WHATCOM COUNTY CONTRACT INFORMATION SHEET

Whatcom County Contract No.
202504023

Originating Department:	Public Works
Division/Program: *(i.e. Dept. Division and Program)*	River & Flood / 907550 (Flood Hazard Reduction)
Contract or Grant Administrator:	Julie Anderson, River & Flood Manager
Contractor's / Agency Name:	U.S. Geological Survey

Is this a New Contract? Yes ◉ No ○
If not, is this an Amendment or Renewal to an Existing Contract? Yes ○ No ◉
If Amendment or Renewal, (per WCC 3.08.100 (a)) Original Contract #: _____

Does contract require Council Approval? Yes ◉ No ○ If No, include WCC: _____
Already approved? Council Approved Date: _____ (Exclusions see: Whatcom County Codes 3.06.010, 3.08.090 and 3.08.100)

Is this a grant agreement?
Yes ○ No ◉ If yes, grantor agency contract number(s): _____ CFDA#: _____

Is this contract grant funded?
Yes ◉ No ○ If yes, Whatcom County grant contract number(s): 23-25 Proviso

Is this contract the result of a RFP or Bid process?
Yes ○ No ◉ If yes, RFP and Bid number(s): _____ Contract Cost Center: 19082247

Is this agreement excluded from E-Verify? No ○ Yes ◉ If no, include Attachment D Contractor Declaration form.

If YES, indicate exclusion(s) below:

- ☐ Professional services agreement for certified/licensed professional.
- ☐ Goods and services provided due to an emergency
- ☐ Contract work is for less than $100,000.
- ☐ Contract for Commercial off the shelf items (COTS).
- ☐ Contract work is for less than 120 days.
- ☐ Work related subcontract less than $25,000.
- ■ Interlocal Agreement (between Governments).
- ☐ Public Works - Local Agency/Federally Funded FHWA.

Contract Amount:(sum of original contract amount and any prior amendments):
$ 222,698

This Amendment Amount:
$

Total Amended Amount:
$ 222,698

Council approval required for; all property leases, contracts or bid awards **exceeding $40,000**, and professional service contract amendments that have an increase greater than $10,000 or 10% of contract amount, whichever is greater, **except when:**

1. Exercising an option contained in a contract previously approved by the council.
2. Contract is for design, construction, r-o-w acquisition, prof. services, or other capital costs approved by council in a capital budget appropriation ordinance.
3. Bid or award is for supplies.
4. Equipment is included in Exhibit "B" of the Budget Ordinance.
5. Contract is for manufacturer's technical support and hardware maintenance of electronic systems and/or technical support and software maintenance from the developer of proprietary software currently used by Whatcom County.

Summary of Scope:

The U.S. Geological Survey to assess alternate gaging methods at the Nooksack River near Cedarville to support the update to the Comprehensive Flood Hazard Management Plan for the FLIP Team.

Term of Contract: Not to exceed	Expiration Date: 9/30/2027

Contract Routing:

1. Prepared by:	Julie Anderson	Date: 4/1/2025
2. Attorney signoff:	Christopher Quinn	Date: 4/2/2025
3. AS Finance reviewed:	bbennett	Date: 4/9/2025
4. IT reviewed (if IT related):		Date:
5. Contractor signed:		Date:
6. Executive contract review:		Date: 4.30.25
7. Council approved, if necessary:	AB2025-326	Date: 4/29/25
8. Executive signed:		Date: 4.30.25
9. Original to Council:		Date:

WHATCOM COUNTY
PUBLIC WORKS DEPARTMENT

ELIZABETH KOSA
DIRECTOR

River and Flood Division
322 N Commercial St.
Bellingham, WA 98225
Phone: 360-778-6230

MEMORANDUM

TO: The Honorable Members of the Whatcom County Flood Control Zone District Board of Supervisors

THROUGH: Elizabeth Kosa, Public Works Director EK

FROM: Julie Anderson, River and Flood Manager JMA
Gary Stoyka, Natural Resources Manager GS

RE: U.S. Geological Survey Joint Funding Agreement to assess alternate gaging methods

DATE: April 1, 2025

Enclosed are two (2) original copies of a contract for services between the Whatcom County Flood Control Zone District (FCZD) and the U.S. Geological Survey (USGS) for your review and signature.

Requested Action
Public Works respectfully requests that the County Council, acting as the FCZD Board of Supervisors, enter into a joint funding agreement with the USGS to develop and assess non-contact methods for measuring discharge in the Nooksack River during high-flow events.

Background and Purpose
Whatcom County is leading the Floodplain Integrated Planning (FLIP) Project to identify mitigation measures and update the 1999 Lower Nooksack River Comprehensive Flood Hazard Management Plan. Accurate high-flow discharge measurements at the Nooksack River at North Cedarville, WA gage are critical for real-time flood monitoring, flood forecasting, long-term flood hazard management, and protecting life and property. However, a combination of turbulent flows, high sediment concentrations, and large volumes of woody debris make traditional discharge measurement methods difficult, dangerous and subject to uncertainty at the high flows of interest. These challenges limit the ability to monitor and plan for flooding that would endanger life and property.

The USGS will develop and assess non-contact methods for measuring discharge in the Nooksack River to support the FLIP team, such as estimating surface velocities using handheld radar units and estimating flow depth using ground-penetrating radar or single-beam echo sounders.

Funding and Source
The proposed contract amount is $222,698. The 2025 FCZD Budget has adequate budget authority for this work. Funding for this work is provided through an existing State Proviso to support the FLIP planning work.

Please contact Julie Anderson at extension 6258, if you have any questions or concerns regarding the terms of this Contract.

Whatcom County Contract No.
202504023

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Washington Water Science Center
934 Broadway St, Ste 300
Tacoma, WA 98402

April 2, 2025

Ms. Paula Harris
River and Flood Manager
Whatcom County Flood Control Zone District
Whatcom County Natural Resources Division
322 N. Commercial Street, Suite 110
Bellingham, WA 98225

Dear Ms. Harris:

Enclosed is our standard joint-funding agreement (25YGJFA30144) between the U.S Geological Survey Washington Water Science Center and Whatcom County Flood Control Zone District for the Assessing Alternate Methods for High-Flow Discharge Measurements in the Nooksack River at North Cedarville for the period May 1, 2025 through September 30, 2027 in the amount of $222,699 from your agency. U.S. Geological Survey contributions for this agreement are $105,000 for a combined total of $327,699. Please sign and return one fully-executed original to Sharbra Gordon-Scott gs-w-wa_agreements_dropbox@usgs.gov at the address above.

Federal law requires that we have a signed agreement before we start or continue work. Please return the signed agreement by **April 25, 2025**. If, for any reason, the agreement cannot be signed and returned by the date shown above, please contact Scott Anderson by phone number (253) 552-1633 or email swanderson@usgs.gov to make alternative arrangements.

This is a fixed cost agreement to be billed quarterly via Down Payment Request (automated Form DI-1040). Please allow 30-days from the end of the billing period for issuance of the bill. If you experience any problems with your invoice(s), please contact Sharbra Gordon-Scott at phone number (253) 552-1698 or email at gs-w-wa_agreements_dropbox@usgs.gov.

The results of all work performed under this agreement will be available for publication by the U.S. Geological Survey. We look forward to continuing this and future cooperative efforts in these mutually beneficial water resources studies.

Sincerely,

SCOTT VANDERKOOI
Digitally signed by SCOTT VANDERKOOI
Date: 2025.04.03 15:53:54 -07'00'

Scott VanderKooi
Center Director

Enclosure
25YGJFA30144 (1)

Form 9-1366
(May 2018)

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

Customer #: 6000000721
Agreement #: 25YGJFA30144
Project #: YG00VGV
TIN #: 91-6001383

Fixed Cost Agreement YES[X] NO[ ]

THIS AGREEMENT is entered into as of the **May 1, 2025**, by the U.S. GEOLOGICAL SURVEY, Washington Water Science Center, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the **Whatcom County Flood Control Zone District** 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) **$105,000** by the party of the first part during the period **May 1, 2025 to September 30, 2027**

(b) **$222,699** by the party of the second part during the period **May 1, 2025 to September 30, 2027**

(c) Contributions are provided by the party of the first part through other USGS regional or national programs, in the amount of: $0.00.

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. The Parties acknowledge that scientific information and data developed as a result of the Scope of Work (SOW) are subject to applicable USGS review, approval, and release requirements, which are available on the USGS Fundamental Science Practices website (https://www2.usgs.gov/fsp/).

Form 9-1366
(May 2018)

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

Customer #: 6000000721
Agreement #: 25YGJFA30144
Project #: YG00VGV
TIN #: 91-6001383

9. Billing for this agreement will be rendered **quarterly**. Invoices not paid within 60 days from the billing date will bear Interest, Penalties, and Administrative cost at the annual rate pursuant the Debt Collection Act of 1982, (codified at 31 U.S.C. § 3717) established by the U.S. Treasury.

USGS Technical Point of Contact

Name: Scott Anderson
Hydrologist
Address: 934 Broadway Suite 300
Tacoma, WA 98402
Telephone: (253) 552-1633
Fax:
Email: swanderson@usgs.gov

Customer Technical Point of Contact

Name: Paula Harris
River and Flood Manager
Address: Whatcom County FCZD
Natural Resources Division
322 N. Commercial Street, Suite 110
Bellingham, WA 98225
Telephone: (360) 778-6285
Fax:
Email: Pharris@co.whatcom.wa.us

USGS Billing Point of Contact

Name: Sharbra Gordon-Scott
Budget Analyst
Address: 934 Broadway Suite 300
Tacoma, WA 98402
Telephone: (253) 552-1698
Fax: (253) 552-1581
Email: sgordon-scott@usgs.gov

Customer Billing Point of Contact

Name: Paula Harris
River and Flood Manager
Address: Whatcom County FCZD
Natural Resources Division
322 N. Commercial Street, Suite 110
Bellingham, WA 98225
Telephone: (360) 778-6285
Fax:
Email: Pharris@co.whatcom.wa.us

U.S. Geological Survey
United States
Department of Interior

Signature

By SCOTT VANDERKOOI Digitally signed by SCOTT VANDERKOOI Date: 2025.04.03 15:54:27 -07'00' **Date:** _____

Name: Scott VanderKooi

Title: Center Director

Whatcom County Flood Control Zone District

Signatures

By_____ **Date:** _____
Name:
Title:

See attached

By_____ **Date:** _____
Name:
Title:

By_____ **Date:** _____
Name:
Title:

WHATCOM COUNTY FLOOD CONTROL ZONE DISTRICT:
Recommended for Approval:

Elizabeth Kosa, Public Works Director — Date 4/30/2025

Approved as to form:

/s/ Christopher Quinn by K. Dalla — 4/29/25

Christopher Quinn — Date
Chief Civil Deputy Prosecuting Attorney

Approved:
Accepted for Whatcom County Flood Control Zone District:

By: Satpal Sidhu — 4.30.25
Satpal Singh Sidhu, Whatcom County Executive

STATE OF WASHINGTON)
) ss
COUNTY OF WHATCOM)

On this 30th day of April, 2025 before me personally appeared Satpal Singh Sidhu, to me known to be the Executive of Whatcom County, who executed the above instrument and who acknowledged to me the act of signing and sealing thereof.

NOTARY PUBLIC in and for the State of Washington, residing at Bellingham. My commission expires 9.10.28.

JAKE LOGAN
APPOINTMENT EXPIRES September 10, 2028
NOTARY PUBLIC
COMM # 24026908
STATE OF WASHINGTON

Assessing Alternate Methods for High-Flow Discharge Measurements in the Nooksack River, WA

SUMMARY

A proposal prepared by the U.S. Geological Survey for Whatcom County

3/4/2025

Problem.—

Accurate high-flow discharge measurements at the Nooksack River at North Cedarville, WA gage are critical for real-time flood monitoring, flood forecasting, long-term flood hazard management, and the safety and protection of life and property. However, a combination of turbulent flows, high sediment concentrations, and large volumes of woody debris make traditional discharge measurement methods on the Nooksack River difficult, dangerous, and subject to uncertainty at the high flows of interest. These challenges limit the ability to monitor and plan for flooding that can place life and property at risk.

Objective(s).—

The objective of this work is to develop and assess non-contact or limited-contact methods for measuring discharge in the Nooksack River. These include estimating surface velocities via handheld radar units and estimating flow depth via ground-penetrating radar or single-beam echo sounders.

Relevance and Benefits.—

This work aligns with the U.S. Geological Survey (USGS) Water Science Strategy goals to "anticipate and respond to water-related emergencies and conflicts" (Goal 4; Evenson and others, 2013), particularly in terms of improving operational decisions during extreme events (Objective 2). This work also aligns with Washington Water Science Center Science priorities (Jaeger and others, 2024) to improve water resource monitoring (Priority 1) and to better understand hydrologic hazards to reduce risk (Priority 5). The use of Cooperative Matching Funds (CMF) for this project aligns with CMF goals in both the Groundwater and Streamflow Information program related to streamflow monitoring and hazard assessments and the Water Availability and Use Sciences program related to analyses of peak streamflow.

If successful, this work should lead to safer and more accurate high flow measurements and discharge estimates at a critical monitoring location with substantial local and international attention. These same methods could also be applied to and improve accuracy at other monitoring sites where woody debris and dynamic channel beds make high-flow discharge measurements and monitoring difficult.

Approach.—

This work will involve three major tasks: (1) acquisition and initial testing of alternate monitoring technologies, including handheld surface velocity radar units, ground-penetrating radar, and single-beam echo sounders; (2) making paired discharge measurements using both traditional and proposed techniques over a range of discharge conditions; and (3) assessments of those new methods and their accuracy to be presented in a USGS report.

Assessing Alternate Methods for High-Flow Discharge Measurements in the Nooksack River, WA

A proposal prepared by the U.S. Geological Survey for Whatcom County

3/4/2025

BACKGROUND/INTRODUCTION

The Nooksack River is a dynamic, gravel-bedded system in northwest Washington State (Figure 1). The unregulated river poses flood risks to numerous communities along its lower reaches. During major floods, water crosses a low drainage divide near Everson, WA, ultimately reaching the Fraser River via the Sumas River valley (KCM, 1995). These 'overflow' events have occurred regularly over the historical record, making flooding in the Nooksack River an international safety concern for life and property. Interest in flooding and flood hazard management has been heighted by a November 2021 storm that caused over one billion dollars of damage, much of it in southwest British Columbia. In the years following that storm, there has been a renewed international interest in improving flood monitoring and forecasting and reducing flood hazards along the Nooksack River.

Flood monitoring and forecasting in the Nooksack River is largely focused on gaging in the upper mainstem reaches, upstream of most major population centers but below the confluences of the Middle Fork and South Fork Nooksack Rivers. From 1935 to 2005, the USGS operated a gage in this reach near Deming, WA, (USGS 12210500), but streamflow estimates during flood events were biased due to limited high-flow measurements and frequent shifts in the channel bed (Franz, 2005). Starting in 2005, monitoring was shifted several miles downstream to a gage near Cedarville, WA (USGS 12210700). While the site provides improved access, the channel bed at this location still experiences frequent shifts, both in terms of short-term scour and fill over individual flood events and longer-term trends extending over periods of years to decades (Anderson and Konrad, 2019). Persistent concerns about the accuracy of published discharge records at high flows have elevated the need to more accurately gage the Nooksack River with specific interest in the Cedarville station.

Maintaining an accurate stage-discharge rating curve requires accurate and timely discharge measurements, which have been difficult to obtain in the Nooksack River. At high flows, the Nooksack River transports an immense quantity of large instream wood, most of which moves within a corridor corresponding to the fastest and deepest flow. The near-continuous transport of debris and extremely mobile bed has made it nearly impossible to measure depth or velocity at the Cedarville measurement section using traditional in-water methods. Acoustic doppler measurement methods have also struggled to detect the bed through deep, turbulent, and extremely turbid water. When high-flow discharge measurements have been possible, the work has been dangerous, time-intensive, and often subject to uncertainty.

Prior work in the region has demonstrated the potential for measuring discharge using a combination of non-contact radar to estimate velocity and ground-penetrating radar (GPR) to

estimate channel geometry (Spicer and others, 1997; Costa and others, 2000, 2006). The methods were developed specifically to improve discharge measurements in dynamic, sediment-rich rivers, and so have clear application to the Nooksack River. However, there have been relatively little development of those non-contact methods since the early 2000s, and it remains unclear if they can be successfully employed at the Cedarville measurement section.

PROBLEM

Accurate high-flow discharge records at the Nooksack River at North Cedarville, WA gage are critical for real-time flood monitoring, flood forecasting, and long-term flood hazard management. Given the dynamic channel bed and frequent rating-curve shifts, accurate discharge estimates require frequent and accurate high-flow discharge measurements. However, a combination of turbulent flows, high sediment concentrations, and large volumes of woody debris make traditional discharge measurement methods difficult, dangerous, and subject to uncertainty at the high flows of interest. These challenges limit the ability to monitor and plan for flooding that can place life and property at risk.

OBJECTIVES and SCOPE

The objective of this work is to develop and assess non-contact or limited-contact methods for measuring discharge in the Nooksack River. These include estimating surface velocity via handheld radar units and estimating flow depth via ground-penetrating radar or single-beam echo sounders. The scope of this work would involve researching and acquiring appropriate equipment and conducting paired discharge measurements using both new and conventional methods over a range to flows to assess accuracy and ease of use. The results will be published in a USGS report and, if found to be successful, may be utilized by USGS streamgagers for high-flow discharge measurements in the future.

RELEVANCE and BENEFITS

This work aligns with USGS water science strategy goals to "anticipate and respond to water-related emergencies and conflicts" (Goal 4; Evenson and others, 2013), particularly in terms of improving operational decisions during extreme events (Objective 2). This work also aligns with Washington Water Science Center Science priorities (Jaeger and others, 2024) to improve water resource monitoring (Priority 1) and to better understand hydrologic hazards to reduce risk (Priority 5). The use of Cooperative Matching Funds (CMF) for this project aligns with CMF goals in both the Groundwater and Streamflow Information program related to streamflow monitoring and hazard assessments and the Water Availability and Use Sciences program related to analyses of peak streamflow.

If successful, this work should lead to safer and more accurate high flow measurements and discharge estimates at a critical monitoring location with substantial local and international attention. These same methods could also be applied to other monitoring sites where woody debris and dynamic channel beds make high-flow discharge measurements and monitoring difficult.

APPROACH

This work will involve three major tasks: acquisition and initial testing of alternate monitoring technologies; making paired discharge measurements using both traditional and proposed techniques over a range of discharge conditions; and assessments of those new methods and their accuracy to be presented in a USGS publication.

Task 1: Technology acquisition and development of methods

The discharge measurement methods to be tested include the use of handheld surface velocity radar monitors to estimate velocity and either ground-penetrating radar or single-beam echo sounders to estimate channel depth. Currently, the Washington Water Science Center already owns surface velocity radar and single-beam echo sounder equipment suitable for this work. We will consult with USGS GPR subject-matter experts to determine what GPR technology would be most appropriate for this task, and if such units are available for loan within the USGS. If not, a unit will be purchased for this project.

A first step will be to develop deployment methods for the GPR and single-beam systems that can be used from the bridge at the Cedarville measurement section, which is relatively high. This will most likely involve custom mountings to existing USGS sampling cranes. Deployment methods will be tested and refined at low flows to ensure basic functionality.

Task 2: Comparisons of Discharge Measurement Methods

Once the monitoring equipment and deployment methods are ready, we will make a series of paired discharge measurements using both conventional acoustic-Doppler methods (Turnipseed and Sauer, 2010) and the proposed (experimental) non/limited-contact methods. These measurements will be used to develop and refine best practices for utilizing the proposed measurement methods and to assess their accuracy relative to traditional methods. Experimental methods of measurement will generally follow procedures outlined in Haeni and others (2000), Fulton and others (2020), and Khan and others (2021).

Paired measurements will initially target moderate flows (~5,000-15,000 ft^3/s), where conventional methods generally work well. If initial results are successful, assessments during high flows would necessarily be opportunistic and dependent on suitable flow conditions. We will target 3-6 paired measurements per year over the two years of monitoring. During each measurement, we will spot-check water quality parameters relevant to understanding GPR performance, including turbidity, specific conductance, and water temperature.

If paired measurements are made during conditions where conventional methods are unable to accurately or safely collect data across the full width of the channel, accuracy assessments will be based on comparisons over sub-sections where conventional data collection is feasible, cross comparisons of single-beam and GPR results, and overall logical consistency.

If initial testing indicates that the new methods, in part or in whole, are unlikely to be useful, the USGS will inform Whatcom County of those findings as soon as possible and collaboratively decide how to proceed.

Task 2a: Assessment of Short-Term Bed Elevation Changes

There is on-going interest in the scale and nature of bed elevations changes at the measurement site during individual high-flow events. Subject to suitable high-flow events, we will conduct a series of frequent discharge measurements over the course of one to two days, using the associated channel depth measurements to document local bed elevation changes, along with concurrent changes in roughness and overall stage-discharge relation inferred from the complete discharge data.

Task 3: Analysis, Archiving and Publication

The available data will be used to assess the viability of experimental measurement, both in terms of accuracy and practical field application. Those results will be summarized in a USGS publication. All newly collected field data will be archived in either the National Water Information System (NWIS) or a USGS ScienceBase data release.

QUALITY ASSURANCE/QUALITY CONTROL/LAB EVALUATION

Discharge measurements made using standard acoustic Doppler methods will be assessed for quality using standard USGS methods (Turnipseed and Sauer, 2010) and those specific to Washington Water Science Center (Mastin, 2017). Discrete measurements of turbidity, specific conductance, and temperature data will be collected during monitoring per USGS and Washington Water Science Center guidelines to assess water column conditions that may impact GPR returns (Wilde, 2008; Conn and others, 2017). The primary assessment of quality for experimental methods will be comparisons with data from the acoustic Doppler measurements, both in terms of local velocities and depths and overall estimates of discharge. Those quality assessments constitute the primary topic of the proposed study and associated publication.

DATA MANAGEMENT AND MODEL ARCHIVES

Conventional discharge measurement data will be stored on USGS servers per standard practice, with summary results published in NWIS. All experimental data, including raw measurement data, field notes, and post-processed estimates of channel geometry, velocity, and discharge will initially be stored on USGS servers per Washington Water Science Center guidelines (Conn and others, 2019) and ultimately archived in a USGS ScienceBase data release.

TIMELINE and PRODUCTS

Full timeline: May 1, 2025 to September 30, 2027

Data release: raw and post-processed experimental data – September 2027

USGS publication – September 2027

Task	FY2025		FY2026				FY2027			
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	Apr-June	July-Sept	Oct-Dec	Jan-Mar	Apr-June	July-Sept	Oct-Dec	Jan-Mar	Apr-June	July-Sept
Task 1: Technology acquisition	X	X	X							
Task 2: Paired measurement tests			X	X	X	X	X	X		
Task 3: Analysis, archiving, publication					X	X	X	X	X	X

PERSONNEL

Scott Anderson – Hydrologist

Nick Sutfin – Hydrologist, surface water specialist

Dan Restivo - Hydrologist

Field assistance will be provided as available including staff responsible for regular discharge measurements at the study site.

BUDGET and FUNDING SUMMARY

Agency	FY 2025	FY 2026	FY 2027	Total Project
Whatcom County	$ 80,957	$ 58,960	$ 82,782	**$ 222,698**
USGS Matching Funds	$ 15,000.00	$ 50,000.00	$ 40,000.00	**$ 105,000**
Total	$ 95,957	$ 108,960	$ 122,782	$ 327,698

USGS Cooperative Matching Funds are subject to availability and Congressional appropriations in future fiscal years.

REFERENCES

Anderson, S.W. and Konrad, C.P., 2019. Downstream-propagating channel responses to decadal-scale climate variability in a glaciated river basin. Journal of Geophysical Research: Earth Surface, 124(4), pp.902-919.

Conn, K.E., Huffman, R.L., and Barton, Cynthia, 2017, Quality-assurance plan for water-quality activities in the U.S. Geological Survey Washington Water Science Center: U.S. Geological Survey Open-File Report 2017–1044, 66 p., https://doi.org/10.3133/ofr20171044.

Conn, K.E., Mastin, M.C., Long, A.J., Dinicola, R.S., and Barton, C., 2019, Data management plan for the U.S. Geological Survey Washington Water Science Center : U.S. Geological Survey Open-File Report 2019-1049, 23 p., https://doi.org/10.3133/ofr20191049.

Costa, J.E., Spicer, K.R., Cheng, R.T., Haeni, F.P., Melcher, N.B., Thurman, E.M., Plant, W.J. and Keller, W.C., 2000. Measuring stream discharge by non-contact methods: A proof-of-concept experiment. Geophysical Research Letters, 27(4), pp.553-556.

Costa, J.E., Cheng, R.T., Haeni, F.P., Melcher, N., Spicer, K.R., Hayes, E., Plant, W., Hayes, K., Teague, C. and Barrick, D., 2006. Use of radars to monitor stream discharge by noncontact methods. Water Resources Research, 42(7).

Evenson, E.J., Orndorff, R.C., Blome, C.D., Böhlke, J.K., Hershberger, P.K., Langenheim, V.E., McCabe, G.J., Morlock, S.E., Reeves, H.W., Verdin, J.P., Weyers, H.S., and Wood, T.M., 2013, U.S. Geological Survey water science strategy—Observing, understanding, predicting, and delivering water science to the Nation: U.S. Geological Survey Circular 1383–G, 49 p.

Franz, D.D., 2005. Flood Frequency Analysis at Deming, Ferndale and Everson. Prepared for Whatcom County, 27 p. with appendices

Fulton, John W., Christopher A. Mason, John R. Eggleston, Matthew J. Nicotra, Chao-Lin Chiu, Mark F. Henneberg, Heather R. Best et al., 2020, "Near-field remote sensing of surface velocity and river discharge using radars and the probability concept at 10 US geological survey streamgages." Remote Sensing 12, no. 8 (2020): 1296., https://doi.org/10.3390/rs12081296

Haeni, F.P., Buursink, M.L., Costa, J.E., Melcher, N.B., Cheng, R.T. and Plant, W.J., 2000, April. Ground penetrating radar methods used in surface-water discharge measurements. In Eighth International Conference on Ground Penetrating Radar (Vol. 4084, pp. 494-500). SPIE.

Jaeger, K., Welch, W., Hopkins, K., Sheibley, R., Conn, K., Long, A., Sutfin, N., Laveau, C., VanderKooi, S., 2024, U.S. Geological Survey, Washington Water Science Center Strategic Science Plan, 2024-2029, 17 p. with appendices

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MAP OF STUDY AREA