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The State of New Hampshire
Department of Environmental Services



Robert R. Scott, Commissioner

April 17, 2018

His Excellency, Governor Christopher T. Sununu
and the Honorable Council
State House
Concord NH 03301

REQUESTED ACTION

Authorize the Department of Environmental Services (DES) to enter into a **SOLE SOURCE** agreement with the U.S. Geological Survey (USGS), Pembroke, NH, (VC # 175772-R001), in the amount of \$29,500 for testing an alternative stream gaging method. Effective as of June 6, 2018 through February 28, 2019, upon Governor & Council approval. 100% General Funds.

Funding is available in the following account:

	<u>FY 2018</u>
03-44-44-442010-1518-102-50731	\$ 29,500
Department of Environmental Services, Lakes-Rivers Management, Contracts for Program Services	

EXPLANATION

Under the Joint Funding Agreement, USGS will test one component of an alternative, low-cost stream gaging method. The agreement is **SOLE SOURCE** because USGS is the national leader in instream flow knowledge and practice and will provide 40% of the cost of the project. The test will show whether daily stream flows can be calculated for a location using flows measured at a nearby USGS gage. An equation would be used to calculate daily stream flow data in real-time at currently ungaged locations. USGS would develop equations at six test locations. Former gage locations will be used as surrogates for ungaged locations. The calculated results of the equations will be compared to measured flows at the former gages as a measure of the accuracy of the calculated values.

The DES Instream Flow Program uses daily stream flow data collected at USGS gaging stations to evaluate protected instream flow conditions for applying management. High-quality and reliable results are important to ensure actions are undertaken only when required. NHDES needs sustained measurements of stream flows at more locations than are currently available. These equations would allow NHDES to use existing USGS gages to generate daily flows at currently ungaged locations and post the data in real time to the NHDES website for public use. See Attachment A for more information.

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Under this agreement the USGS will provide \$19,500 (40%) in funds towards the total cost of \$49,000 to create an equation to estimate ungagged stream flow at six locations, with the balance of \$29,500 being provided by the State. The agreement has been approved by the Office of the Attorney General as to form, execution, and content.

We respectfully request your approval.

A handwritten signature in black ink, appearing to read "Robert R. Scott", written over a horizontal line.

Robert R. Scott, Commissioner

**Form 9-1366
(April 2015)**

**U.S. Department of the Interior
U.S. Geological Survey
Joint Funding Agreement
FOR
Water Resource Investigations**

**Agreement#: 18ENNH000000004
Customer#: 6000000093
Project #: LG40FDZ
TIN #: 02-6000618
USGS DUNS #: 025291357**

Fixed Cost Agreement YES[X] NO[]

THIS AGREEMENT is entered into as of the June 6, 2018, by the U.S. GEOLOGICAL SURVEY, New England Water Science Center, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the New Hampshire Department of Environmental Services party of the second part.

1. The parties hereto agree that subject to the availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation Water Resource Investigations (per attachment), herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50, and 43 USC 50b.

2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. 2(b) include In-Kind-Services in the amount of \$0.00

- (a) \$19,500 by the party of the first part during the period
June 6, 2018 to February 28, 2019
- (b) \$29,500 by the party of the second part during the period
June 6, 2018 to February 28, 2019
- (c) Contributions are provided by the party of the first part through other USGS regional or national programs, in the amount of :

Description of the USGS regional/national program:

- (d) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties
- (e) The performance period may be changed by mutual agreement and set forth in an exchange of letters between the parties.

3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.

4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.

5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.

6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party may terminate this agreement upon 60 days written notice to the other party.

7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

8. The maps, records or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request; be furnished by the party of the first part; at cost, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records or reports published by either party shall contain a statement of the cooperative relations between the parties.

9. USGS will issue billings utilizing Department of the Interior Bill for Collection (form DI-1040). Billing documents are to be rendered quarterly. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30 day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983.)

U.S. Department of the Interior
U.S. Geological Survey
Joint Funding Agreement
FOR
Water Resource Investigations

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Customer#: 6000000093
Project #: LG40FDZ
TIN #: 02-6000618
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USGS Technical Point of Contact

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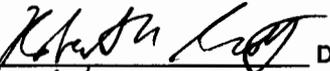
U.S. Geological Survey
United States
Department of Interior

New Hampshire Department of Environmental Services

Signature

By:  Date: 4/9/18
Name: Keith Robinson
Title: Director

Signatures

By:  Date: 4-18/18
Name: Robert R. Scott
Title: Commissioner

Approval by the Attorney General (Form, Substance and Execution)

By:  Date: 4.30.18
Name: Gordon P. Landrigan
Title: Attorney



**Development of streamflow record extension equations
in New Hampshire**

U.S. Geological Survey, New England Water Science Center
New Hampshire – Vermont Office

April 2, 2018

Introduction

Estimates of daily mean streamflow for streams are crucial for establishing the baseline information needed for planning and allocating water resources. As demands on streamflow in the form of regulation, withdrawals, and diversions increase, it is critical to ensure that there is adequate streamflow to meet various objectives, such as public water supply, agricultural and industrial water usage, recreation, and aquatic habitat protection. Typically, streamflow statistics are determined from streamflow data collected at U.S. Geological Survey (USGS) streamgages. However, it is impractical to gage all streams in New Hampshire and at many sites where information is needed, the streamflow data required for determining streamflow statistics do not exist. At such sites, techniques are required to estimate streamflow and may be done by employing record extension techniques used to reconstruct historic records of streamflow. Record extension techniques relate streamflows at the site of interest to concurrent streamflows at a nearby long-term USGS streamgage (Granato, 2009; Riggs, 1972; Matalas and Jacobs, 1964; Hirsch, 1979; Hirsch, 1982).

Currently, there are 16 designated rivers in New Hampshire in need of daily mean streamflow estimates for managing instream flows. Many of New Hampshire's Designated Rivers have current and/or historical streamflow data that may be used to extend an existing streamgages streamflow record in time through record extension techniques. Evaluating the feasibility of record extension techniques to provide the streamflow data necessary to manage New Hampshire's designated rivers would provide valuable insight for optimizing the development of a cost-effective streamgaging network. This proposed investigation will evaluate record extension techniques at six previously gaged locations on designated rivers by relating previously published field measurements of discharge at discontinued stations to daily discharges at some nearby active streamgage (fig. 1, table 1).

U.S. Geological Survey Proposal

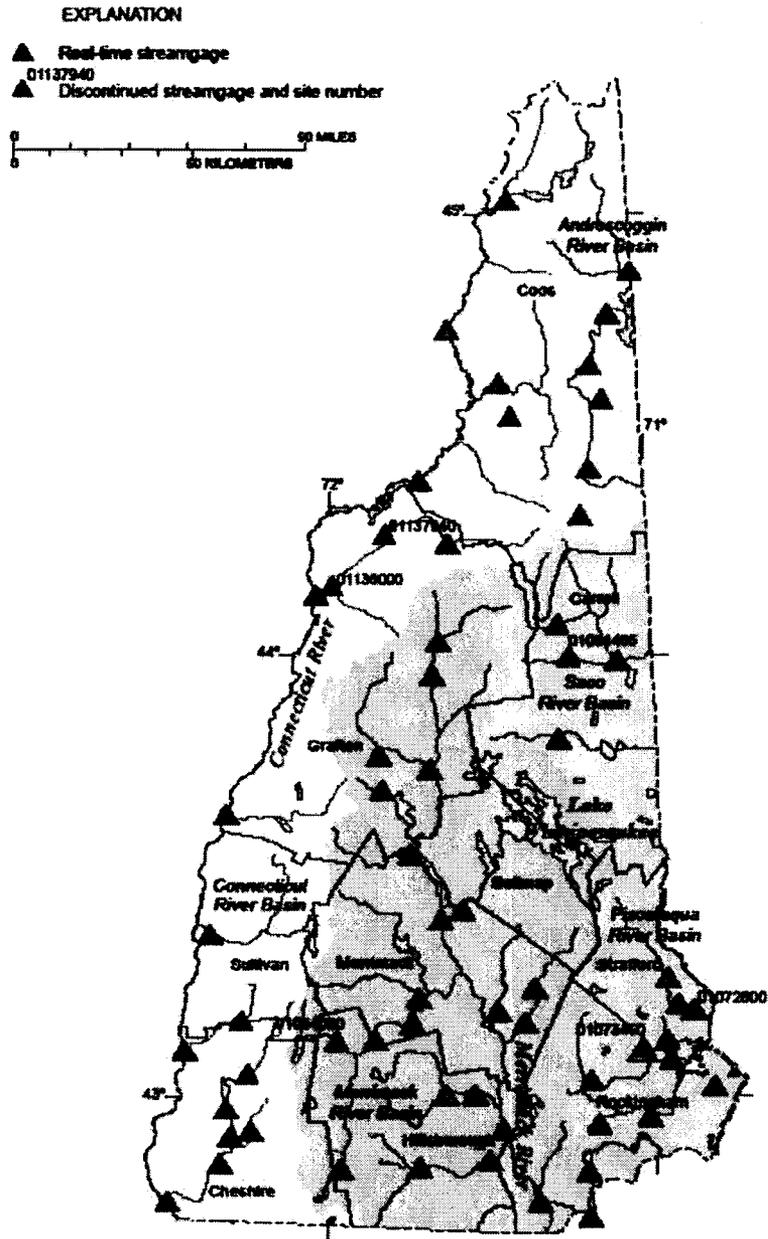


Figure 1. Location of real-time and select discontinued streamgages in New Hampshire.

Table 1. Select discontinued streamgages in New Hampshire.

Streamgage Number	Streamgage	Drainage Area (mi ²)	Number of Field Measurements	Period of streamflow record
01064485	Swift River 0.5 mi below Hobbs Br, nr Conway, NH	76.8	17	2009-11
01072880	Cocheco River, at Spaulding Turnpike, at Dover, NH	178	42	1991-96
01073460	North River above NH 125, near Lee, NH	35.6	30	2004-06 1924-70,
01084000	North Branch River near Antrim, NH	54.8	489	2009-11
01137940	Ammonoosuc R blw Lisbon Dam, at Lisbon, NH	288	18	2009-2011
01138000	Ammonoosuc River near Bath, NH	395	441	1935-1980

Objectives

This study proposes to provide:

1. Record extension techniques equations for estimates of daily mean streamflow for six discontinued streamgages (table 1). This would include upper and lower confidence intervals for daily mean streamflow.
2. Assessment of error in the extended streamflow record developed for the six previously gaged locations on designated rivers.

Approach

Developed record extension technique equations will provide estimates of daily mean streamflow for the six discontinued streamgages.

Objective 1. Provide record extension equations for estimates of daily mean streamflow for six previously gaged stations on designated rivers. Historical field measurements at each of the discontinued USGS streamgages will be related to concurrent daily mean streamflow from a nearby long-term streamgage to develop record extension technique equations for estimating the daily mean streamflow at the discontinued streamgages for the period of interest.

Objective 2. Assessment of error in the extended streamflow record developed for the six previously gaged locations on designated rivers. Extended daily mean streamflow records, based on the developed equations from objective 1, will be evaluated relative to the daily mean streamflows for

U.S. Geological Survey Proposal

periods where daily data exist at each of the discontinued stations using calculated regression statistics.

Relevance and Benefits

Results from this study will provide tools and data that are critical to the management of New Hampshire’s water resources. The information can be used by New Hampshire water-resource managers for planning, management, and permitting decisions to help ensure adequate water for consumptive use, water-quality standards, recreation, and aquatic habitat protection.

Products

A USGS Scientific Investigations Report will describe the methods and results for estimating daily mean streamflow for the six discontinued USGS streamgages in New Hampshire.

Project Timeline

Timeline for this project is shown below [FY, Federal fiscal year].

Task	FY2018												FY2019											
	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
Data analysis									X	X	X													
Publication													X	X	X	X	X	X						

Project Staffing, Costs, and Funding

Work required to meet the objectives will be carried out by hydrologists from the USGS. These USGS staff will collaborate, as needed, with state officials. The total cost of the project is \$49,000 with \$29,500 to be provided by NHDES and \$19,500 to be provided by USGS.

References

Granato, G.E., 2009, Computer programs for obtaining and analyzing daily mean streamflow data from the U.S. Geological Survey National Water Information System Web Site: U.S. Geological Survey Open-File Report 2008-1362, 123 p. on CD-ROM, appendix 3 of 5.
 Hirsch, R.M., 1979, An evaluation of some record reconstruction techniques, Water Resources Research, vol 15, no. 6.
 Hirsch, R.M., 1982, A comparison of four streamflow record extension techniques, Water Resources Research, vol. 18, no. 4, pages 1081-1088.

U.S. Geological Survey Proposal

Matalas, N.C. and Jacobs, B.A., 1964, A correlation procedure for augmenting hydrologic data,
U.S. Geological Survey Professional Paper, 434-E, 13 p.

Riggs, H.C., 1972, Low-flow investigations, U.S. Geological Survey Techniques of Water-Resources
Investigations, Book 4, chapter B1, 18 p.

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