Washington State Department of Ecology

Environmental Assessment Program

Standard Operating Procedure for Conducting Riparian Vegetation and Stream Channel Surveys in Wadeable Streams for Temperature Total Maximum Daily Load Studies

EAP084

Version 1.0

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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	Rev number	Summary of changes	Sections	Reviser(s)

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for conducting riparian vegetation and stream channel surveys in wadeable streams for temperature Total Maximum Daily Load (TMDL) Studies.

1.2 The purpose of these surveys is to collect field data necessary for modeling stream temperatures in EAP's TMDL studies.

1.3 Survey data consist of channel geometry and substrate measurements, near-stream vegetation measurements and characteristics, and shade data from 10 transects, 100 feet apart, at and upstream of a temperature data logger.

1.4 Vegetation survey data include vegetation heights and overhang and vegetation zone and near-stream disturbance zone (NSDZ) measurements. Vegetation survey data is important for groundtruthing ortho photographs and vegetation height data used in the models.

1.5 Hemispherical photography and Solar Pathfinder™ shade measurements are also components of riparian vegetation data collection and are discussed in this SOP. Detailed procedures for taking and processing hemispherical photos can be found at http://www.ecy.wa.gov/programs/eap/quality.html.

1.6 Channel survey measurements include wetted widths and depths, bankfull widths and depths, incision, and flood prone widths.

1.7 Substrate characteristics are also recorded at each transect. Methods have been adopted from Wolman, 1954 to count and classify substrate particle sizes during the pebble count component of the surveys.

2.0 Applicability

2.1 This SOP should be followed when measuring channel geometry, collecting substrate data, characterizing near-stream vegetation, and collecting shade data from wadeable streams for modeling stream temperatures in EAP's TMDL studies.

3.0 Definitions

3.1 Aerial photograph – A photograph taken from an airplane or satellite.

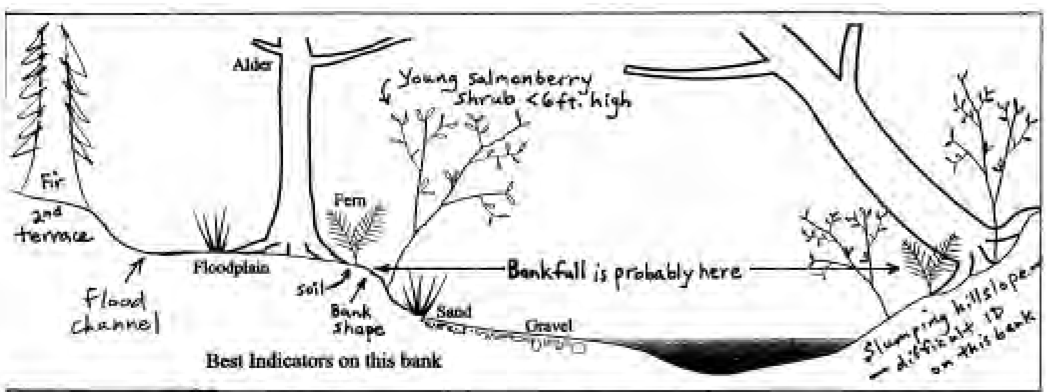
3.2 Bank – The shoreline of a stream. Left and right banks are determined while looking downstream.

3.3 Bankfull depth – The vertical distance from the deepest part of the wetted channel to the top of the bankfull channel.

3.4 Bankfull edge – The edge of a stream at bankfull stage (stage at which the stream is contained in a channel but over which flooding can occur). Bankfull is demarcated by assessing near-stream bank slope, vegetation, and soil characteristics. EAP's TMDL studies often define the edge as the point at which perennial (permanent) vegetation grows and below which annual (temporary) vegetation exists. See Figure 1.

3.5 Canopy cover – Coverage of the canopy (shade producing vegetation) overlying the forest floor.

3.6 Flood prone width – The stream width at a discharge level defined as twice the maximum bankfull depth.



Typical bankfull ID situation, adapted from Pleus and Schuett-Hames, 1998.

Figure 1. Diagram showing common bankfull edge and floodplain indicators, taken from SWAMP, 2006.

3.7 Floodplain – Land adjacent to a stream that stretches from its bankfull edge to the base of the enclosing valley walls and experiences flooding during periods of high discharge. It is the area that is covered by the stream at twice the maximum bankfull depth. Figure 1 shows an example of a floodplain.

3.8 Groundtruthing – The process of gathering data to test the accuracy of a model. Groundtruthing also allows aerial imagery to be related to real features on the ground.

3.9 HemiView – Equipment used to acquire and analyze hemispherical images of forest canopies.

3.10 Incision – The vertical distance a stream is incised relative to the surrounding landscape. In EAP's TMDL studies, incision is measured as the vertical distance between the top of a stream's bankfull depth to the highest point in the entrenched area.

3.11 Near-Stream Disturbance Zone (NSDZ) – The area between the wetted edge of the stream and the first shade producing vegetation. This usually occurs at or near the bankfull edge. Permanent vegetation such as large trees typically grows outside of the NSDZ.

3.12 Orthophotograph – An aerial photograph geometrically corrected such that the scale is uniform: the photo has the same lack of distortion as a map. Unlike an uncorrected aerial photograph, an orthophotograph can be used to measure true distances, because it is an accurate representation of the Earth's surface, having been adjusted for topographic relief, lens distortion, and camera tilt.

3.13 Riparian vegetation – Vegetation near a stream.

3.14 Solar Pathfinder™ – A hand-held shade analysis tool used to determine the percentage of solar radiation blocked by objects in a specific area throughout the course of a day. It is specific to month of the year and latitude (see Figure 10).

3.15 Thalweg – Deepest channel of a stream. The thalweg is almost always the line of fastest flow.

3.16 Vegetation density – Percent of the ground that is covered by a certain type or species of vegetation.

3.17 Wetted depth – The distance from the channel bed to the top of the water surface along the transect line.

3.18 Wetted edge – The edge of water in a stream.

3.19 Wolman pebble count – A method used for measuring the particle size distribution of the surface substrate of a streambed.

4.0 Acronyms

4.1 BFD – Bankfull Depth

4.2 BFW – Bankfull Width

4.3 FPW – Flood Prone Width

4.4 LB/RB – Left Bank/Right Bank

4.5 LBFE/RBFE – Left Bankfull Edge/Right Bankfull Edge

4.6 LEW/REW – Left Wetted Edge/Right Wetted Edge

4.7 LVO/RVO – Left Vegetation Overhang/Right Vegetation Overhang

4.8 NSDZ – Near Stream Disturbance Zone

5.0 Personnel Qualifications/Responsibilities

5.1 All field operations require training specified in EAP's Field Safety Manual (Ecology, 2012), such as first aid, CPR, and defensive driving. Experience and training in the natural sciences and methods for collecting environmental data are also important.

5.2 This SOP can be used by to all Natural Resource Scientists, Environmental Engineers, Environmental Specialists, Hydrogeologists, and Interns and Technicians in Ecology.

6.0 Equipment

6.1 Waders and wading boots
6.2 Personal flotation devices
6.3 Flow meter
6.4 Flow rod
6.5 Stakes for securing measuring tapes to stream banks.
6.6 Notebook or paper for recording flow measurements
6.7 Laser range finder
6.8 HemiView equipment (tripod, charged camera, fisheye lens, and camera/lens mounting bracket)
6.9 Solar Pathfinder™ and extra sunpath diagrams
6.10 Stadia rod
6.11 Survey prism
6.12 Survey pole (optional)
6.13 Color ortho or aerial photo of each site reach. One site (~1:1,500 scale) per 8" x 11" page works well. Try to use the same ortho photos the modeler will use.
6.14 300' measuring tape
6.15 100' measuring tape
6.16 Metal ruler (metric preferable)
6.17 Transect field forms (Figure A-1), 10 per site.
6.18 Wolman pebble count field form (Figure A-2), one per site.
6.19 Clipboard (metal with compartments preferable)
6.20 Several #2 pencils and black ballpoint or felt pen
6.21 White wax pencil for tracing shade on the Solar Pathfinder™ (optional)

7.0 Summary of Procedure

7.1 <u>Survey Site Selection</u>

7.1.1 Vegetation and channel surveys should occur at each of the stream temperature monitoring stations to be modeled. Each survey should begin at or near the stream temperature data logger and continue 1,000 feet upstream (10 transects). If access is a problem (e.g., stream is too deep to continue or is blocked by vegetation, or landowner permission was not given), measure as many transects as possible up to that point. The field survey crew should always stay within the boundaries of the property for which permission has been granted.

7.1.2 Figure 2 provides a diagram of all the terms in the proceeding sections.

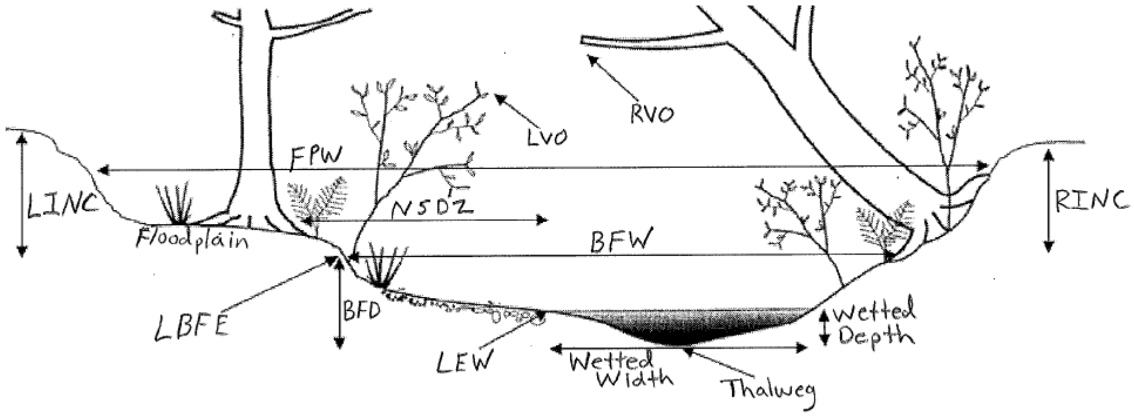


Figure 2. Cross section of a stream (looking downstream) showing channel features measured by EAP. See section 4.0 for acronym definitions.

7.2 Measure streamflow

7.2.1 Establish the first transect at or near the temperature data logger. Measure and record streamflow by following the appropriate EAP-approved SOP (EAP 024, Kardouni, 2013). This data will be important during the modeling phase.

7.3 Measure Incision

7.3.1 On one side of the stream, measure the vertical distance from the top of the bankfull edge to the top of the incised bank and record on a field sheet (example; Figure A-1, column 2, row 1). This can be done with any measuring device, but a stadia rod usually works best. The laser range finder can be used when incision is too great for the stadia rod.

7.3.2 Write LINC (left bank incision) or RINC (right bank incision) in the "Mark" column (Figure A-1, column 3, row 1).

7.3.3 When the other side of the stream is reached, measure and record incision again in the same manner.

7.4 Bankfull measurements (requires two people)

7.4.1 Person one – hold the laser range finder at the **wetted** edge.

7.4.2 Person two – hold a reflective prism (Figure 3), or mount it on a survey rod for stabilization, at the **bankfull** edge on the same side of the stream. A tape or stadia rod may also be used if vegetation obstructs the line of site between the laser and prism.

Note: Although a survey prism is preferred, any flat surface - such as a clipboard or binder - will work.

Figure 3. Example of a survey prism.

7.4.3 Person one – laser the prism and record the distance from the laser to the prism on the field sheet as a negative number (example; Figure A-1, column 1, row 2). Mark as LBFE or RBFE (left or right bankfull edge) in column 3 of the field sheet.

7.4.4 At the same time, person one or two should use a stadia rod and measure and record the vertical distance from the wetted edge to the bankfull edge (Figure A-1, column 2, row 2). This is a positive number because it is above the wetted edge.

Note: EAP does not directly measure bankfull depth, as defined in section 3.0. To get true bankfull depth, which will be needed when calculating flood prone width and to populate the model, add the maximum wetted depth (section7.5) to the above measured depth.

7.4.5 After taking bankfull measurements, compare left and right bankfull depths. They should be the same or very close. Some deviation is normal due to unclear bankfull edge indicators, rapidly changing stream stage, or minor mistakes made while measuring bankfull depth. If the left and right bankfull edge depths are more than 0.5 feet different from each other, reevaluate the bankfull edge indicators up and downstream from the transect line to find better visual cues for bankfull stage. See Figure 1 for help with these cues.

7.5 <u>Wetted stream channel measurements (requires two people)</u>

7.5.1 Person one – record your current position as “0” distance and “0” depth (Figure A-1, row 3). Make sure to record whether the transect starts at the LEW or REW (left or right bank wetted edge) in row 3 of the field sheet.

Note: Everything on the field sheet is relative to the wetted edge, which is why the first wetted edge depth and distance are “0.”

7.5.2 Continue by recording the prism distance from the wetted edge at about 12 to 20 increments across the wetted portion of the stream (depending on stream size; narrower streams tend to require fewer increments than wider streams). The transect should be a straight line from person one to the opposite bank, perpendicular to the stream's channel.

7.5.3 Person two should use a stadia rod to measure stream depth at every place the prism distance is measured and person one should record depths as negative numbers, because they are below the stream surface (see Figure A-1 for example).

7.5.4 Figure 4 shows an example of a transect cross section and measurement intervals.

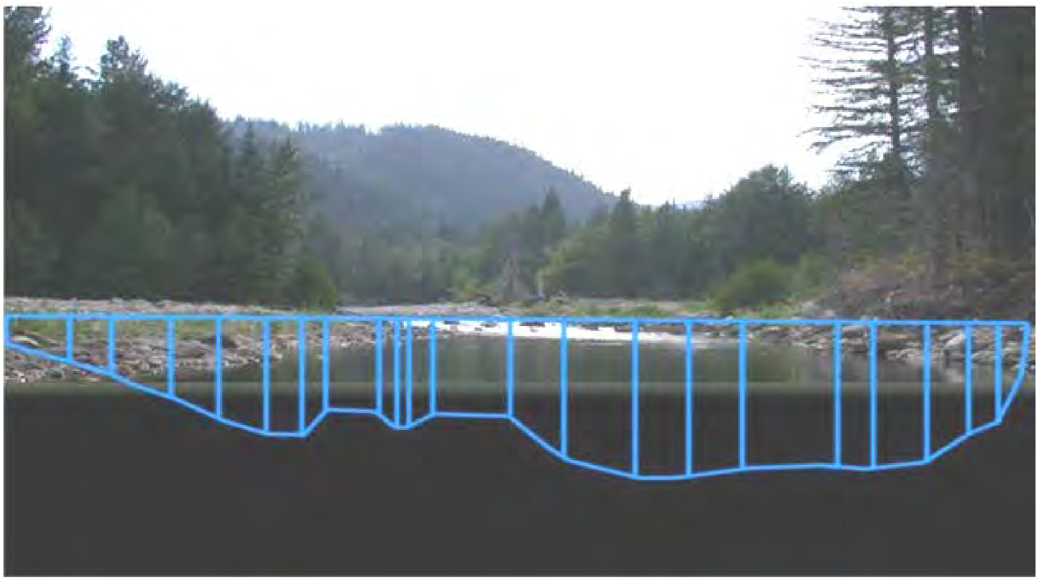


Figure 4. Example of cross section measurement intervals.

7.5.5 When person two reaches the other side of the wetted channel, person one should mark the wetted edge depth as "0" and record the laser measurement as shown in Figure A-1, row 13.

7.5.6 The same measurement techniques covered in sections 7.3 and 7.4 should be applied to get bankfull distance and depth and incision on the opposite bank of the stream.

7.6 Vegetation overhang

7.6.1 Person two – while measuring the stream transect, be aware of any vegetation overhanging the bankfull channel. If there is any, record the distance the vegetation extends over the channel from both banks. For example, Figure A-1, column 3, rows 6 and 12 show that vegetation extended over the stream 6.2 feet from the **left** wetted edge and on the right bank, vegetation extended over by 16.4 feet from the **left** wetted edge. Make sure to write LVO or RVO (left or right vegetation overhang) in column 3.

7.6.2 Take notes on the type or species of vegetation that is overhanging the banks (example on bottom of Figure A-1).

7.7 Near-stream disturbance zone (NSDZ)

7.7.1 Record the NSDZ width on the same field sheet as the transect measurements (Figure A-1). Most often, NSDZ is recorded as "bankfull" or "bankfull plus (a distance in feet)." See Figure A-1 for an example.

7.7.2 NSDZ can be accurately measured with a laser range finder, stadia rod, tape, or it can be estimated by an experienced vegetation and channel surveyor.

7.8 Flood prone width

7.8.1 After measuring channel geometry and bankfull width, estimate how far the stream would extend horizontally from each bankfull edge if it was twice the maximum bankfull depth. Add the horizontal distances from both sides of the stream to the bankfull width to get the total flood prone width (FPW).

7.8.2 On the field sheet (Figure A-1), record the FPW as either 1.) greater than 2.2 multiplied by the bankfull width of the stream 2.) less than 1.4 multiplied by the bankfull width, or 3.) in between the two measurements.

7.8.3 For example, measurements in Figure A-1 tell us that twice the maximum bankfull depth was 4.28 feet above the bankfull edge, or 2 times the sum of 1.5 feet (vertical distance between wetted edge and bankfull edge) and 0.64 feet (deepest wetted depth). Horizontally extending the stream at a depth of 4.28 feet above the bankfull depth until it meets both incised banks fell in the "FPW<1.4XBFW" category.

Note: Usually, flood prone widths will be either "greater than…" or "less than…," but can occasionally fall into the "in between" category.

7.9 Groundtruthing and vegetation measurements

7.9.1 After transect data have been recorded, one person should pull out the aerial photos and take vegetation notes directly on the photos with a black ballpoint or felt pen (whichever can be seen the best on the photos).

7.9.2 Take notes on vegetation height, type, density, canopy coverage, and zone widths.

7.9.3 For the purposes of EAP's vegetation surveys, a vegetation zone is the area adjacent to the stream where one pattern of vegetation or vegetation type dominates or is distinguishable from the next. For example, a mix of 35 foot tall alders and 4 foot tall grass that extends 50 feet away from the stream might be zone 1, while zone 2, which is mostly covered in 100 - 120 foot tall conifers extends from 50 feet to 150 feet away from the stream. Zone 3 might be a farmer's field or bare ground that extends from 150 feet to 300 feet away from the stream.

7.9.4 It is not necessary to estimate zones beyond 300 feet from the stream.

7.9.5 There can be as little as one zone or as many as four or more zones on each stream bank, depending on vegetation types, land uses, flood plain characteristics, and many other factors.

7.9.6 Write vegetation zone notes directly on or adjacent to corresponding vegetation in the photos or on a separate sheet if desired. This information will be helpful to groundtruth data the model will use.

7.9.7 If tree species is obvious, circle the tree(s) and write species information next to the circle on the photo. If species is not obvious, write "C" for conifer, "D" for deciduous, "M" for mixed conifer/deciduous, "G" for grass, and "S" for shrubs and bushy vegetation, and "B" for bare earth.

7.9.8 Measure and record vegetation heights in the same manner.

7.9.9 Although individual tree heights are easy to measure and can be useful groundtruthing data, the height of the dominate vegetation type in each zone is the most important data for modelers.

7.9.10 Measure tree heights with the laser range finder, if possible, or provide a "best guess" and note that the height is an estimated value.

Note: During the groundtruthing stage, it is not necessary to measure all vegetation heights, just the ones that can be easily distinguished in the photos and that will provide the best groundtruthing data. If in doubt about what to measure, include estimates on a variety of vegetation types and groups of trees and shrubs.

7.9.11 One person should also record vegetation density for each zone of vegetation. Vegetation density is the percent of the ground that is covered by a certain type or species of vegetation. Percentages for a given vegetation zone should add up to 100. For example, zone 1 in the above example (section 7.9.3) might be 75% alder and 25% grass. Zone 2 might be 80% conifer and 20% shrub. Zone 3 might be 85% grass and 15% bare ground or roadway. Write down your observations in the same manner you recorded zone information.

7.9.12 At the same time vegetation density notes are taken, record an estimate of each zone's canopy coverage over the forest floor (e.g., 0%, 25%, 50% canopy cover, etc.).

7.10 Wolman pebble count

7.10.1 Wolman pebble counts should take place at one transect from each site reach to characterize the substrate in that reach. Most often, pebble counts are performed at the first transect, where the data logger is installed.

7.10.2 A uniform, channel-spanning, obstruction-free riffle where no point bars are present is preferable. Avoid transects that include anomalous patches of fine sediment or are near obstructions such as woody debris or riprap from bridge construction. Figure A-2 shows the field sheet with the particle size classes.

7.10.3 The sampling method is virtually the same as the method described in Wolman (1954), with the exception that a minimum of 50 particles are counted instead of 100.

7.10.4 Begin at the bankfull edge.

7.10.5 Take one or two steps towards the wetted channel and select the first particle at the end of your wading boot.

7.10.6 Measure each particle at its intermediate axis (Figure 5) and place a tick mark in the appropriate size class of the field sheet (Figure A-2).

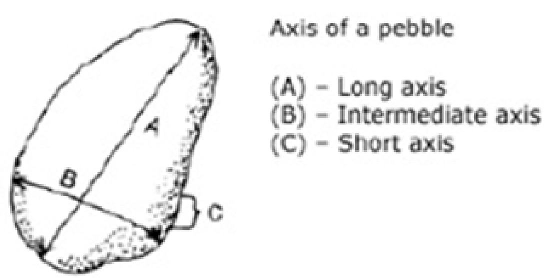


Figure 5. Example substrate particle showing different measurement axis.

7.10.7 Continue selecting particles in a straight line across the channel while remaining consistent in sampling technique.

7.10.8 Measure at least 50 particles. If the end of the first transect (at the opposite bankfull edge) is reached before 50 particles are measured, turn around and measure particles with the same technique until the bankfull edge is reached again. Do not stop midway through the transect as this will bias the pebble count data.

7.11 Other substrate notes

7.11.1 Although no more Wolman pebble counts are necessary, substrate type and percentages should be recorded at all upstream transects. See Figure A-1 for an example of how to record substrate percentages. Percentages should add up to 100.

7.12 HemiView photography

7.12.1 Procedures for taking and processing hemispherical photos can be found at http://www.ecy.wa.gov/programs/eap/quality.html (SOP EAP045 and EAP046 – Stohr and Bilhimer, 2008 and Stohr, 2008, respectively).

7.12.2 Take hemispherical photographs at or near the temperature data loggers (usually transect 1) during leaf-out conditions (late spring through summer).

7.12.3 The instream photo should be taken at the thalweg, or the middle of the channel if there is no obvious thalweg.

7.12.4 Remember to record the height of the fisheye lens above the water when taking photos in streams, and above the ground when taking photos on stream banks.

7.12.5 Figure 6 shows a HemiView setup without the camera.

Figure 6. HemiView setup, including tripod, fisheye lens, and camera/lens mounting bracket (camera not shown).

7.13 <u>Solar Pathfinder™</u>

7.13.1 Like HemiView photos, Solar Pathfinder™ measurements are important for groundtruthing temperature models and also checking HemiView shade outputs.

7.13.2 Record pathfinder measurements at each transect, including transects where HemiView photos were not taken.

7.13.3 Before taking measurements, make sure the declination and latitude on the instrument's sunpath diagram are correct (specify the correct sunpath diagram latitude at the time of purchase; it cannot be adjusted later) (Figure 7).

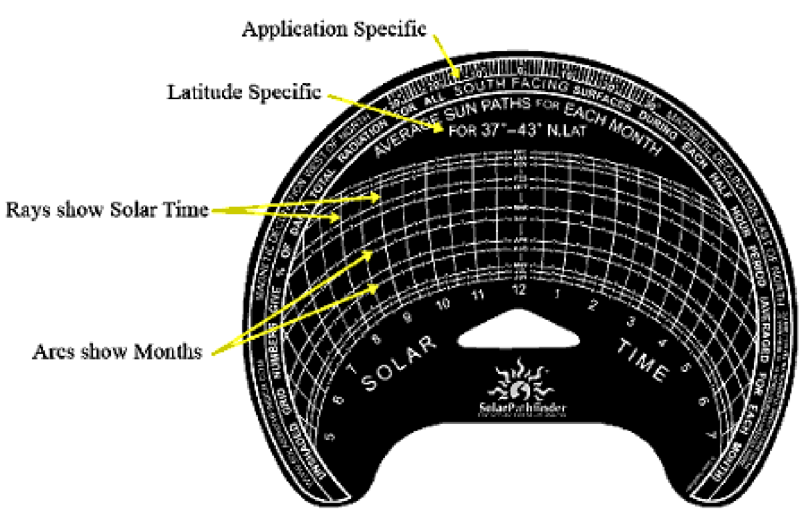


Figure 7. Sunpath diagram that is inserted into the Solar Pathfinder™ at each transect.

7.13.4 If it hasn't already been set, adjust the pathfinder for declination.

7.13.5 Pull out the magnetic declination tab (Figure 8).

7.13.6 Rotate the diagram (use the blue triangle) to make the magnetic declination adjustment.

7.13.7 Line the white dot up with the proper declination value (negative numbers are left of the "0"; positive numbers are right of the "0").

7.13.8 Push in the magnetic declination tab to relock.

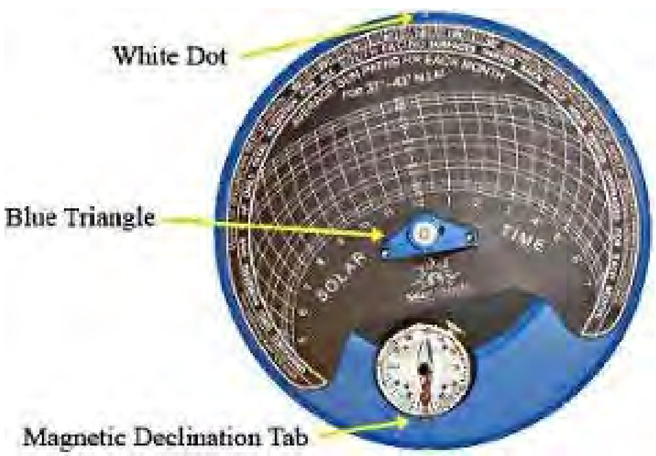


Figure 8. Solar Pathfinder™ features for adjusting magnetic declination (shown with reflective dome off).

7.13.9 Next, place the plastic dome back on the base and level the instrument facing south using the level and compass (Figure 9).

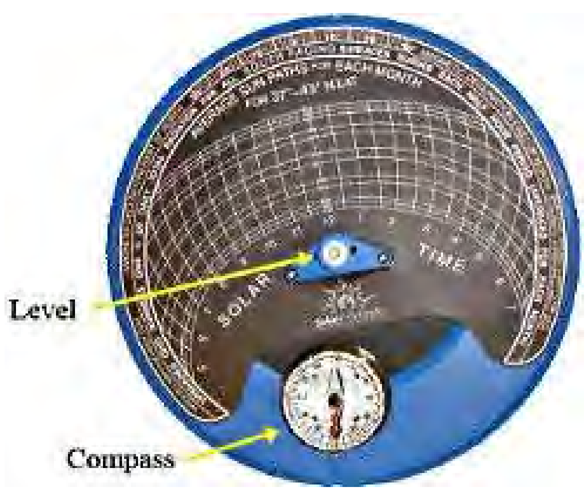


Figure 9. Solar Pathfinder™ features for leveling and orienting the instrument when viewing (shown with reflective dome off).

7.13.10 Hold the pathfinder at stomach level and view the instrument from directly above, at a distance of about 1 to 1.5 feet from your eyes.

7.13.11 Look for the reflection of the sky and objects providing shade (trees, ridges, etc.) on the instrument dome.

7.13.12 Orienting to the July sun path first, trace around the shaded areas with a white wax pencil or thick #2 pencil (Figure 10).

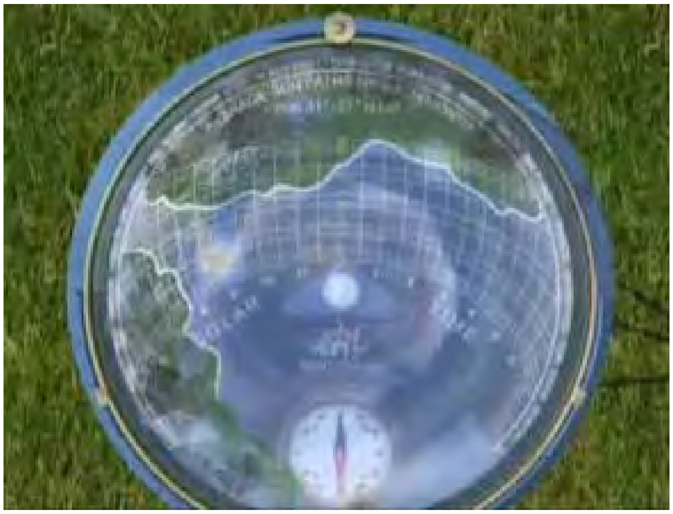


Figure 10. Solar Pathfinder™ showing a line traced around the shaded portion of the reflected sky.

7.13.13 Count each shaded section in July's sunpath and add up all the sections to yield the total percent shade. Consider fractions of individual sections. For example, if half of a "6" section is shaded, record "3"; if 2/3 of a "3" section is shaded, record "2."

7.13.14 Write the total number of shaded sections in the "% Shade" box of the field form (Figure A-1).

7.13.15 Flip the Sunpath diagram sheet over and record the site ID, transect number, date, and time and put it with the rest of the field data for record keeping purposes.

7.13.16 Repeat for August.

Tip: Similar to taking HemiView photos, cloudy or overcast skies provide optimal conditions for the pathfinder. On sunny days, it may be helpful to hold a hand above the pathfinder in a position that reduces glare while still allowing shade to be observed.

8.0 Records Management

8.1 All field forms created in the office (flow sheets, channel transect forms, Wolman pebble count forms, and ortho and aerial photos with notes) should be printed on waterproof paper.

8.2 All forms should have the date, time, site ID, and the transect number written on them.

8.3 Completed forms from each site should be kept together in a separate section in a binder.

9.0 Quality Control and Quality Assurance

9.1 Upon completion of each transect, check all forms (flow sheets, Wolman pebble count forms, channel and vegetation transect forms, Sunpath diagrams, and aerial photos) to ensure that necessary notes, descriptions, measurements, and other data are not missing.

9.2 If measurements or modifications in procedures need explaining, make sure these notes are on the appropriate form.

9.3 Also note any groundwater seeps or other pertinent information on the field forms during the surveys.

10.0 Safety

10.1 Proper fieldwork safety procedures are outlined in EAP's Safety Manual (Ecology, 2012). For more unique situations use common sense and follow the general safety procedures in the manual.

10.2 Use caution when traversing over unstable stream banks, or through deep pools, thick mud, and heavy vegetation. If a transect is unsafe to measure for any reason, either skip it and move to the next transect or move slightly up or downstream until it is safer.

10.3 When using the Solar Pathfinder™, do not stare at the reflection of the sun in the dome.

10.4 Always be aware of your surroundings.

11.0 References

Ecology, 2012. Environmental Assessment Program Safety Manual. Washington State Department of Ecology. Olympia, WA. http://aww.ecology/programs/eap/safety.html

Stohr, A. 2008. Standard operating procedure for the computer analysis of hemispherical digital images collected as part of a temperature Total Maximum Daily Load (TMDL) or Forests and Fish Unit technical study. SOP #EAP046. Washington State Department of Ecology, Olympia WA. http://www.ecy.wa.gov/programs/eap/quality.html

Stohr, A. and Bilhimer, D. 2008. Standard operating procedures for hemispherical digital photography field surveys conducted as part of a temperature Total Maximum Daily Load (TMDL) or Forests and Fish Unit technical study. SOP EAP045. Washington State Department of Ecology, Olympia WA. http://www.ecy.wa.gov/programs/eap/quality.html

Kardouni, J. 2013. Standard operating procedure for estimating streamflow. SOP EAP024. Washington State Department of Ecology, Olympia WA. http://www.ecy.wa.gov/programs/eap/quality.html

SWAMP, 2006. Bankfull: What is it and how to locate it. California Environmental Protection Agency Surface Water Resources Control Board, Surface Water Ambient Monitoring Program (SWAMP). May, 2013. http://www.swrcb.ca.gov/water_issues/programs/swamp/docs/cwt/guidance/413.pdf

Wolman, M. Gordon, 1954. A method of sampling course river-bed material. Transactions, American Geophysical Union, Vol. 35 No. 6. December 1954. 951-6.

12.0 Appendix A

12.1 This section contains example forms for field data collection (Figures A-1 and A-2). Forms may be modified for individual project needs. Field forms should be printed on waterproof paper. All completed forms should be retained for office and archival use. Forms can be found at Y:\SHARED Files\Temperature TMDLs\Field Forms.

Station ID	**SPA-0.1**	FPW>2.2XBFW	____
Transect #	**1**	FPW<1.4XBFW	**X**
Date	**7/10/2012**	1.4<FPW<2.2XBFW	_____
Time	**1605**		

	1	2	3	
	Tape (ft)	Depth (ft)	Mark	% Shade
1		**2.5**	**LINC**	July **19**
2	**-3**	**1.5**	**LBFE**	Aug **23**
3	**0**	**0**	**LEW**	NSDZ=
4	**1.6**	**-0.3**		**bankfull + 2'**
5	**3.3**	**-0.38**		Substrate %
6	**6.2**	**-0.6**	**LVO**	Bedrock **10**
7	**8.4**	**-0.64**		Boulder ____
8	**10.1**	**-0.59**		Cobble **30**
9	**11.4**	**-0.38**		Gravel **50**
10	**13.6**	**-0.46**		Sand **5**
11	**14.7**	**-0.3**		Silt/Clay **5**
12	**16.4**	**-0.28**	**RVO**	
13	**18.2**	**0**	**REW**	
14	**23.2**	**1.5**	**RBFE**	
15		**2**	**RINC**	
16				
17				
18				
19				
20				

NOTES: **right and left veg. overhang was 100% alder**

Figure A-1. Example of a completed stream transect field sheet. Bold values have been collected in the field.

Wolman Pebble Count

Station ID: ______________________________

Date/Time: ______________________________

Transect Number: _________

Size Class

Inches	Millimeters	Particle		Particle Count	Total
< .08	< 2.0	≤ sand	**S/C/S**		
.08 - 0.16	2.0 - 4.0	Very Fine			
0.16 - 0.24	4.0 - 6.0	Fine	**G**		
0.24 - 0.31	6.0 - 8.0	Fine	**R**		
0.31 - 0.47	8.0 - 12.0	Medium	**A**		
0.47 - 0.63	12.0 - 16.0	Medium	**V**		
0.63 - 0.94	16.0 - 24.0	Coarse	**E**		
0.94 - 1.26	24.0 - 32.0	Coarse	**L**		
1.26 - 1.9	32.0 - 48.0	Very Coarse	**S**		
1.9 - 2.5	48.0 - 64.0	Very Coarse			
2.5 - 3.8	64.0 - 96.0	Small	**C**		
3.8 - 5.0	96.0 - 128.0	Small	**O**		
5.0 - 7.6	128.0 - 192.0	Large	**B**		
7.6 - 10.0	192.0 - 256.0	Large	**L**		
10.0 - 15.0	256.0 - 384.0	Small	**B**		
15.0 - 20.0	384.0 - 512.0	Small	**L**		
20.0 - 40.0	512.0 - 1024.0	Medium	**D**		
40.0 - 80.0	1024.0 - 2048.0	Large	**R**		
80.0 - 160.0	2048.0 - 4096.0	Very Large	**S**		
> 160.0	> 4096.0		**Bedrock**		

Notes:

Figure A-2. Example field sheet for Wolman pebble count.