



Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks

Data Quality Standards

Natural Resource Report NPS/SECN/NRR—2018/1695



ON THE COVER

Upstream facing picture of a large woody debris step and floodplain (in the background) on Long Island Creek (CHAT 013) at Chattahoochee National Recreation Area. Photograph courtesy of Southeast Coast Network.

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August 2018

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

Starkey, E. N., and J. M. McDonald. 2018. Monitoring wadeable stream habitat conditions in Southeast Coast Network parks: Data quality standards. Natural Resource Report NPS/SECN/NRR—2018/1695. National Park Service, Fort Collins, Colorado.

Contents

	Page
Tables.....	iii
Executive Summary	iv
Introduction.....	1
Protocol Overview.....	1
Protocol Activities and Modules	2
Sampling Design.....	5
Data Quality Objectives.....	7
Literature Cited	13

Tables

	Page
Table 1. Project activity matrix for <i>Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative</i> (McDonald et al. 2018).	3
Table 2. Activity-level sample design matrix for <i>Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative</i> (McDonald et al. 2018)	5
Table 3. Data quality values (DQVs) for <i>Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative</i> (McDonald et al. 2018).	8
Table 4. Measurement quality objectives for Data quality values (DQVs) for <i>Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative</i> (McDonald et al. 2018).....	10
Table 5. Data Protection standards for <i>Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative</i> (McDonald et al. 2018)	12

Executive Summary

The purpose of this report is to document the standards used by the Southeast Coast Network (SECN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in the *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018). This plan also serves as a guide for all Southeast Coast Network personnel who are involved in protocol or program activities and serves as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Introduction

The purpose of this report is to document the standards used by the Southeast Coast Network (SECN) for activities related to the collection, processing, storage, analysis, and publication of monitoring data as described in the *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018). The policies and procedures documented in this quality-assurance plan (QAP) for activities outlined in the above protocol complement the QAPs of other monitoring activities conducted by the Southeast Coast Network and supplement National Inventory & Monitoring Division Quality Management Plans. This plan also serves as a guide for all SECN personnel who are involved in protocol and program activities and serves as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

Protocol Overview

The Southeast Coast Network has initiated a monitoring effort to assess in-channel and riparian habitat conditions in wadeable streams at parks, battlefields, and monuments in Alabama, Georgia, and South Carolina. These parks include Chattahoochee River National Recreation Area (CHAT, Chattahoochee River NRA), Kennesaw Mountain National Battlefield Park (KEMO, Kennesaw Mountain NBP), Congaree National Park (CONG, Congaree NP), Horseshoe Bend National Military Park (HOBE, Horseshoe Bend NMP), and Ocmulgee National Monument (OCMU, Ocmulgee NM).

This monitoring focuses specifically on providing relevant data needed to assess the physical condition of Piedmont and Upper Coastal Plain streams (with respect to aquatic and riparian habitats) and how these conditions may be changing over time. The habitat assessment methods proposed in the *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018) rely on standard data collection methods and standard operating procedures (SOPs) currently in use by the U.S. Geological Survey (USGS; Fitzpatrick et al. 1998), U.S. Environmental Protection Agency (EPA 2013), and U.S. Forest Service (USFS; Harrelson et al. 1994) and have been modified to better meet the needs of NPS managers.

The Southeast Coast Network (SECN) developed the stream habitat monitoring protocol to provide data that will give park resource managers insight into the status of, and trends in, wadeable stream and riparian habitat conditions. For the purposes of this report, wadeable streams are narrowly defined as small- to medium-sized, perennially-flowing waterbodies with easily identifiable channel banks that can be accessed and traversed without the use of a watercraft. The wadeable streams referred to herein do not include some non-perennial channel-like features found on large river flood plains and as part of ephemeral hillslope drainages.

The number of sites surveyed at each park is dependent on the spatial extent of the park and the total number of wadeable stream reaches that are present within park boundaries. Regardless of the size of the park and the number of sites that are to be monitored, sites: (1) are representative of the processes influencing the streams in each park; (2) can address current and anticipated management concerns, and (3) offer the most utility for future complementary studies.

The objectives of this protocol are to:

- Determine status of upstream watershed characteristics such as basin area, basin slope, and drainage density, and changes to land cover that may affect stream habitat;
- Determine the status of and trends in the geomorphic dimensions (cross-sectional morphology) of selected wadeable stream reaches including channel widths, bank characteristics (e.g., heights, angles, and vegetative cover), and reach slope and sinuosity; and
- Determine the status of and trends in physical measures of benthic and riparian habitat features present in selected wadeable stream reaches such as the size, type, and distribution of bed sediment and large woody debris, the distribution of geomorphic channel units, and canopy cover.

In addition to these monitoring objectives, the data collected under this protocol allow the network to summarize the wadeable stream resources within SECN parks, highlighting similarities and differences in these resources as they relate to general stream habitat and geomorphic conditions. This protocol also makes a strong case for the relevance of monitoring wadeable stream habitats by highlighting known issues related to stream habitats in SECN parks; identifying the important linkages between the physical condition of streams and park resources. Most importantly, this protocol provides early warnings of changing conditions and helps to inform managers of fluctuations in stream channel habitat.

Data collected as part of this effort are stored locally on the SECN internal file server and uploaded annually to the Integrated Resource Management Applications (IRMA) website. In addition to utilizing customized data handling and reporting procedures, this protocol and its accompanying standard operating procedures set guidelines for data to be made available both internally and externally via publication of data reports and briefing statements.

Protocol Activities and Modules

Data are collected or derived as a part of the protocol for *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018) in 11 different activities or modules (Table 1).

Table 1. Project activity matrix for *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018).

Activity Type	Activity Number	Activity	Description
Site Recon, Establishment, and Maintenance	1	Site Recon and Selection	Site selection is a five-step process. (1) Identification of potential stream segments in GIS, (2) Consultation with park staff, (3) Field evaluation of potentially suitable segment(s), (4) Preliminary Basin-scale assessment in GIS, and (5) Final reach (site) selection.
	2	Establishment	Installation of primary and secondary benchmarks and initial evaluation of standard and detailed transects.
	3	Maintenance	During each subsequent revisit, primary and secondary benchmarks are re-surveyed or re-located.
Field Observations	4	Reach scale measures	Geomorphic Dimensions: Longitudinal profile (channel slope), reach sinuosity, bearing sinuosity, thalweg sinuosity Habitat: Large woody debris amount, volume, position and function, bed material (pebble count), distribution of geomorphic channel units
	5	Standard transect measures	Geomorphic Dimensions: Wetted width, active channel width, bankfull width, channel full width, floodplain width, thalweg position, thalweg depth, in-channel features, bankfull height, channel full height, bank undercut depth, bank undercut height, bank angle, bank sediment, bank erosion (presence and type), bank stability index Habitat: Canopy closure, dominant particle size, dominant habitat, vegetative cover, ground cover
	6	Detailed transect measures	Geomorphic Dimensions: Bankfull area, bankfull perimeter, bankfull hydraulic radius, bankfull width, bankfull depth, bankfull width to depth ratio, channel-full area, channel-full perimeter, channel-full hydraulic radius, channel-full width, channel-full depth, channel-full width to depth ratio
External Data	7	National Elevation Dataset	Used in the calculation of the geomorphic descriptors.
	8	National Land Cover Database (NLCD) datasets	Used in the calculation of land use and land cover characteristics.

Table 1 (continued). Project activity matrix for Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative (McDonald et al. 2018).

Activity Type	Activity Number	Activity	Description
Derived Data	9	Summary metrics	Descriptive statistics for measures outlined in activities 4-6, cross sectional areas, entrenchment ratios, and bank stability index.
	10	GIS Analysis: Basin- and Segment-Scale Characteristics	Geomorphic descriptors: Each study reach's watershed is delineated and characterized. The following geomorphic measures are calculated: drainage area, total perennial stream length, drainage density, basin shape, basin relief, basin relief ratio, slope, stream order, entire stream gradient, and bifurcation ratio. Land use and land cover characteristics: The land use and land cover characteristics of each site's watershed are derived for each year that is available from the National Land Cover Data Base.
Quality control data	11	Pre-field season data collection	Training site data provides double-observations and allow for evaluation of repeatability and variability of measures listed in activities above. Data collection at a test site also serves as an equipment check prior to fieldwork.

Sampling Design

Information regarding the sampling design is provided in Table 2.

Table 2. Activity-level sample design matrix for *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018). Numbers (second column) match those in the protocol activity matrix (Table 1).

Activity Type	Activity Number	Activity	Sampling Design	Revisit Design
Field Observations	4	Reach scale measures	Stream reaches selected based on professional judgment to be representative of park wadeable streams. Sample sizes: CHAT(14) CONG (4) HOBE (1) KEMO (2) OCMU (1)	Revisit every 3 years
	5	Standard transect measures	Stream reaches selected based on professional judgment to be representative of park wadeable streams. Eleven transects per stream reach are systematically selected for measurement. Sample sizes: CHAT(154) CONG (44) HOBE (11) KEMO (22) OCMU (11)	Revisit every 3 years
	6	Detailed transect measures	Stream reaches selected based on professional judgment to be representative of park wadeable streams. Three transects per stream reach are systematically selected for measurement. Sample sizes: CHAT(42) CONG (12) HOBE (3) KEMO (6) OCMU (3)	Revisit every 3 years

Data Quality Objectives

Data quality values and standards for implementation are provided in Table 3 and Table 4.

Table 3. Data quality values (DQVs) for *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018).

Data Quality Category	Data Quality Value	Definition	Protocol Considerations
Intrinsic Data Quality	Accuracy	Measurements reflect the true value of the parameter being observed. This applies to measures (length, width, position) or classes (species, types, or categories). Includes components of precision and bias.	Plans for protocols, programs, or projects specify accuracy requirements designed to ensure desired results, taking into account estimated or expected precision and bias. May be of heightened importance for protocols where data are known or expected to be used in legal, regulatory, or policy situations. Accuracy varies depending upon the specific reach or transect scale measure; Table 4 provides additional detail regarding accuracy. The accuracy of these data allow changes and differences to be measured and quantified through time and between sites. The expected repeatability of these measurements is within 5–10% of the measurement depending on the parameter
	Representativeness	Measurements represent conditions at the time of sampling. Combined with accuracy, leads to repeatable data collection.	Parameters and methods are chosen such that they measure representative conditions. Measurements may be direct measures, indexes, or indicators of conditions. At every sample reach, measures of stream morphology and riparian habitat are collected at 11 standard transects; three of these are also detailed transects. These data provide a representative understanding of reach-scale conditions at each site.
Contextual Data Quality	Comparability	The degree to which data can be compared among sample locations, data sources, or periods of time.	For IMD it is assumed for most protocols that data must be comparable over time in order to conduct trend analyses. If the intent for data analysis is to combine IMD data with other data sets (other networks, other agencies), there may be some considerations necessary in terms of training, equipment, standards, sampling design, index period, etc.). As long as training guidelines, equipment maintenance, and suggested sample windows are maintained as outlined in the protocol, uncertainties in the dataset will be minimized, and differences in space and time will be identifiable and measurable through spatial and trend analyses.
	Timeliness / Currency	How recent the data need to be to be considered valid for their intended use. Data represents conditions and/or is available and in a format for use at the appropriate time in the decision-making process.	Data processing occurs in a timely fashion based on certification requirements and intended use of data. Where certified data cannot be provided for resource management decisions in a timely manner, requirements for provisional use of data are defined and documented prior to data dissemination and use.

Table 3 (continued). Data quality values (DQVs) for Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative (McDonald et al. 2018).

Data Quality Category	Data Quality Value	Definition	Protocol Considerations
Contextual Data Quality (continued)	Completeness	All data/ measures required to evaluate accuracy representativeness are present; incomplete data sets (either at a location, across sampling locations, or over time) lose utility or relevance. Data records contain values as planned across the period of record.	Methods, sampling plans, and analyses are designed and implemented such that they result in a complete dataset across space and the planned period of record. Note that this value is for a collection of data records; how many measures are deemed valid and suitable for use at the completion of all QA/QC procedures. Also of potential importance for panel or GRTS-type designs where missing data can affect analysis and inference. Data sheets are checked prior to leaving each site to insure that all data were collected and recordings are legible. If, upon returning to the office, the data are found to be less than 100 percent complete, data that are missing are noted and these metrics/characteristics will not be included in subsequent analyses.
Representational Data Quality	Consistent Representation	Use of standard definitions when describing data quality or resource quality based on data	This is particularly relevant when reporting data in comparison to management, ecological, or regulatory thresholds. Networks should consider establishing a consistent framework so that conditions are reported the same way over time and across parks where protocols are implemented (i.e., for condition assessments a rating of “good” always means the same thing). All diagnostic geomorphic surfaces and points surveyed along each detailed transect are labeled using a standardized data dictionary. All categorical measures (e.g., type of bank and bed material, type of geomorphic channel unit, type of step, and function of large woody debris) are labeled using a pre-determined set of descriptors. Additionally, the bank stability index scores attributed to each transect/reach use the same scale (stable, at-risk, unstable, and very unstable).
Data Accessibility	Secure	Access to data, products, and systems limited to appropriate audiences.	Networks must identify and ensure that potentially protected data, including sensitive species location data, sensitive cultural resource information, and other data as protected by DO #66 are not released to the public. Protected data may be released in limited cases only with park Superintendent approval following park procedures. It is not anticipated that any sensitive or protected data will be collected during the implementation of this protocol.

Table 4. Measurement quality objectives for Data quality values (DQVs) for *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018). Activities match those in the protocol activity matrix (Table 1).

Activity	Measure/Quality Indicator	Quality Objective
Site Recon and Selection	Location Accuracy	Navigate to within 50 meters of proposed reach coordinates.
Establishment	Location Accuracy	Benchmarked locations are located within 0.01 meter of total station established coordinates (x, y, z).
Maintenance	Location Accuracy	Benchmarked locations are located within 0.01 meter of total station established coordinates (x, y, z).
Reach scale measures	Accuracy	Geomorphic Dimensions: ± 0.0005 m/m for longitudinal profile (channel slope) (total station point accuracy ± <0.01m) ± 5o for reach sinuosity ± 5o/m for bearing sinuosity ± 10% of mean for thalweg sinuosity Habitat: ± 2% of mean for large woody debris (LWD) amount ± 2% of mean for LWD volume ± 2% of mean for bed material (pebble count) ± 10% of the mean for distribution of geomorphic channel units, ± 10 % of the mean for reach average for canopy cover Categorical measures- LWD position, LWD function
	Resolution	Geomorphic Dimensions: Longitudinal profile (channel slope) measured to the nearest 0.0001 m/m Reach sinuosity to the nearest degree Bearing sinuosity to the nearest degree Thalweg sinuosity to the nearest degree Habitat: Large woody debris (LWD) amount is a total count LWD volume to the nearest 0.01 m³ Bed material (pebble count) measured to the nearest 1 mm Distribution of geomorphic channel units to the nearest 5% Reach average canopy cover to the nearest 5% Categorical measures- LWD position, LWD function

Table 4 (continued). Measurement quality objectives for Data quality values (DQVs) for *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018). Activities match those in the protocol activity matrix (Table 1).

Activity	Measure/Quality Indicator	Quality Objective
Standard transect measures	Accuracy	Geomorphic Dimensions: ± 5% of stadia rod measurements less than 1.5m or ± 10% of stadia rod measurements greater than 1.5m for wetted width, active channel width, bankfull width, channel full width, floodplain width, bankfull height, channel full height, bank undercut depth, bank undercut height, thalweg depth ± 10% for thalweg position ± 10o for bank angles Binary – in-channel features and undercut presence Categorical measures- bank undercut presence, bank sediment, bank erosion (presence and type) Habitat: ± 5% per transect for transect average for canopy cover ± 1 Wentworth size class for bed and bank sediment ± 10% for vegetative and total ground cover Categorical measure – geomorphic channel units (dominant habitat)
	Resolution	Geomorphic Dimensions: Wetted width, active channel width, bankfull width, channel full width, floodplain width, bankfull height, channel full height, bank undercut depth, bank undercut height, and thalweg depth are measured to the nearest 0.01 m Thalweg position is estimated to the nearest 5% Bank angles is measured to the nearest 0.1 o Binary – in-channel features and undercut presence Categorical measures- bank undercut presence, bank sediment, bank erosion (presence and type) Habitat: Canopy cover is to the nearest 1% Bed and bank sediment are to the nearest Wentworth size class Vegetative and total ground cover are to the nearest 5% Categorical measure – geomorphic channel units (dominant habitat)
Detailed transect measures	Accuracy	Geomorphic Dimensions: ± 0.1m for diagnostic point coordinates (total station point accuracy ± <0.01m) used to calculate: bankfull area, bankfull perimeter, bankfull hydraulic radius, bankfull width, bankfull depth, bankfull width to depth ratio, channel-full area, channel-full perimeter, channel-full hydraulic radius, channel-full width, channel-full depth, and channel-full width to depth ratio

Table 4 (continued). Measurement quality objectives for Data quality values (DQVs) for *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018). Activities match those in the protocol activity matrix (Table 1).

Activity	Measure/Quality Indicator	Quality Objective
Detailed transect measures (continued)	Resolution	Geomorphic Dimensions: Coordinates used to calculate bankfull area, bankfull perimeter, bankfull hydraulic radius, bankfull width, bankfull depth, bankfull width to depth ratio, channel-full area, channel-full perimeter, channel-full hydraulic radius, channel-full width, channel-full depth, and channel-full width to depth ratio are measured to the nearest 1.0 mm

Table 5. Data Protection standards for *Monitoring Wadeable Stream Habitat Conditions in Southeast Coast Network Parks: Protocol Narrative* (McDonald et al. 2018). With the exceptions noted, all data collected are made publicly available in a timely fashion.

Type of Data	Data	Level of Protection	Rules for Dissemination
Location Data and Information	Permanent Sampling Locations	Operationally protected	Provided upon request only. Shown in reports.
Personally Identifiable Information	Non-NPS Staff Information	Legally Protected	All but first name and last initial redacted from public release.

Literature Cited

- Fitzpatrick, F. A., I. R. Waite, P. J. D'Arconte, M. R. Meador, M. A. Maupin, and M. E. Gurtz. 1998. Revised methods for characterizing stream habitat in the National Water Quality Assessment Program: U.S. Geological Survey water resources investigations report 98-4052. Available at: <http://water.usgs.gov/nawqa/protocols/WRI98-4052/index.html> (last accessed December 2016).
- Harrelson, C. C., C. L. Rawlins, and J. P. Potyondy. 1994. U. S. Forest Service's (USFS) stream channel reference site: an illustrated guide to field techniques. U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.
- McDonald, J. M., M. B. Gregory, J. W. Riley, and E. N. Starkey. 2018. Monitoring wadeable stream habitat conditions in Southeast Coast Network parks: Protocol narrative. Natural Resource Report NPS/SECN/NRR—2018/1715 National Park Service, Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2254874> (last accessed September 2018).
- U.S. EPA. 2013. National Rivers and Streams Assessment 2013-2014: Field operations manual – wadeable. EPA841-B-12-009b. U.S. Environmental Protection Agency, Office of Water, Washington, D. C.

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NPS 910/147661, August 2018

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