



Summary of Indian River Streamflow Data Collected by the Southeast Alaska Network

Sitka National Historical Park, 2007-2016

Natural Resource Report NPS/SEAN/NRR—2017/1399





ON THIS PAGE

Indian River streamflow monitoring site at a stage of 25.71 feet.

Image credit: STEVE PAUSTIAN

ON THE COVER

Indian River streamflow monitoring site at a stage of 20.50 feet.

Image credit: STEVE PAUSTIAN

Summary of Indian River Streamflow Data Collected by the Southeast Alaska Network

Sitka National Historical Park, 2007-2016

Natural Resource Report NPS/SEAN/NRR—2017/1399

Christopher J. Sergeant¹, Terence C. Schwarz²

¹National Park Service
Southeast Alaska Network, Inventory and Monitoring Program
3100 National Park Road
Juneau, AK 99801

²Alaska Department of Natural Resources, Division of Mining, Land, and Water
400 Willoughby Avenue, Suite 400
Juneau, AK 99801

March 2017

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

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data, and whose background and expertise put them on par technically and scientifically with the authors of the information.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from the [Southeast Alaska Network website](#) and the [Natural Resource Publications Management website](#). To receive this report in a format that is optimized to be accessible using screen readers for the visually or cognitively impaired, please email irma@nps.gov.

Please cite this publication as:

Sergeant, C. J., and T. C. Schwarz. 2017. Summary of Indian River streamflow data collected by the Southeast Alaska Network: Sitka National Historical Park, 2007-2016. Natural Resource Report NPS/SEAN/NRR—2017/1399. National Park Service, Fort Collins, Colorado.

Contents

	Page
Figure	iv
Table	iv
Abstract.....	v
Acknowledgments.....	vi
List of Acronyms	vi
Introduction.....	1
Methods.....	2
Gage location description and directions	2
Stage and discharge recording equipment	2
Results.....	4
Available data products	4
Stage-discharge relationships (rating curves).....	4
Literature Cited	6

Figure

Page

Figure 1. Visualization of rating curves used in the Indian River for streamflow monitoring periods between 2007 to 2016.....	5
--	---

Table

Page

Table 1. Complete list of data products and methods descriptions related to Indian River streamflow data collected from 2007-2016.	4
--	---

Abstract

From 7 September 2007 through 1 April 2016, the Southeast Alaska Inventory and Monitoring Network (SEAN), in collaboration with the City and Borough of Sitka (CBS), Alaska Department of Fish and Game (ADFG), Alaska Department of Natural Resources (ADNR), and National Weather Service (NWS), collected stage and water temperature data in the Indian River at river mile 0.6 (referred to in some previous documentation as the “lower” gage site).

Beginning April 2016, SEAN partnered with the City and Borough of Sitka and the U.S. Geological Survey (USGS) to fund a USGS-led streamgaging operation at this site (USGS 15087700 INDIAN RIVER AT SITKA AK). These current and historical data are available at:

http://waterdata.usgs.gov/ak/nwis/uv?site_no=15087700

This report describes all available data and supporting documentation preceding the current monitoring effort by USGS. These products are stored within the National Park Service Data Store and publically available for download. While no long-term monitoring protocol was created, the stage and water temperature data collected during the 2007-2016 period can inform many future research questions related to topics such as thermal regime variability, riverine habitat quality, flood timing and frequency, and correlations between water quality variability and river stage.

Acknowledgments

Many people contributed to data collection and analysis, and we apologize if anyone was forgotten here. NPS staff include P. Burger, B. Carter, T. Jones , T. Kucerovy, R. Sablan, and C. Smith. External partners A. Jacobs (NWS), C. Johnson (NWS), S. Paustian (Sitka Hydro Science), and J. Sowa (ADFG) contributed their expertise to data downloading and telemetry, discharge measurements, and rating curve development. The City and Borough of Sitka has graciously contributed funds over many years to support site operation. M. Bower and R. Host reviewed this manuscript and provided helpful comments.

List of Acronyms

ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
CBS	City and Borough of Sitka
NPS	National Park Service
NWS	National Weather Service
SEAN	Southeast Alaska Inventory and Monitoring Network
USGS	United States Geological Survey

Introduction

Since 2007, the Southeast Alaska Inventory and Monitoring Network (SEAN) coordinated several efforts with the intent of creating a long-term streamflow monitoring program for the Indian River, which flows through Sitka National Historical Park. Due to staff capacity limitations, variable funding, and the logistical challenges associated with maintaining accurate stage-discharge relationships, this program never reached full maturity.

Beginning April 2016, the SEAN partnered with the City and Borough of Sitka and the U.S. Geological Survey (USGS) to cooperatively fund a USGS-led streamgaging operation at this site that is formally hosted as “USGS 15087700 INDIAN RIVER AT SITKA AK” and available at:

http://waterdata.usgs.gov/ak/nwis/uv?site_no=15087700

This report describes all available data and locations for downloading supporting documentation produced from 2007-2016. While no long-term monitoring protocol was created, the information collected during this period can inform many future research questions related to topics such as thermal regime variability, riverine habitat quality, flood timing and frequency, and correlations between water quality variability and river stage.

Methods

From 7 September 2007 through 30 September 2012, continuous river stage data were collected at 15-minute intervals by NPS staff and analyzed by a third-party contractor (Water Walkers Streamflow Monitoring, Parker, Colorado). During this period, surveyors collected 20 manual discharge measurements ranging from 10.5-124.0 ft³/s. From 1 October 2007 through 30 September 2010, discharge measurements and analysis were sufficient to create a robust stage-discharge relationship (rating curve).

From 1 October 2013 through 1 April 2016, data continued to be collected by NPS staff, to maintain the current rating curve. During this period, surveyors collected 19 manual discharge measurements ranging from 5.1 to 125.6 ft³/s. On 19 November 2014, 15-minute stage intervals were adjusted to hourly for the remainder of the data collection effort due to the solar power needs of real-time gage telemetry and sparse sunlight at the site. From 17 December 2013 through 6 September 2014, discharge measurements were sufficient to create a robust rating curve. Outside of this period, only stage, water temperature, and occasional discharge measurements are available. On 21 November 2013, a flood event reaching a stage height of 26.21 ft, one of the highest levels recorded during the entire monitoring period, was believed to have significantly shifted the site control and necessitated development of a new rating curve (see “Stage-discharge relationships (rating curves)” section below).

Gage location description and directions

Latitude 57° 03' 12" Longitude 135° 18' 52" in NE ¼, SW ¼, SE ¼, sec, 36 (Sitka A-4 quad), Hydrologic Unit 19010203, in Greater Sitka Borough, on Baranof Island, in Tongass National Forest, on right bank 500 ft upstream from Sawmill Creek Road, 600 ft downstream from Sitka Sound Science Center Diversion, and 0.6 mi above the mouth; Drainage area 12.0 mi².

From the town of Sitka, Alaska, proceed southerly along Sawmill Creek Road to the bridge over the Indian River. Park nearby and proceed up the right bank on foot about 500 ft to gage location. It may be easiest to hike or walk upstream along the diversion pipeline (also above right bank) 500 ft and then drop down onto the creek bank when gaging station and telemetry equipment are in view.

Stage and discharge recording equipment

Stage and water temperature were recorded using either a Druck 1830 or In-Situ Level TROLL 500 vented pressure transducer housed within a small metal shelter mounted to the top of a bedrock-bolted steel pipe. Both transducers have an accuracy of 0.1% or less of full scale pressure. During the entire reporting period, river stage measurements were checked and corrected using either tape-down measurements from two reference bolts in bedrock at the gage site or visual level checks from a permanently mounted staff gage plate (installed 12 June 2014 after surveying levels to ensure pressure transducer orifice and reference markers did not move). Velocity measurements were collected using a SonTek FlowTracker handheld Acoustic Doppler Velocimeter at the control reach approximately 70 ft downstream of the gage location. Velocity measurements were generally recorded at stations denoted every 1-1.5 ft across the wetted width of the stream channel. To measure total discharge (ft³/s) across the wetted stream channel, station discharge (station velocity [ft/s] *

station area [ft^2/s]) was summed across all stations (see more instruments operational details in SonTek 2016). Velocity was measured at 6/10 of total depth at stations less than 2.5 ft, and at 2/10 and 8/10 of total depth at stations greater than 2.5 ft (Rantz et al. 1982).

Results

Available data products

Indian River streamflow statistics for Water Years 2008-2010 were analyzed by B. Bigelow (Water Walkers Streamflow Monitoring) and summarized along with detailed methods in Sergeant and Smith (2012).

Beyond these water years, data were collected by NPS staff and S. Paustian (Sitka Hydro Science, LLC) and reported as part of the data products summarized below (Table 1).

Table 1. Complete list of data products and methods descriptions related to Indian River streamflow data collected from 2007-2016. Interested parties downloading these products will have the complete set of documents held by SEAN at the time of this report.

Product	Description
1.IndianRiver_Stage&Discharge_2007-2016.xls https://irma.nps.gov/DataStore/Reference/Profile/2238996	All available river stage, water temperature, and discharge measurements collected by NPS and NPS contractors from 7 September 2007 to 1 April 2016
2. IndianRiver_SupportingInformation.zip https://irma.nps.gov/DataStore/Reference/Profile/2238997	Folder containing all supporting information for the master data spreadsheet
2a. RatingCurves.xls	The two rating curves used for stage-discharge relationships
2b. SonTekOutputs_WY2012-2015	Detailed discharge files created by SonTek FlowTracker Acoustic Doppler Velocimeter for water years 2012-2015
2c. UnmodifiedWaterWalkerFiles_WY2012-2015	All data analysis and methods descriptions provided by Water Walkers Streamflow Monitoring for water years 2010-2012

Stage-discharge relationships (rating curves)

Two rating curves were applied to a sub-set of stage measurements (Figure 1):

- 1) WW3.0: This rating curve was developed by Water Walkers Streamflow Monitoring and applied to stage data from 1 October 2007 through 30 September 2010. Based on existing notes from this time period, it is not apparent which discharge measurements originally created this rating curve, but across the entire time period when this curve was applied, manual discharge measurements were within 0.3-26.6% of discharges predicted by the rating curve. No high flow discharge measurements were made during this period, so high discharge predictions (approximately those greater than 300 ft³/s) are likely to be inaccurate

and should be interpreted with caution. Daily mean discharges greater than 300 ft³/s are considered poor (>8% error).

- 2) 2014.1: This rating curve was developed by NPS in collaboration with hydrologists at ADNR and ADFG and applied to stage data from 17 December 2013 to 6 September 2014. The curve was developed using seven manual discharge measurements collected between 17 December 2013 and 9 July 2014 and ranging from 5.1-125.6 ft³/s. Across the entire time period that this curve was applied, manually measured discharges were within 1.7-16.1% of discharges predicted by this rating curve. No high flow discharge measurements were made during this period, so high discharge predictions (approximately those greater than 300 ft³/s) are likely to be inaccurate and should be interpreted with caution. Daily mean discharges greater than 300 ft³/s are considered poor (>8% error).

For all other time periods outside those listed in the rating curve descriptions above, insufficient manual discharge measurements for a shifting control did not allow for the estimation of a robust rating curve and therefore no discharge was estimated.

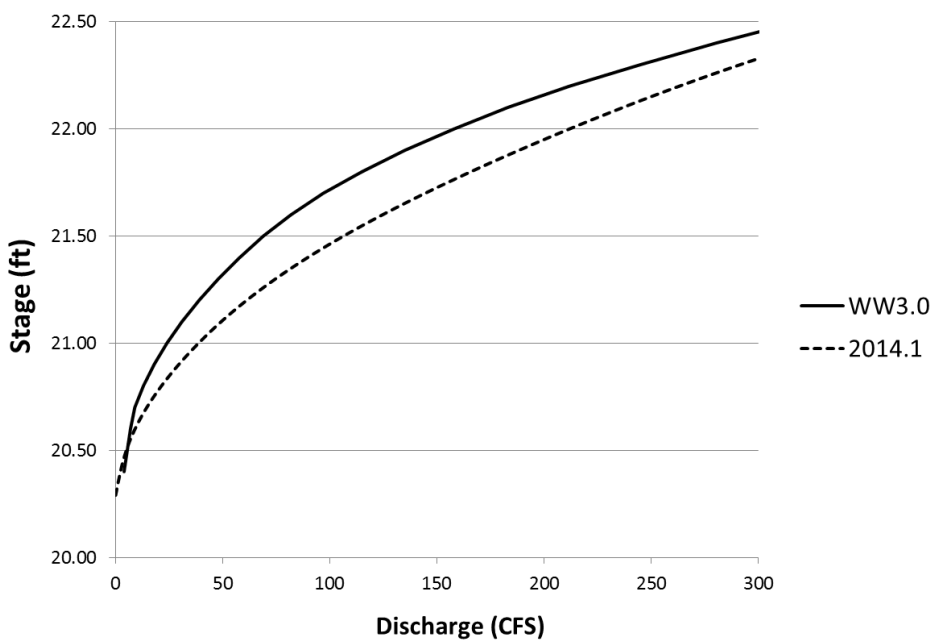


Figure 1. Visualization of rating curves used in the Indian River for streamflow monitoring periods between 2007 to 2016. See descriptions above and Table 1 for supporting data.

Literature Cited

- Rantz, S.E., et al. 1982. Measurement and computation of streamflow. Volume 1: Measurement of stage and discharge. Volume 2: Computation of discharge. U.S. Geological Survey Water Supply Paper 2175. <http://pubs.usgs.gov/wsp/wsp2175>.
- Sergeant, C. J., C. S. Smith. 2012. Southeast Alaska Network streamflow monitoring program: Indian River streamflow statistics for water years 2008-2010, Sitka National Historical Park. Natural Resource Data Series NPS/SEAN/NRDS—2012/269. National Park Service, Fort Collins, Colorado. Available in the NPS Data Store at: <https://irma.nps.gov/DataStore/Reference/Profile/2184364>
- Sontek. 2016. FlowTracker2 User's Manual 1.1.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 314/136648, March 2017

National Park Service
U.S. Department of the Interior



Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

EXPERIENCE YOUR AMERICA TM