



DEPARTMENT OF
ECOLOGY
State of Washington

Standard Operating Procedure EAP123, Version 1.1

Measuring Compass Bearings (Narrow Protocol)

May 2019
Publication 19-03-217
Approved 2017

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/1903217.html>.

Ecology's Activity Tracker Code for this SOP is 18-051.

Recommended citation:

Hartman, C. 2019. Standard Operating Procedure EAP123, Version 1.1: Measuring Compass Bearings (Narrow Protocol). Publication No. 19-03-217. Washington State Department of Ecology, Olympia. <https://fortress.wa.gov/ecy/publications/SummaryPages/1903217.html>. Approved 2017.

Contact Information

For more information contact:

Publications Coordinator
Environmental Assessment Program
P.O. Box 47600, Olympia, WA 98504-7600
Phone: (360) 407-6764

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

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

Any use of product or firm names in this publication is for descriptive purposes only and does not imply endorsement by the author or the Department of Ecology.

To request ADA accommodation for disabilities, or printed materials in a format for the visually impaired, call the Ecology ADA Coordinator at 360-407-6831 or visit <https://ecology.wa.gov/accessibility>. People with impaired hearing may call Washington Relay Service at 711. People with speech disability may call TTY at 877-833-6341.

Watershed Health Monitoring: Standard Operating Procedures for Measuring Compass Bearings
(Narrow Protocol)

Author – Chris Hartman

Date – 03/09/2017

Reviewer – Dan Dugger, George Onwumere, Glenn Merritt and Meghan Rosewood-Thurman

Date – 03/21/2017

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

EAP123

APPROVED – 03/21/2017

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)
3/9/17	1.1	Changed Title, removed drafted dates, added footers, updated glossary terms and references, general edits and formatting	All	Meghan Rosewood-Thurman
3/21/17	1.1	Simplified 2016 SOP EAP070 instead of policy Added spare paper forms New form is cited Simplified Simplified Simplified, merged with 9.2 Added link 2016 version 2017 citation Accessed web page 3/21/2017	4.2 4.6 5.2 5.4 6.1.1 6.3.2 6.3.3 9.1 11.5 11.8 Figure 1 11.9	Glenn Merritt
3/21/17	1.1	Initial approval		Kammin
5/31/19	1.1	Formatting and accessibility updates	All	Ruth Froese

1.0 Purpose and Scope

- 1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for measuring the direction of flow (bearing) between major and minor transects of a stream during a Data Collection Event (DCE) for the Watershed Health Monitoring (WHM) program.
- 1.2 This SOP is limited to field procedures for sites sampled with the *Narrow Protocol*. Methods for office-based measurement of bearings for the *Wide Protocol* are discussed in SOP EAP105 (Hartman, 2017). See SOP EAP106 (Merritt, 2017) to determine which protocol applies.

2.0 Applicability

- 2.1 This SOP is used in conjunction with several others to complete a DCE for the WHM Program Narrow Protocol. This method is applied at each of 20 equal-length segments across the length of a site, and occurring between major and minor transects. Follow the method outlined in this SOP only after the site layout has been completed, see SOP EAP106 (Merritt, 2017).
- 2.2 Data collected with the method outlined in this SOP are used to calculate sinuosity of the stream reach (Janisch, 2013).

3.0 Definitions

- 3.1 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.
- 3.2 EAP: Environmental Assessment Program
- 3.3 Ecology: The Washington State Department of Ecology
- 3.4 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.
- 3.5 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).
- 3.6 Minor transect: One of 10 equidistant transects across the length of a site that is sampled using the Narrow Protocol. Each minor transect is located midway between major transects. Minor transects are A5, B5, C5, D5, E5, F5, G5, H5, I5, and J5.

- 3.7 Narrow protocol: The set of Watershed Health Monitoring SOPs that describe data collection at wadeable sites with an average bankfull width of less than 25 m at the index station.
- 3.8 QAMP: Quality Assurance Monitoring Plan. The QAMP for WHM is Cusimano *et al.* (2006). An updated version is in early stages of development.
- 3.9 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, SOP EAP106 (Merritt, 2017) for the Narrow Protocol. Typically, a site is centered on the index station and is equal in length to 20 times the average of 5 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 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.
- 3.10 Thalweg: Path of a stream that follows the deepest part of the channel (Armantrout, 1998). For WHM, we emphasize Armantrout's use of the word "path," because the thalweg longitudinal profile excludes (sometimes deeper) side pools that are not part of the dominant flow path.
- 3.11 Transect: A straight line along which observations are made or measurements are taken. This line spans the stream channel and is perpendicular to the direction of flow.
- 3.12 WHM: Watershed Health Monitoring, a status and trends monitoring program within the Environmental Assessment Program at the Washington State Department of Ecology.
- 3.13 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.

4.0 Personnel Qualifications/Responsibilities

- 4.1 This SOP pertains to anyone collecting and entering data for the WHM Program.
- 4.2 All field staff must comply with the requirements of the most current EAP Safety Manual (Ecology, 2019).
- 4.3 All field staff must have completed the annual WHM Program field training and be familiar with the set of SOPs that comprise the *Narrow Protocol*.
- 4.4 All field staff must be familiar with the electronic data recording tablet and web-based field forms used to record and submit data for the WHM Program.
- 4.5 The field lead directing sample collection must be knowledgeable about 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 at the site.

4.6 All field staff must comply with Ecology’s SOP EAP070, “Minimizing the Spread of Aquatic Invasive Species,” to the level described in the QAMP (Parsons et al., 2016).

5.0 Equipment, Reagents, and Supplies

5.1 Field tablet, electronic field forms.

5.2 Disinfection solutions, brushes, or other equipment necessary to minimize the spread of invasive species from site to site. See SOP EAP070 (Parsons, et al., 2016) for more information.

5.3 Compass

5.4 Paper forms, pencils (in case of tablet malfunction)

6.0 Summary of Procedure

6.1 Pre-sampling Preparation

6.2 Complete an EAP Field Plan and file it on the EAP SharePoint website under Field Schedules. See the Safety Manual for details (Ecology, 2019).

6.2.1 Establish 11 major transects and 10 minor transects (Table 1) using the site layout procedures (Merritt, 2017).

Table 1. Transects within a site.

Location in Site	Transect	Type
Top of site	K0	Major
0.05 from top	J5	Minor
0.10 from top	J0	Major
0.15 from top	I5	Minor
0.20 from top	I0	Major
0.25 from top	H5	Minor
0.30 from top	H0	Major
0.35 from top	G5	Minor
0.40 from top	G0	Major
0.45 from top	F5	Minor
0.50 from top	F0	Major
0.55 from top	E5	Minor
0.60 from top	E0	Major
0.65 from top	D5	Minor
0.70 from top	D0	Major
0.75 from top	C5	Minor
0.80 from top	C0	Major
0.85 from top	B5	Minor
0.90 from top	B0	Major
0.95 from top	A5	Minor
Bottom of site	A0	Major

- 6.3 General Considerations and Cautions
 - 6.3.1 Never compromise your personal safety or that of field partners to complete a DCE. Always plan ahead to avoid falling and drowning hazards.
 - 6.3.2 Be aware of wildfire activity. It may pose a safety threat or may change or limit access to certain areas.
- 6.4 Measure and Record Compass Bearing
 - 6.4.1 Measure bearing between every major and minor transects. There are 20 measurements needed per DCE.
 - 6.4.1.1 Familiarize yourself with the components of a standard compass shown in Figure 1.
 - 6.4.1.2 Stand in the thalweg at the upstream transect. Point the compass' direction of travel arrow at the downstream transect's thalweg (Figure 2).

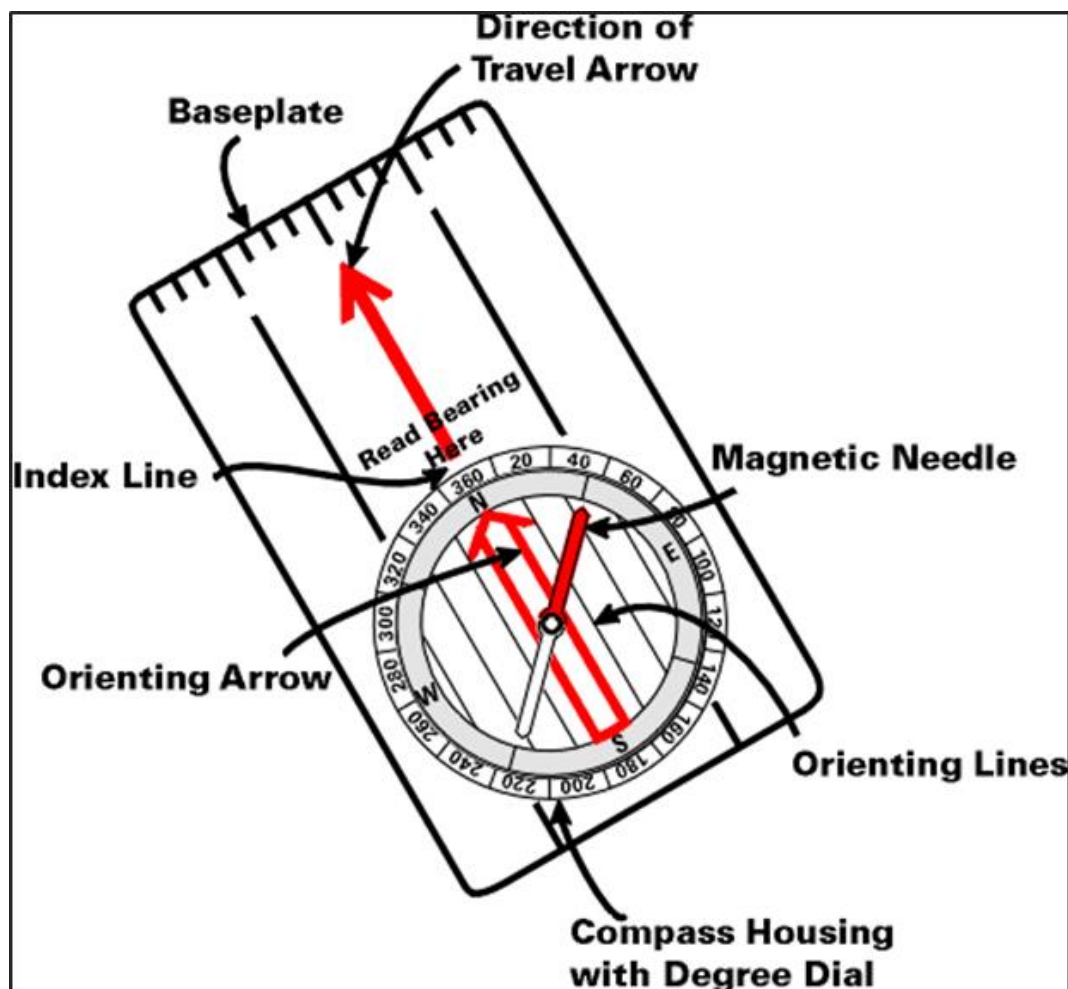


Figure 1. The components of a compass. (From USSARTF 2017).

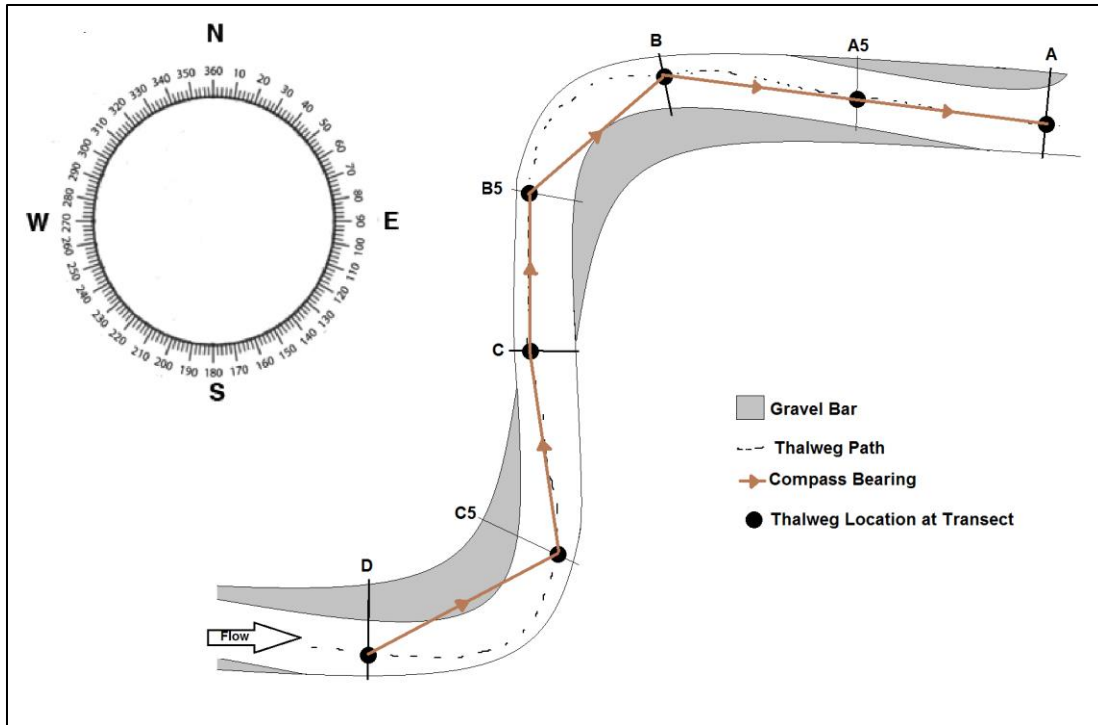


Figure 2. Example compass bearing measurements from major transect D through major transect A.

- 6.4.1.3 Without moving the baseplate, rotate the compass housing until the orienting arrow aligns with magnetic north (magnetic needle/red side of arrow).
- 6.4.1.4 The bearing of record is the bearing value (0–360°) that most closely aligns with the index line
- 6.4.2 On the tablet, record bearings for major transects on the Transect Page, Channel Tab (Figure 3).
- 6.4.3 Record bearings for minor transects on the Thalweg Page, Minor Transect Tab. (Figure 4)

Channel Dimensions							WAM06600-EAST01-DCE-2015-0618-09:59				Save	Navigate
Transect G		Channel	Substrate	Riparian	Fish Cover	Human Influence						
Wetted Width (m)	Bar Width (m)	Bankfull Width (m)	Bearing (deg)									
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>									
Left Bank												
Bankfull Height (cm)	Densimeter	Bank Angle	Bank Location	Bank Cover	Bank Failure							
<input type="text"/>	<input type="text"/>	Angle	Location	Yes	No	Yes	No	Yes	No	Yes	No	
Right Bank												
Bankfull Height (cm)	Densimeter	Bank Angle	Bank Location	Bank Cover	Bank Failure							
<input type="text"/>	<input type="text"/>	Angle	Location	Yes	No	Yes	No	Yes	No	Yes	No	

Figure 3. Major transect bearing field highlighted in red.

Main WAM06600-WEST01-DCE-2015-0713-07:58 Save ⌵ Navigate

Thalweg **G** Thalweg Large Woody Debris Habitat Units Minor Transect

Wetted Width (m) Bar Width (m) Bankfull Width (m) **Bearing (deg)**

Substrate Size Classes

LB	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	RB
Size	Size	Size	Size	Size	Size	Size	Size	Size	Size	Size

Figure 4. Minor transect bearing field highlighted in red.

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

8.1 QA/QC procedures are addressed in the QAMP for this project (Cusimano et al., 2006).

9.0 Safety

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

10.0 References

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

10.2 Cusimano, R., G. Merritt, R. Plotnikoff, C. Wiseman, C. Smith, and WDFW. 2006. Status and Trends Monitoring for Watershed Health and Salmon Recovery: Quality Assurance Monitoring Plan.
<https://fortress.wa.gov/ecy/publications/SummaryPages/0603203.html>

10.3 Ecology, 2019. Environmental Assessment Program Safety Manual. Washington State Department of Ecology. Olympia.

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

10.5 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, Olympia.
<https://fortress.wa.gov/ecy/publications/SummaryPages/1303033.html>

10.6 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, Olympia.
<http://www.ecology.wa.gov/programs/eap/quality.html>

- 10.7 Merritt, G. 2017. Watershed Health Monitoring: Standard Operating Procedures for Verification and Layout of Sites (Narrow Protocol) SOP EAP106. Washington State Department of Ecology, Olympia.
<http://www.ecology.wa.gov/programs/eap/quality.html>
- 10.8 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 Version 2.1 <http://www.ecology.wa.gov/programs/eap/quality.html>
- 10.9 USSARTF. 2017. United State Search and Rescue Task Force: Compass Basics. Internet Page [accessed March 21, 2017]. http://www.ussartf.org/compass_basics.htm