | | | Distance of discharge reach = ____ m. | | | | | |
| 2 | Y N | Y N | Y N | | | | | Gradient of discharge reach = ____ %. | | | | | |
| 3 | Y N | Y N | Y N | | | | | MANNING'S N ESTIMATE | | | | | |
| 4 | Y N | Y N | Y N | | | | | N0 = | | N2 = | | N4 = | |
| 5 | Y N | Y N | Y N | | | | | N1 = | | N3 = | | M5 = | |
| SEG. | GRADIENT MEASUREMENT NOTES | | | | | | % | TRIBS | Dis.(m) | BFW | % Flow | Side of Stream | |
| 1 | | | | | | | | Trib 1: | | | | RL | RR |
| 2 | | | | | | | | Trib 2: | | | | RL | RR |
| 3 | | | | | | | | Trib 3: | | | | RL | RR |
| 4 | | | | | | | | Trib 4: | | | | RL | RR |
| 5 | | | | | | | | Trib 5: | | | | RL | RR |

Notes:

Morph codes: (BR, CO, CA, SP, PB, PR, DR, FA, DR). For Channel Form codes, circle Y if present and N if absent.
 SC=Side Channel, BW=Back Water, W=Wetland. Con=Coniferous, Dec=Deciduous. Classify dominant morph code, or use two if 50/50.