WHATCOM COUNTY CONTRACT INFORMATION SHEET

Whatcom County Contract No.

Originating Department:	Public Works
Division/Program: *(i.e. Dept. Division and Program)*	River & Flood (907525)/Flood Planning
Contract or Grant Administrator:	Paula Harris
Contractor's / Agency Name:	United States Geological Survey

Is this a New Contract? If not, is this an Amendment or Renewal to an Existing Contract? Yes ○ No ◉
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): 202311009

Is this contract the result of a RFP or Bid process? Contract
Yes ○ No ◉ If yes, RFP and Bid number(s): _____ Cost Center: 722007 / WO# 23747

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):
$ 94,050

This Amendment Amount:
$

Total Amended Amount:
$ 94,050

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:

This agreement provides funding for technical analysis to assess topographic changes in the Nooskack River channel and support the Floodplain Integrated Planning (FLIP) work.

Term of Contract: Fixed	Expiration Date: March 31, 2025

Contract Routing:

1. Prepared by:	Paula Harris	Date: 01/08/24
2. Attorney signoff:	Christopher Quinn	Date: 1/9/2024
3. AS Finance reviewed:	Amy Martin	Date: 1/9/24
4. IT reviewed (if IT related):		Date:
5. Contractor signed:		Date:
6. Executive contract review:		Date:
7. Council approved, if necessary:	AB2024-077	Date: 1/23/2024
8. Executive signed:		Date:
9. Original to Council:		Date:

Last edited 06/23/2023

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 #: 24YGJFA30132
Project #: YG00V4X
TIN #: 91-6001383

Fixed Cost Agreement YES[X] NO[ ]

THIS AGREEMENT is entered into as of the **January 1, 2024**, 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) **$61,000** by the party of the first part during the period **January 1, 2024 to March 31, 2025**

(b) **$94,050** by the party of the second part during the period **January 1, 2024 to March 31, 2025**

(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 #: 24YGJFA30132
Project #: YG00V4X
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

SCOTT VANDERKOO Digitally signed by SCOTT VANDERKOOI Date: 2023.12.14 18:17:29 -07'00'

By: _____ **Date:** _____

Name: Scott VanderKooi

Title: Center Director

Whatcom County Flood Control Zone District

Signatures

By *See attached signature page **Date:** _____

Name:

Title:

By_____ **Date:** _____

Name:

Title:

By_____ **Date:** _____

Name:

Title:

WHATCOM COUNTY FLOOD CONTROL ZONE DISTRICT:
Recommended for Approval:

_____
Elizabeth Kosa, Public Works Director Date

Approved as to form:

_____
Christopher Quinn Date
Civil Deputy Prosecuting Attorney

Approved:
Accepted for Whatcom County Flood Control Zone District:

By: _____
Satpal Singh Sidhu, Whatcom County Executive

STATE OF WASHINGTON)
) ss
COUNTY OF WHATCOM)

On this _____ day of _____, 20 __, 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 _____. My commission expires _____.

Assessing recent topographic change of the lower Nooksack River

SUMMARY

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

10/23/2023

Problem.—

Flood hazard management in the lower Nooksack River is inherently intertwined with the dynamics of sediment transport and deposition. These issues have become particularly salient near Everson, WA, where the 2020 floods caused immense damage to communities in both Washington and SW British Columbia and reflect, in part, the loss of channel conveyance due to sediment deposition. Understanding how channel geometry has changed historically, the underlying causes of those changes, and how channels may adjust in the future all inform management decision making. Regular monitoring of local channel change is also critical for understanding evolving flood risks year to year, or even flood-event to flood-event.

Objective(s).—

The primary goal of this work is to finalize and expand existing channel change analyses for the lower Nooksack River, largely based on analyses of repeat topographic surveys. Observed changes will be reported and, in combination with other existing data, used to improve conceptual and quantitative understanding of sediment transport dynamics through the Everson Reach. Secondary goals include minor collection of additional grain size data. This work includes salary time for discussion and collaboration with consultants who will be using the topographic change results to help calibrate/validate sediment transport models, as well as salary time to help present and discuss results to technical work groups and to the public.

Relevance and Benefits.—

This work will support active flood-management decision making in the lower Nooksack River, with emphasis on the Everson Reach. By providing local stakeholders with timely and relevant synthesis of complex data, this work aligns with the USGS mission to "engage with stakeholders and decision makers who rely on our science to carry out actions to mitigate riverine and coastal flooding, perform ecosystem restoration, [and] manage inland freshwater fisheries…" (USGS, 2021).

Approach.—

This work primarily involves differencing of high-resolution topographic datasets to document channel change, with the larger goal of improving understanding of the transport, erosion, and deposition of coarse (sand and gravel) sediment through the lower Nooksack River. The scope of this proposal is primarily to extend and finalize preliminary results obtained through WMA funding; synthesize observations in an interpretive publication; and help integrate results into concurrent sediment transport modeling efforts, flood management discussions, and general public understanding. There is a minor additional task of collecting river channel grain size distribution in collaboration with Northwest Hydraulic Consultants (NHC) to support sediment transport modeling.

Assessing recent topographic change of the lower Nooksack River

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

10/23/2023

BACKGROUND/INTRODUCTION

The Nooksack River drains a 786 mi^2 basin in northwest Washington State (Figure 1). The basin has steep headwaters, including glaciated terrain on Mount Baker, high precipitation rates, and extensive glacial and volcanic Quaternary valley fills that, in combination, result in high sediment loads and a dynamic channel. This includes substantial variations in mean channel elevation (Anderson and Konrad, 2019), which can have a direct impact on channel flood conveyance and discharge at which water begins to overtop local banks or levees.

Near the town of Everson, WA, major floods of the Nooksack River can overtop a low drainage divide (Figure 1). Overtopping flows are routed northeast down the Sumas River valley and ultimately into the Fraser River, British Columbia. These events then cause flood damages in areas nominally outside the Nooksack River watershed, and across an international border. Such over-topping events have occurred many times over the historic record (KCM, 1995; Applied Geoscience, 2019). Concerns have existed for decades about the deposition of sand and gravel near Everson increasing the likelihood and intensity of such overtopping events. Over the latter half of the 20th century, commercial sand and gravel extraction from the lower river was partly justified in terms of reducing flood risk, though the lack of reliable information on channel elevations and extraction details over this era make it difficult assess the claim. Increased regulatory pressure led to the end commercial extractions in the late 1990s.

Franz (2005) identified the threshold discharge for Everson overtopping events as 46,000 ft^3/s, using a combination of data from 1990s and early 2000s. Subsequent analyses of channel change between 2006 and 2013 documented 1-2 ft of sediment deposition near Everson, and elevation trends at a nearby gage suggest deposition continued through at least 2016 (Anderson et al., 2019). Overtopping events in 2015 and 2017 occurred at unexpectedly low (35,000-40,000 ft^3/s) discharges, consistent with a loss of conveyance due to deposition. These events were followed by immense flooding in November 2021, resulting in the highest peak flows recorded in the basin. Nooksack floodwaters caused extensive damage to communities in both Washington State and SW British Columbia, including over $1 billion in damages to the community of Abbotsford, BC.

The 2021 floods re-invigorated both US and Canadian efforts to address Nooksack River flood risks. Much of this discussion has focused on management options in and around the Everson overflow area, where channel conditions and flood protection structures interact to define the relative flood risk down the mainstem versus overflow flood pathways. Many management alternatives have been explored using hydraulic models, and there is a new effort to better understand how various actions are likely to impact sediment transport and deposition via explicit sediment transport and channel change modeling. There is also a need to monitor on-going natural changes in channel conveyance to better understand and communicate evolving flood risks to at-risk communities.

PROBLEM

Flood risk and flood management in the lower Nooksack River are both inherently intertwined with the dynamics of sediment transport and deposition. Understanding how channel geometry has changed historically, the underlying causes of those changes, and how channels may adjust moving forward all inform management decision making. Potential future adjustments include both the impacts of climate and any management actions. Regular monitoring of local channel change is also critical for understanding evolving flood risks year to year, or even flood-event to flood-event.

OBJECTIVES and SCOPE

The primary goal of this work is to finalize and expand existing channel change analyses for the lower Nooksack River, largely based on analyses of repeat topographic surveys. Observed changes will be reported and, in combination with other existing data, used to improve conceptual and quantitative understanding of sediment transport dynamics through the Everson Reach. Secondary goals include minor collection of additional grain size data. This work also includes salary time for discussion and collaboration with consultants who will be using the topographic change results to help calibrate/validate sediment transport models, as well as salary time to help present and discuss results to technical work groups and to the public.

RELEVANCE and BENEFITS

This work will support active flood-management decision making in the lower Nooksack River, with emphasis on the Everson Reach. This work was developed in collaboration with both Whatcom County flood managers and NHC consultants tasked with developing sediment transport models of the reach, and the results will be directly integrated into those efforts.

By providing local stakeholders with timely and relevant synthesis of complex data, this work aligns with the USGS mission to "engage with stakeholders and decision makers who rely on our science to carry out actions to mitigate riverine and coastal flooding, perform ecosystem restoration, [and] manage inland freshwater fisheries…" (USGS, 2021).

APPROACH

This work primarily involves differencing of high-resolution topographic datasets to document channel change, with the larger goal of improving understanding of the transport, erosion, and deposition of coarse (sand and gravel) sediment through the lower Nooksack River. Much of this work was initiated through a modest USGS WMA grant in the aftermath of the 2021 floods and the large majority of the datasets have already been assembled and analyzed. The scope of this proposal is primarily to extend and finalize those preliminary results, synthesize observations in an interpretive publication, and help integrate results into concurrent sediment transport modeling efforts, flood management discussions, and general public understanding. There is a

minor additional task of collecting river channel grain size distribution in collaboration with NHC to support sediment transport modeling.

Task 1 – Finalize and extend topographic change analyses

The central analysis effort involves assessments of topographic/bathymetric change from 1993 to 2022. This work focuses on the lower Nooksack near Everson but includes analyses covering various extents from the SF confluence near Deming to the rivers mouth below Ferndale. Datasets include lidar collected in 2006, 2009, 2013, and 2016, topo-bathymetric data collected in 2022, topography derived from aerial imagery from 1993 and 1999, and dense cross sections collected in 2006. Analyses primarily involve differencing of raster digital elevation models to assess change, subject to corrections accounting for systematic offsets in georeferencing, vegetation, and discharge (Anderson et al., 2019, Anderson and Jaeger, 2020). These data have already been assembled and primary change analyses completed. Additional work to be done includes refinement of bias reduction approaches and error analyses, addition of 2006-2022 change analysis based on cross sections, and summary presentation of results.

Task 2 – Conduct new change analysis using planned 2024 lidar

There are plans for Whatcom County to fund collection of new topo-bathymetric lidar in the spring of 2024. When available, these data will be used to update channel change trends through 2024 using the same methods as earlier intervals. This task is contingent on successful data collection and timely data delivery.

Task 3 – Collect channel grain size data

The USGS will collaborate with NHC to characterize surface and subsurface grain size distribution (GSD) along exposed gravel bars along the Nooksack River. Data will be collected to cover the spatial extents of the sediment transport modeling domain. The exact number and location of samples will be determined based on NHC modeling needs.

Surficial GSD will be characterized using 200-pt pebble counts (Wolman, 1954), with clasts selected at 1-ft marks of two parallel 100-ft tapes placed along the main axis of unforced point bars. Grain size will be measured at ½-phi intervals down to two millimeters using a standard gravelometer. Subsurface GSD will be characterized using bulk sieving methods at the mid-point of the surficial point counts. Material coarser than 8 mm will be sieved and weighed in the field using certified sieves and a calibrated hanging scale; a split of the <8 mm material will be collected and further sieved to 0.5 mm upon return to the office.

Task 4 – Integrated analysis and publication

Results from the topographic change analyses will be synthesized and interpreted in combination with grain size data, updated assessments of elevation trends at USGS gages (Anderson and Konrad, 2019), bedload samples collected by the USGS at Everson (funded via a separate agreement), and other existing data and prior studies in an interpretive report. The emphasis of integrated analyses will be improving understanding of the erosion, transport, and deposition of bed material through the lower Nooksack, and using time/space variations in channel change

trends to assess potential physical causes of observed trends. These analyses will be summarized in a USGS Scientific Investigations Report (SIR).

Task 5 – Internal discussion and public dissemination of results

This work includes salary time to discuss and refine results to support concurrent sediment transport modeling by NHC. Additional time has been slated to allow for presentation of results to various technical working groups, stakeholder groups, and the general public.

QUALITY ASSURANCE/QUALITY CONTROL/LAB EVALUATION

Repeat topographic change results will be carefully reviewed and adjusted to account for systematic offsets associated with datum/registration offsets, vegetation-specific biases, and discharge-related biases following approaches in Anderson et al. (2019) and Anderson and Jaeger (2021). Uncertainty bounds for estimated change volumes will be assessed via error propagation methods presented in Anderson (2019).

Scales used for weight-based grain size measurements will be checked for accuracy and field notes reviewed using established WAWSC processes (Conn et al., 2019).

DATA MANAGEMENT AND MODEL ARCHIVES

Most of the topographic data used in this work is or will be available through the Washington DNR's lidar repository. Data collected and used for the project will be stored on the WAWSC internal network as described in Conn et al., 2019 and quality assured through an internal approval process. Upon project completion, data not already available in a durable public repository will be publicly archived in a USGS ScienceBase data release. This includes scanned imagery and derived topography from 1993 and 1999, final DEMs of difference (DoDs) for various inter-survey intervals, and grain size data.

TIMELINE and PRODUCTS

USGS Data Release – Oct 2024

USGS SIR – June 2025

Task or Element	FY 2024				FY 2025	
	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec	Jan-Mar
Task 1 – Existing repeat topo	X	X	X			
Task 2 – 2024 differencing			X	X		
Task 3 – Grain size	X	X	X			
Task 4 - Synthesis and publication		X	X	X	X	X
Task 5 - Discussion and public presentation			X	X	X	X

PERSONNEL

Scott Anderson – Hydrologist

WAWSC to support grain size collection as available

BUDGET and FUNDING SUMMARY

Agency	FY 2024	FY 2025	Total Project
Whatcom County	$ 77,002	$ 17,048	**$ 94,050**
USGS Matching Funds	$ 50,000	$ 11,000	**$ 61,000**
Total	$ 127,002	$ 28,048	**$ 155,050**

REFERENCES

Anderson, S.W., 2019. Uncertainty in quantitative analyses of topographic change: error propagation and the role of thresholding. Earth Surface Processes and Landforms, 44(5), pp.1015-1033.

Anderson, S.W., Konrad, C.P., Grossman, E.E., and Curran, C.A., 2019, Sediment storage and transport in the Nooksack River basin, northwestern Washington, 2006–15: U.S. Geological Survey Scientific Investigations Report 2019-5008, 43 p., https://doi.org/10.3133/sir20195008.

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.

Anderson, S.W., and Jaeger, K.L., 2020. Coarse sediment dynamics in a large glaciated river system: Holocene history and storage dynamics dictate contemporary climate sensitivity. GSA Bulletin, 133 (5-6): 899–922. doi: https://doi.org/10.1130/B35530.1

Applied Geomorphology, 2019. Lower Nooksack River Geomorphic Assessment. Prepared for Whatcom County, 153 p. with appendices

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.

Franz, D.D, 2005. Flood frequency analysis at Deming, Ferndale, and Everson. Prepared for Whatcom County. 27 p.

KCM, 1995. Lower Nooksack River Comprehensive Flood Hazard Management Plan: Nooksack River Flood History. Prepared for Whatcom County, 47 p. with appendices

U.S. Geological Survey, 2021, U.S. Geological Survey 21st-Century Science Strategy 2020–2030: U.S. Geological Survey Circular 1476, 20 p., https://doi.org/10.3133/cir1476

Wolman. M.G., 1954. A method of sampling coarse river bed material: American Geophysical Union Transcript, v. 35, no. 6. p. 95 1.

MAP OF STUDY AREA

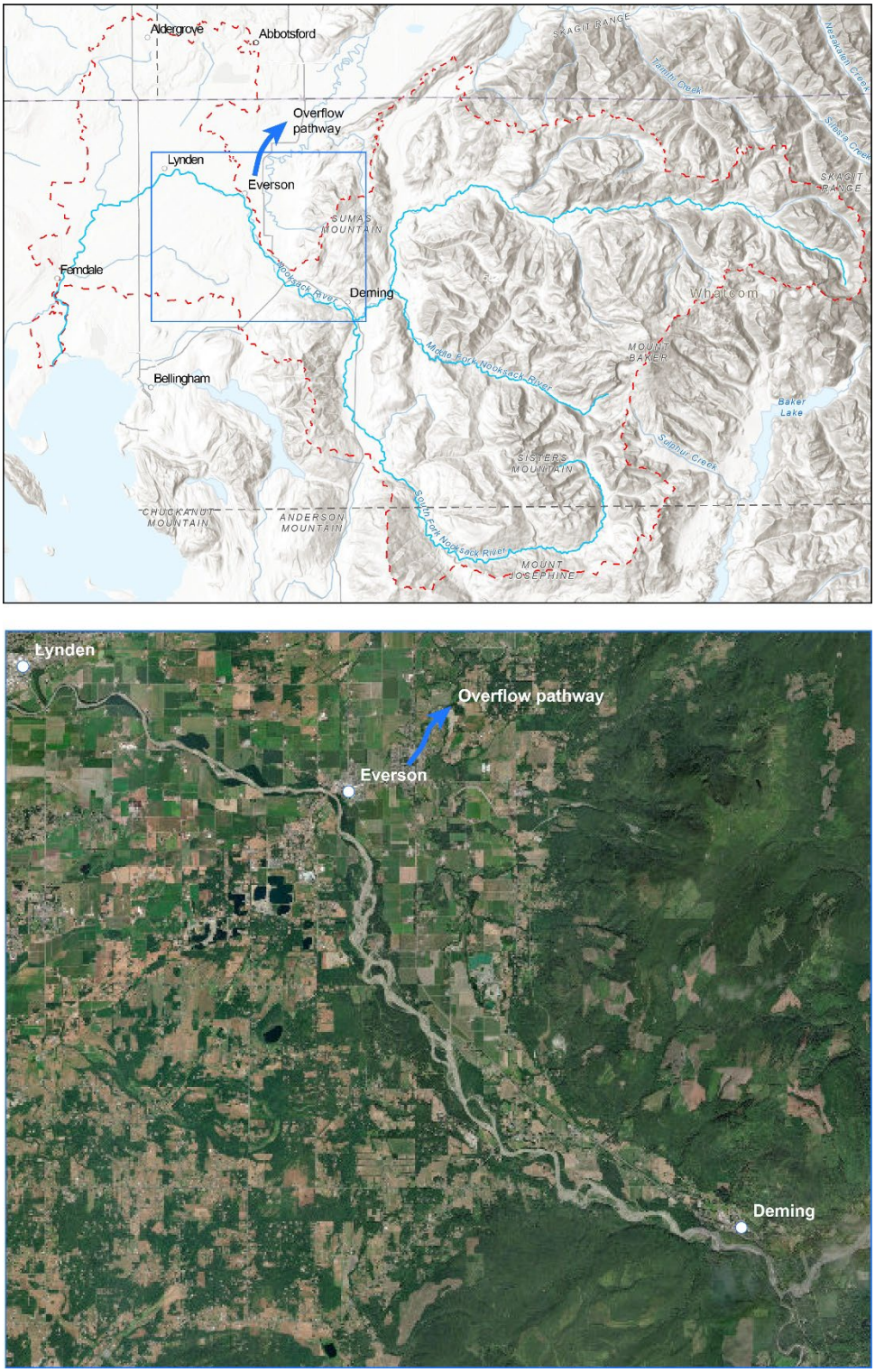

Figure 1. Map of study area. Top panel shows entire watershed; bottom panel covers extents of focused analyses. Blue box in top panel shows extents of bottom panel.